Flood Studies

TOOWOOMBA REGION
Rich traditions. Bold ambitions.

2D Flood Study for areas within the Upper Condamine River Floodplain Broad-Scale Hydraulic Model Study Area including Cecil Plains

June 2014 • *Endorsed on 25 February 2015*

Addendum 1 – Updated 2D Hydraulic Modelling to include LiDAR and Flexible Mesh GPU Approach, November 2015 • Endorsed 15 December 2015

GENERAL NOTE

These reports/documents are a base source of information that will be continually refined over time.

DISCLAIMER

SP051 Flood Studies – Work Package 7

Document title:	2D Flood Study for areas within the Upper Condamine River Floodplain Broad-Scale Hydraulic Model study area including Cecil Plains.
Document no.	QE06787_N_HY_RP_001_Pk_7_Final_Rev2
Version:	Rev2
Date:	June 2014
Prepared by:	Nicole Bichel
Approved by:	Scott Abbey
File name:	I:\QENV2\Projects\QE06787\Reports\Final Reports\WP7\Report\QE06787_N_HY_RP_001_Pk_7_Final_Rev2.docx

Sinclair Knight Merz
ABN 37 001 024 095
32 Cordelia Street
PO Box 3848
South Brisbane QLD 4101 Australia
T +61 7 3026 7100
F +61 7 3026 7300
www.globalskm.com

Contents

1. Introduction

Sinclair Knight Merz (SKM) was commissioned by Toowoomba Regional Council (TRC) to undertake Work Package 7 (WP7) of the SP051 Toowoomba Flood Studies Project. The scope of WP7 was to undertake a 2D flood study for the areas within the Condamine River floodplain study area including the Cecil Plains township. The study included the development of the TRC Condamine River Model by truncating, upgrading and re-running an existing 2D (MIKE 21) model originally developed as part Upper Condamine River Floodplain Broad Scale Hydraulic Model Development Report ("Broad Scale Hydraulic Modelling Report") (SKM, 2003). To effectively use the terrain data available as part of this project a stand-alone coupled 1D-2D (MIKEFLOOD) model was also developed for the township of Cecil Plains.

The TRC Condamine River Model was used to simulate the flooding characteristics of the localities of Pampas, Yandilla and Tummaville. The Cecil Plains Model was used to simulate the flooding characteristics in and around Cecil Plains township. Both models were validated using data from the 1976 and the December 2010 / January 2011 flood events.

This report provides details of the development and validation of the models, the generation of design flood events and the documentation of flooding behaviour and characteristics for the design events. The report consists of the following sections:

- Section 2: Review of Available Data
- Section 3: Hydrologic Analysis
- Section 4: Design Hydrology
- Section 5: Model Development
- Section 6: Hydraulic Model Validation
- Section 7: Design Event Flood Behaviour
- Section 8: Isolation and Evacuation
- Section 9: Flood Hazard Mapping Methodology
- Section 10: Sensitivity Assessments
- Section 11: Conclusions
- Section 12: References

1.1 Study objectives

The purpose of the Work Package is to define the nature and extent of flood behaviour within the study area to enable TRC to:

- Develop a Flood Risk Management Study and Plan to address the flood hazards identified in the flood studies; and
- Amend the Toowoomba Regional Planning Scheme to appropriately reflect the flood requirements of State Planning Policy 1/03 and the recommendations of the Queensland Flood Commission of Inquiry (QFCI).

The QFCI recommendations require Councils to obtain flood information where a current or future community could be at risk. As such, these studies focus on providing adequate overlay mapping through Cecil Plains focusing on current and potential development areas. The studies will support land use and infrastructure planning and provide emergency planning information that will assist Council in its emergency management planning, preparedness and response.

1.2 Approach

A broad-scale flood model of the Condamine River was previously developed by SKM in 2002/2003 using the hydraulic modelling software MIKE by DHI. This model covered an area of 6,800 km^2 and utilised a 60 m grid. As part of WP7 the model area was reduced to cover land within the Toowoomba Regional Council boundary only. This model is herein referred to as the TRC Condamine River Model. In addition to this, an area of 24.4 km^2 surrounding Cecil Plains was then modelled at a 10 m grid resolution to provide greater detail in the vicinity of the town. Inflows to this smaller model were obtained from the 60 m TRC Condamine River Model. The 10 m grid model is herein referred to as the Cecil Plains Model. The TRC Condamine River Model runs in the 2D modelling program MIKE21, while the Cecil Plains Model links 1D structures into a 2D domain using MIKEFLOOD.

1.3 History of the Upper Condamine River model

In 2002, SKM was commissioned to develop a broad-scale two-dimensional model of the Upper Condamine River and floodplain on behalf of the then Department of Natural Resources and Mines (DNRM) and the Eastern Downs Regional Organisation of Councils (EDROC). This project was conducted as part of the Upper Condamine Floodplain Management Project, Natural Heritage Trust Project – 972976 and was completed in 2003.

The area modelled included the Condamine River and floodplain from just upstream of the Chinchilla Weir to approximately the Leyburn-Cambooya Road. This encompassed a river distance of about 350 km and a floodplain area of approximately 6,800 km^2. Council’s area of interest for WP7 formed part of the modelled area.

Hydrologic modelling for this project was carried out using the Unified River Basin Simulator (URBS) runoff routing modelling software, version 3.95e. Since this project, the Bureau of Meteorology (BoM) has further refined the URBS models for the Condamine catchment and continues to use the models for flood forecasting purposes. This process involved six separate URBS models, which are linked to represent the entire catchment associated with the study area. Three of these models relate to the study area of WP7 and these models were refined specifically to meet the requirements of this study.

Hydraulic modelling was undertaken using a two-dimensional hydraulic modelling package called MIKE21, version 2002, developed by the Danish Hydraulic Institute (DHI). A grid resolution of 60 metres was adopted, providing a broad-scale model of the area. The hydraulic model was calibrated to data available for the 1976 flood. The model was then used to generate predictions for the 20 year ARI (average recurrence interval) and the 100 year ARI design flood events.

Outputs from the modelling of the design events included:

- Peak flood levels at key locations on the floodplain
- Flooding depths and extent maps
- Flood velocity maps
- Flood hazard maps

This study was conducted prior to the broad-scale availability of LiDAR (light detection and ranging survey) information and the terrain was developed by manually surveying the floodplain and topographical features such as farm dams and ring tanks. Importantly, it was noted that the model results for the Condamine River floodplain on the left bank near Cecil Plains should be considered “indicative only”. This is due to the terrain being developed from 25m contour data which did not provide an adequate representation of the terrain in this area.

2. Review of Available Data

Data has been collated for this study from a variety of sources, including flood data recorded from debris lines and flood marks visible shortly after the 2010/2011 flood events and anecdotal information provided by the community. The flood data used in the study is based on the information that was available to Toowoomba Regional Council which may not be accurate or complete.

2.1 Terrain information

LiDAR survey data of the Cecil Plains township was collected by Council in 2011/2012. This information was provided to SKM as a 1m grid with a vertical accuracy of +/-0.15 m.

2.2 URBS hydrologic model

Council supplied the existing URBS models used in the 2003 broad-scale modelling for use in WP7. The model was used “as is” for validation of the Cecil Plains Model to the 1976 event, as the URBS model had already been calibrated to the 1976 event.

For the 2010/2011 event, the URBS model was refined to reflect changes within the catchment upstream of Warwick. Advice was also sort from the Bureau of Meteorology (BoM) in regard to any changes to model parameters since 2003. Unfortunately, the BoM was unable to provide any information in regard to changes in model parameters.

Refinements of the URBS model structure and parameters that were undertaken as part of this project are discussed further in Section 3.

2.3 Rainfall data used for URBS modelling

Rainfall information for the 2010-2011 event was sourced from BoM and the suitability of the rainfall data was reviewed.

The existing Upper Condamine URBS Model had used the following gauges for event modelling:

Table 2-1 Gauges used in the SKM Upper Condamine URBS Model

BoM number	Name	Latitude	Longitude
041530	Yangan alert	28.20°S	152.22°E
041531	Glengallan Creek Alert	28.12°S	152.06°E
041532	Connolly Dam Alert	28.36°S	152.00°E
041533	Emu Vale Alert	28.23°S	152.23°E
041534	Warwick Alert	28.21°S	152.03°E
041535	Elbow Valley Alert	28.37°S	152.14°E
041536	Murrays Bridge Alert	28.29°S	152.11°E
041537	Killarney Alert	28.34°S	152.29°E

Following a review of a number of sub-daily and daily gauges in the area, the following gauges were added to the URBS model to represent the 2010-2011 flood event rainfall.

Table 2-2 Gauges added to the WP7 URBS model

BoM number	Name	Gauge type	Latitude	Longitude	Event total (mm) (21/12-12/01)
041011	Cambooya Post Office	Sub-daily	27.71°S	151.87°E	245
041515	Felton TM	Daily	27.85°S	151.68°E	303
041404	Ellangowan	Daily	27.96°S	151.67°E	301
041306	Tosari	Daily	27.86°S	151.45°E	299
041069	Millmerran Post Office	Daily	27.87°S	151.27°E	263
041019	Condamine Plains	Daily	27.72°S	151.29°E	258
041170	Aubigny Purrawunda	Daily	27.54°S	151.64°E	384
041025	Dunmore State Forest	Daily	27.57°S	151.08°E	283
041016	Cecil Plains Homestead	Daily	27.53°S	151.20°E	383

Where daily data was available, it was disaggregated to hourly so that all rainfall files had consistent inputs. Disaggregation was a linear function of time. This was deemed a suitable technique as the event developed over a prolonged period. The rainfall gauge locations are shown on Figure 3-2.

The 2010-2011 event occurred over a prolonged period between December 2010 and January 2011, therefore using daily data combined with sub-daily information was considered a suitable approach.

Rainfall distribution data was not collected for the 1976 event, as this was outside the scope of this study. Figure 2-1 shows rainfall distribution data that was collected from BoM for the 2010/2011 event.

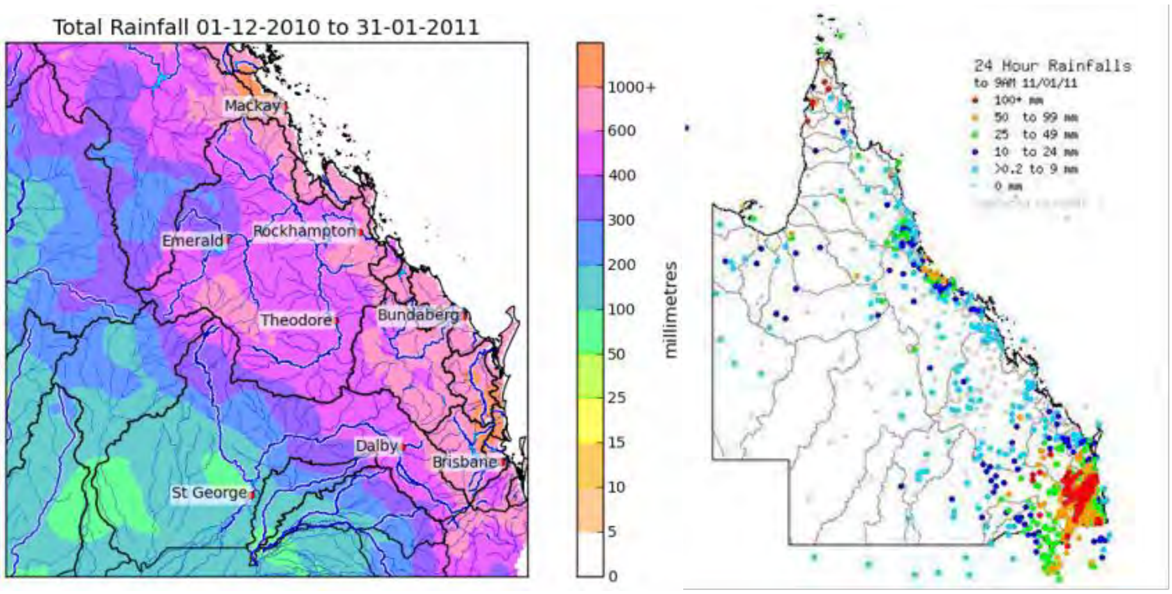


Figure 2-1 Rainfall distribution data for the 2010/2011 event (BoM).

2.4 Streamflow data

Data was collected for the 1976 and 2010/2011 flood events.

For the 1976 event, the information presented in the Broad Scale Hydraulic Modelling Report was adopted for WP7. At Cecil Plains, this data indicated a recorded flood level of 9.17 metres (BoM) and a peak flood flow of 2,024 m^3/s (DNRM).

For the 2010/2011 flood event a recorded hydrograph of flood level at the Cecil Plains gauge was sourced from DNRM. Figure 2- shows the recorded water levels from the 26th of December 2010 to the 27th January 2011. The larger peak of 356.73m AHD, (9.22 m on the gauge), on the 29th of December 2010 was used for validation purposes.

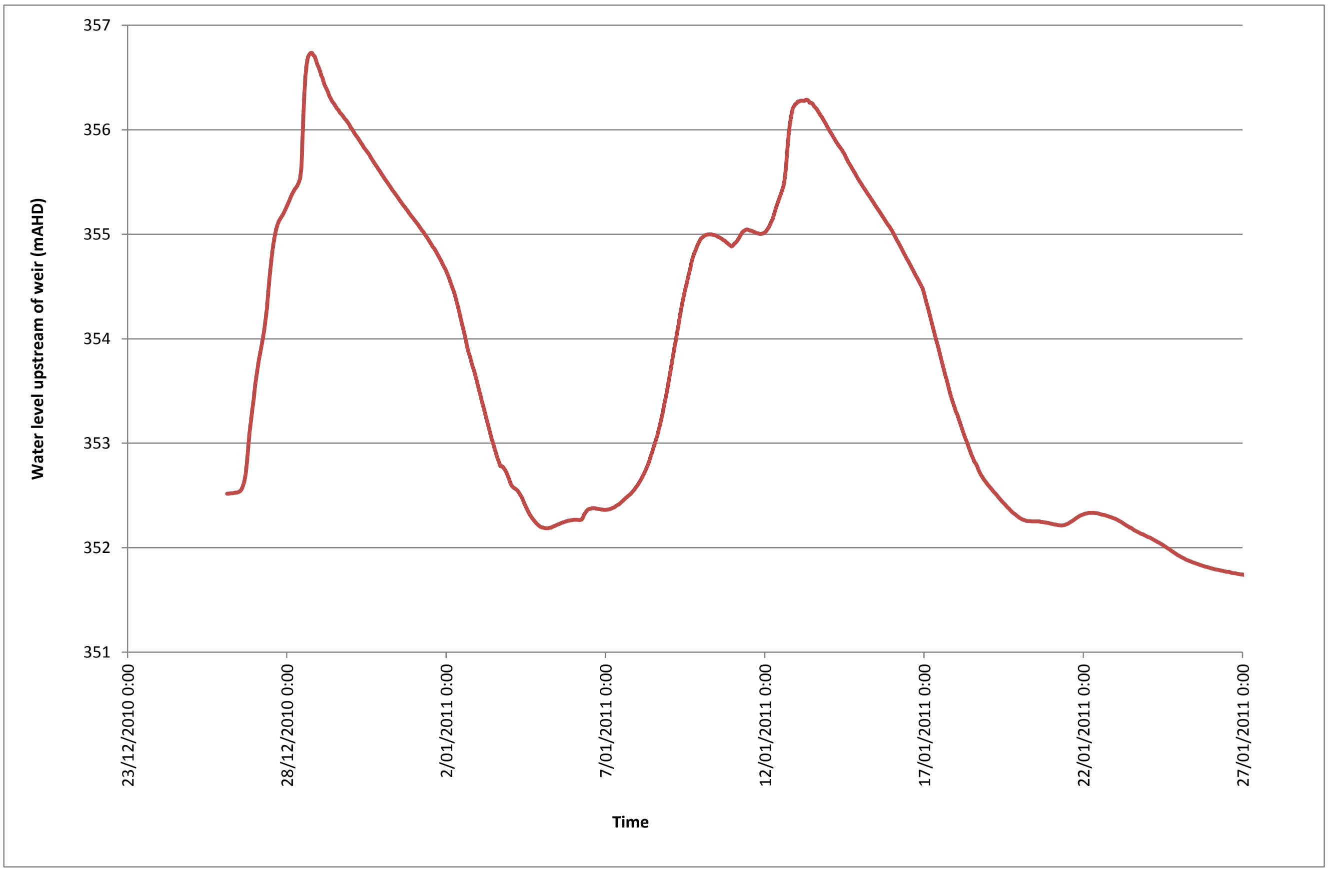


Figure 2-2 Recorded water level hydrograph at Cecil Plains gauge (GS422316A) during 2010/2011 flood event

2.5 Validation data

2.5.1 TRC supplied validation data

In addition to the recorded gauge levels, validation points indicating peak flood levels at various locations were provided by TRC. It is to be noted that the TRC supplied data has been collated for the study from a variety of sources, including flood data recorded from debris lines and flood marks visible shortly after the 2010/2011 flood events and anecdotal information collected by the community. The flood data used in the study is based on the information that was available to Toowoomba Regional Council which may not be accurate or complete

This validation data is presented in Table 2-3 below. The location of these points is illustrated in Figure 6-9.

Table 2-3 Validation point data provided by TRC

Validation point number	Observed flood level (m AHD)
192	354.09
193	353.84
194	355.97
195	356.68
196	356.13
197	356.86
198	356.30
199	356.59

These levels were used to assist with the model validation for the 2010/2011 flood event. The results of the model validation are discussed in Section 6.

2.5.2 Community interviews

SKM undertook a site inspection and interviewed the SES controller for Cecil Plains. The SES officer was able to provide a general description of how the 2010/2011 flood occurred at Cecil Plains and identified four flood levels for the event. Unfortunately three of the four flood levels were located outside the Cecil Plains Model extent.

The remaining level and the description of flooding characteristics were used to assist in the validation of the Cecil Plains Model.

3. Hydrologic Analysis

The URBS model previously developed for the Upper Condamine River Floodplain Management Project was used for WP7. The model was maintained in its existing form for the validation of the model to 1976, as the model had previously been calibrated to this event. The model was then updated with refinements to model parameters and structures for validation to the 2010/2011 flood event.

3.1 2003 URBS model

The Bureau of Meteorology (BoM) developed and calibrated an URBS model for use in its flood forecasting and flood warning system. This model formed the hydrological inputs to the Upper Condamine River broad scale hydraulic model. This hydrological model consists of six separate URBS models linked together to represent the upper and mid Condamine River catchment upstream of the Chinchilla Weir. The six models are as follows:

- Model A: Condamine River to Warwick
- Model B: Condamine River, Warwick to Tummaville
- Model C: Oakey Creek Catchment
- Model D: Condamine River, Tummaville to Loudon Bridge
- Model E: Myall Creek Catchment
- Model F: Condamine River, Loudon Bridge to Chinchilla Weir

Models A and B represent the Condamine River catchment upstream of the WP7 study area while the upper portion of Model D represents the area of catchment within TRC. The configuration of these models is illustrated on Figure 3-1.

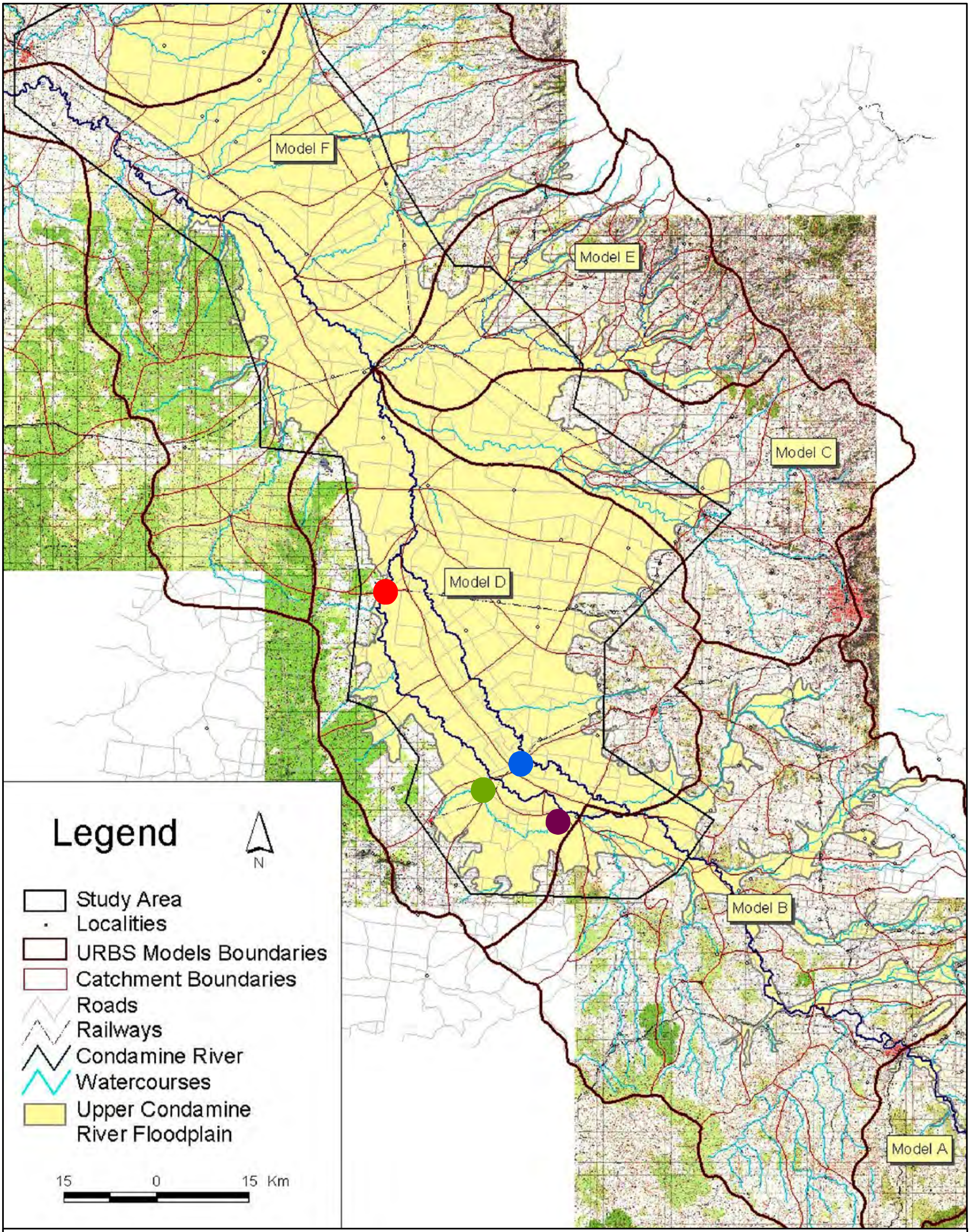
3.2 2012 URBS model

SKM undertook a review and revision of the BoM URBS models A and a portion of model B as part of the Condamine River and Tributaries Study (SKM) carried out in 2012 for Southern Downs Regional Council. Subsequently these updates were used to develop a new “Upper Condamine” model which was successfully calibrated and validated to a number of events, including the 2010/2011 event. The downstream boundary of this model is the Condamine River at Tummaville. At the commencement of this project this model provided the best representation of the hydrological response of the Condamine River catchment upstream of the WP7 study area.

The changes made to the BoM URBS model included further catchment delineation and an update of loss parameters.

3.3 2013 TRC URBS model development

The 2013 TRC URBS model used in WP7 was developed by extending the 2012 URBS model (discussed above) down to Cecil Plains using catchment areas and reach length information from the 2003 BoM models B and D. Only small adjustments to the delineation of the catchments, catchment lengths and their resultant catchment areas were required. The sub-catchments that form the 2013 TRC URBS model are shown in Figure 3-2. A figure has been included in Appendix A showing the URBS catchment reference numbers.



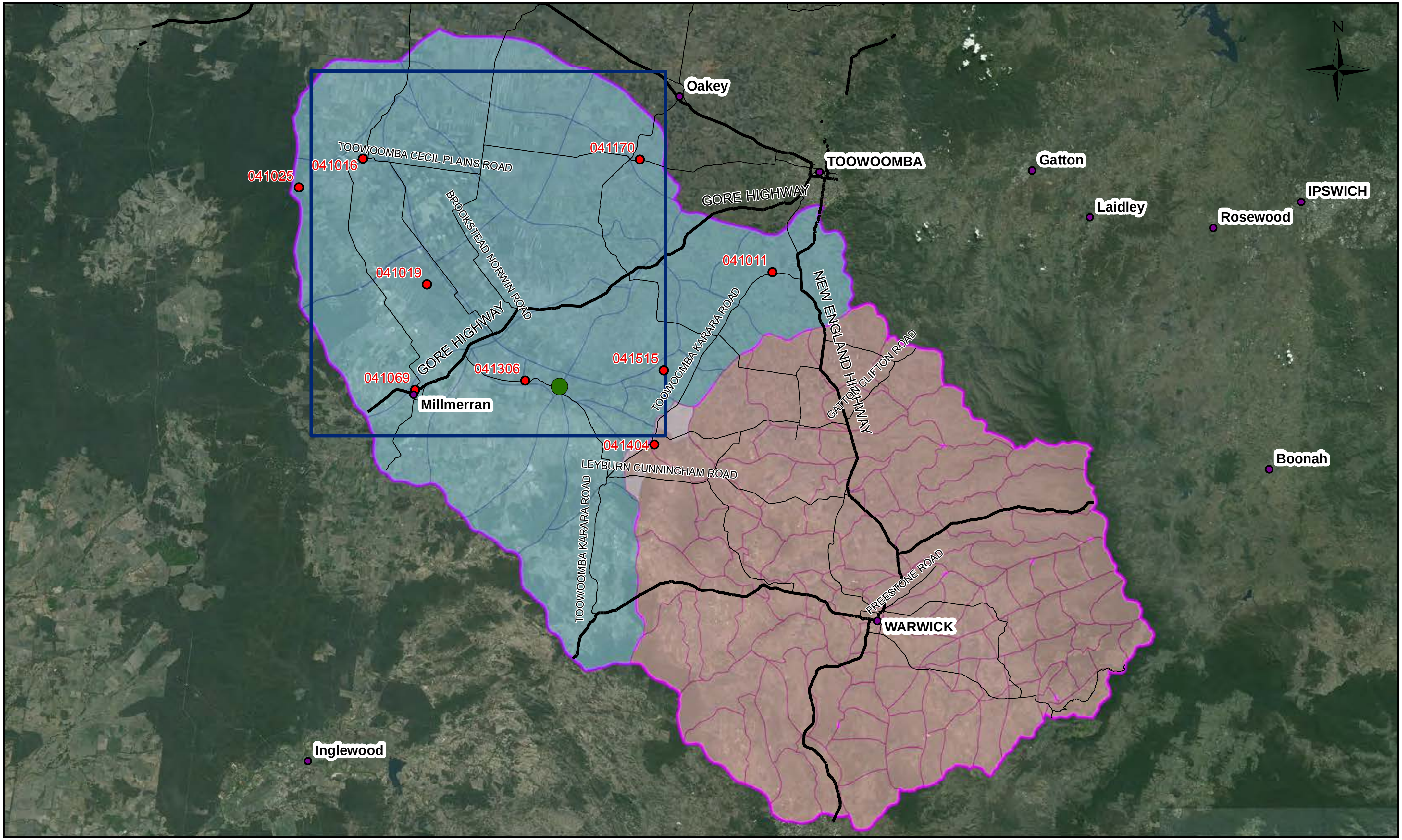
● Cecil Plains
● Yandilla
● Pampas
● Tummaville

Figure 3-1
2003 URBS Model Configuration

SP051 Flood Studies

Extract from Upper Condamine River Floodplain Broad Scale Hydraulic Model Development Project (SKM, 2003)

TOOWOOMBA REGIONAL COUNCIL



TOOWOOMBA REGIONAL COUNCIL

Figure 3-2 2013 TRC URBS Model Extents

I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\Figure 3-2.mxd
Author/Date: nbichel 11/04/2014

3.4 Hydrologic model routing

The routing between each URBS sub-catchment was modelled though a combination of channel lag/storage and catchment storage. The parameters that were tested during the calibration and validation were:

- α = channel lag parameter. This parameter is equal to the inverse of wave celerity, controlling the speed at which a hydrograph will propagate through the model
- β = catchment storage parameter
- x = Muskingham translation parameter
- m = exponential catchment storage parameter
- n = exponential channel storage parameter
- f = reach length factor, reducing this factor has the same effect as reducing the length of reach and increasing α

To calculate the sensitivity of each parameter, a suite of runs isolating each parameter was undertaken. This identified ‘α’, ‘m’ and ‘n’ as the parameters with the highest sensitivities as slight variations in these parameters resulted in significant changes in the hydrological outputs. Varying the parameters ‘β’ and ‘x’ resulted in relatively smaller differences in flow behaviour. Changes to the ‘β value influenced the magnitude of the flood peak and to a lesser extent the volume under the hydrograph. It was found that an increase in the ‘β’ value lead to decrease in the peak. The model was fairly insensitive to changes to the x value.

The ‘f’ factor was varied throughout the catchment to account for changes in the terrain throughout the model.

3.4.1 1976 validation event

The 1976 URBS validation remained unchanged from the original calibration in 2003. The joint validation is further discussed in Section 6.

3.4.2 2010/2011 validation event

The purpose of this exercise was to match the Cecil Plains gauge hydrograph with the URBS hydrograph output at the same location.

The URBS model was sufficiently validated to the Cecil Plains weir (GS422316A) gauge levels. The validation process and discussion on the limitations of the rating curve are further discussed in Section 6.

The m value selected represents the response of the sub-catchments for wet conditions of soil. In the case of saturated catchment conditions after previous storms, the value of m = 1.0 is suitable, as it believed to represent the relationship between antecedent wetness of soil and flood response. As the catchment was significantly wet in the lead up to this event, this assumption is considered appropriate.

The peak flow and timing of the event hydrograph was replicated reasonably well with the following validation parameters:

- alpha=0.2
- m=1
- beta=3.5
- x=0.3
- n=1.0
- Initial loss 10mm and continuing loss 1.5mm/h

Figure 3-3 provides a comparison of the URBS generated hydrograph and the recorded hydrograph at the Cecil Plains weir gauge site for this event.

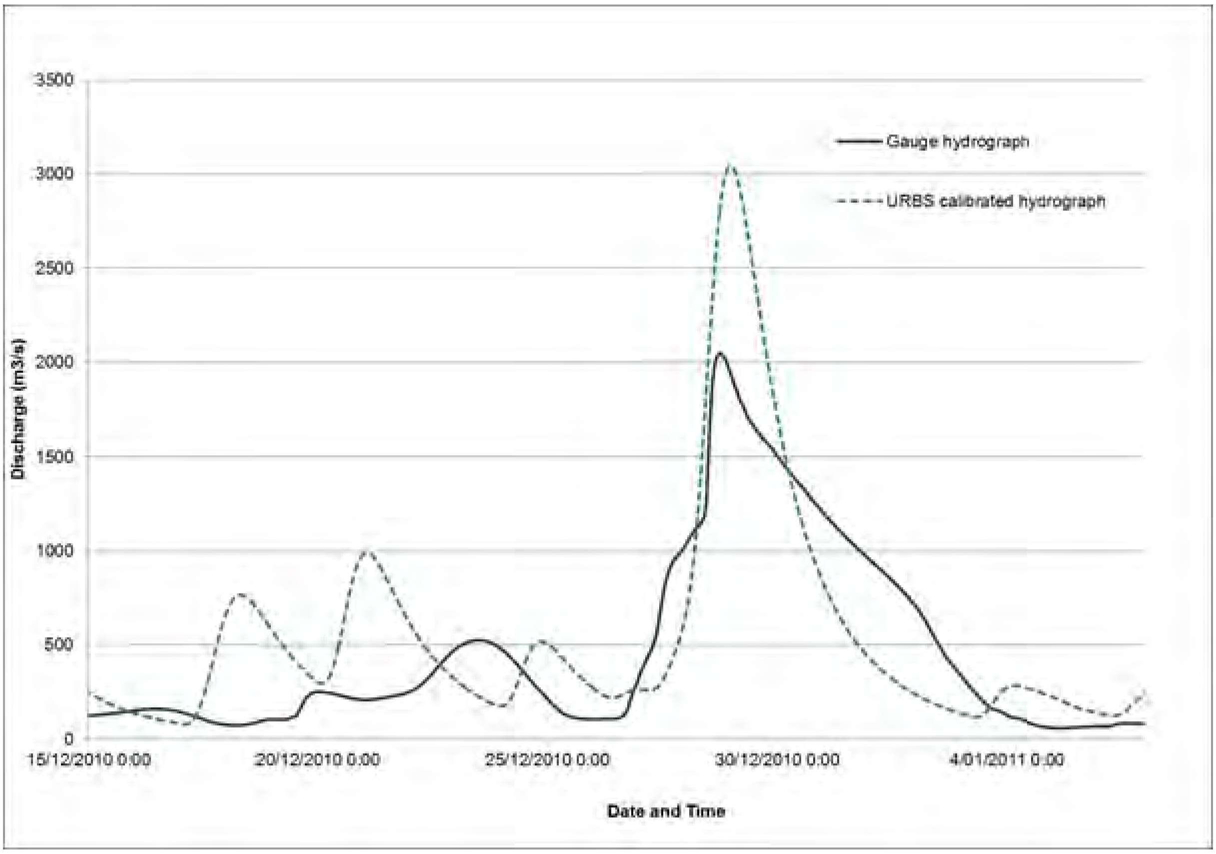


Figure 3-3 2003 Comparison of URBS hydrograph and recorded hydrograph at Cecil Plains gauge (GS422316A) 2010 event

From Figure 3-3 it can be seen that, while the URBS generated hydrograph generally matches the shape and timing of the recorded hydrograph, the peak discharge estimates for the main peak and the earlier minor peaks are quite different. This outcome was further investigated through the process of joint validation of the hydrologic and hydraulic models. This process identified that the reliability of the rating curve at major flood levels was potentially low. This is further discussed in Section 6.

3.4.3 Comparison between parameters used in the 2003 URBS model and the 2013 TRC URBS model

The 2003 URBS model and the 2013 TRC URBS models are not directly comparable. The 2003 model includes six different models with individual parameters whereas for the 2013 model one set of parameters was adopted.

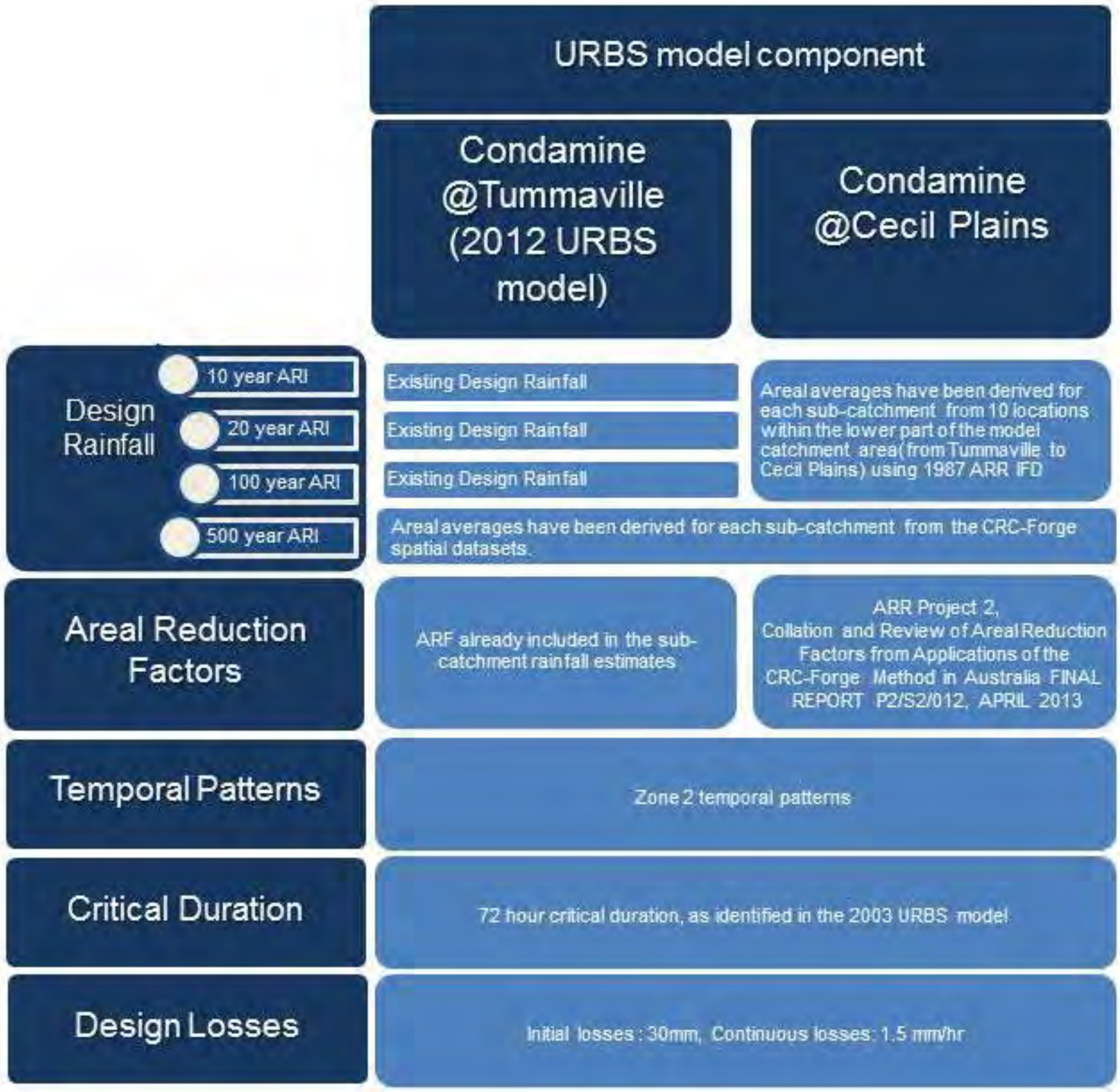
As a broad comparison, the values of alpha, used in the six 2003 models ranged from 0.2 to 0.7. The alpha adopted for the 2013 TRC model was 0.2. The values of beta, used in the six 2003 models ranged from 1.2 to 4.0. The beta adopted for the 2013 TRC model was 3.5.

In terms of initial loss the values adopted are very much influenced by the antecedent moisture condition within the catchment at the commencement of each event. The 2003 study adopted initial loss rates in the range of 40 to 70 mm. Given that the catchment was saturated at the commencement of the 2010/2011 event, in the 2013 TRC URBS model an initial loss of 10mm was adopted.

With respect to continuing losses, the 2003 URBS models used a uniform proportional loss model to simulate continuing loses during an event. The proportional runoff factor adopted varied from 0.35 to 0.8. A continuing loss model was adopted for use in the 2013 TRC URBS model. For the 2010/2011 event a continuing loss rate of 1.5mm / hour was adopted.

4. Design Hydrology

Design flows were required to be used as input to the MIKE 21 TRC model. The 2013 URBS model validated to the 2010/2011 flood event was used. Figure 4-1 provides an overview of the approach followed for the estimation of the design flows from URBS.



		URBS model component	
		Condamine @Tummaville (2012 URBS model)	Condamine @Cecil Plains
Design Rainfall	10 year ARI	Existing Design Rainfall	Areal averages have been derived for each sub-catchment from 10 locations within the lower part of the model catchment area(from Tummaville to Cecil Plains) using 1987 ARR IFD
	20 year ARI	Existing Design Rainfall	
	100 year ARI	Existing Design Rainfall	
	500 year ARI	Areal averages have been derived for each sub-catchment from the CRC-Forge spatial datasets.	
Areal Reduction Factors		ARF already included in the sub-catchment rainfall estimates	ARR Project 2, Collation and Review of Areal Reduction Factors from Applications of the CRC-Forge Method in Australia FINAL REPORT P2/S2/012, APRIL 2013
Temporal Patterns		Zone 2 temporal patterns	
Critical Duration		72 hour critical duration, as identified in the 2003 URBS model	
Design Losses		Initial losses : 30mm, Continuous losses: 1.5 mm/hr	

Figure 4-1 Methodology for the estimation of design flows

The general approach was to use readily available data, where available, from the existing 2012 URBS model. The following paragraphs describe the process in detail.

4.1 2013 TRC model configuration

The validated 2013 TRC URBS model was used for the derivation of the design flows to be used as inputs to the hydraulic model. Eight inflow locations were selected, which represent the respective source points to the MIKE 21 model. Source point locations are illustrated on Figure 4-2.

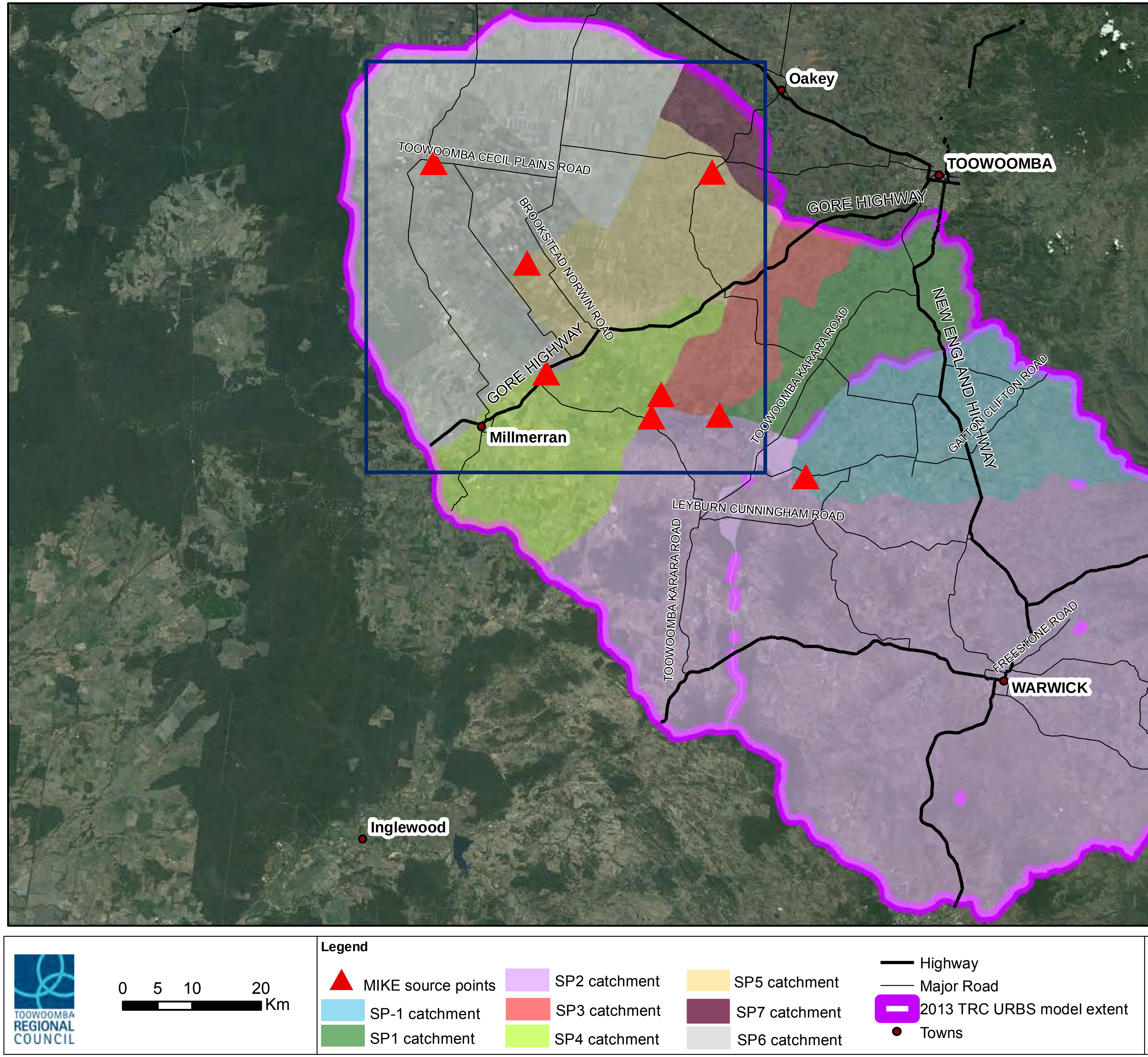


Figure 4-2 Source point inflow catchments

I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\Figure-4-2.mxd
Author/Date: nbichel 11/04/2014

4.1.1 Critical duration

The critical duration of 72 hours had been identified as the critical duration during the Upper Condamine Floodplain Management Project. This duration was taken forward in this analysis.

4.1.2 Design rainfall

Design rainfall estimates for the 10, 20, 100 and 500 year ARIs were required to be used as input to the URBS design model. The design rainfall for the catchment is shown below in Table 4-1.

Table 4-1 Design catchment rainfall.

ARI	10	20	100	500
Catchment rainfall (mm)	144	167	221	292

For the 10 to 100 year ARIs, the design rainfall estimates for the sub-catchments of the upstream component of the URBS model to Tummaville (pink component of Figure 3-2) were extracted from the existing sub-catchment rainfall data available through the 2012 URBS model.

For the downstream component of the model, ten locations within the catchment were selected, shown in Figure 4-3. Point rainfall depths were estimated for the different sub-catchments by interpolating between the 10 rainfall depths. Inverse distance weighting was the selected mode of interpolation. Figure 4-4 provides an example of the interpolated results, showing the sub-catchment point rainfall depths derived by interpolating the 100 year ARI rainfall depths from the ten locations.

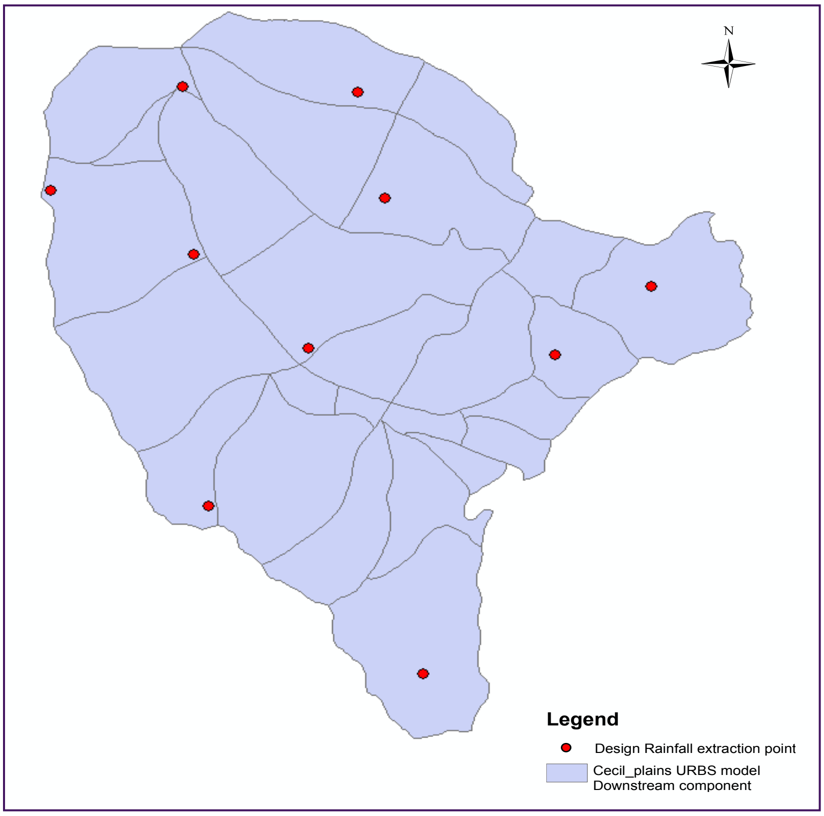


Figure 4-3 Location of design point rainfall points within the downstream URBS model component

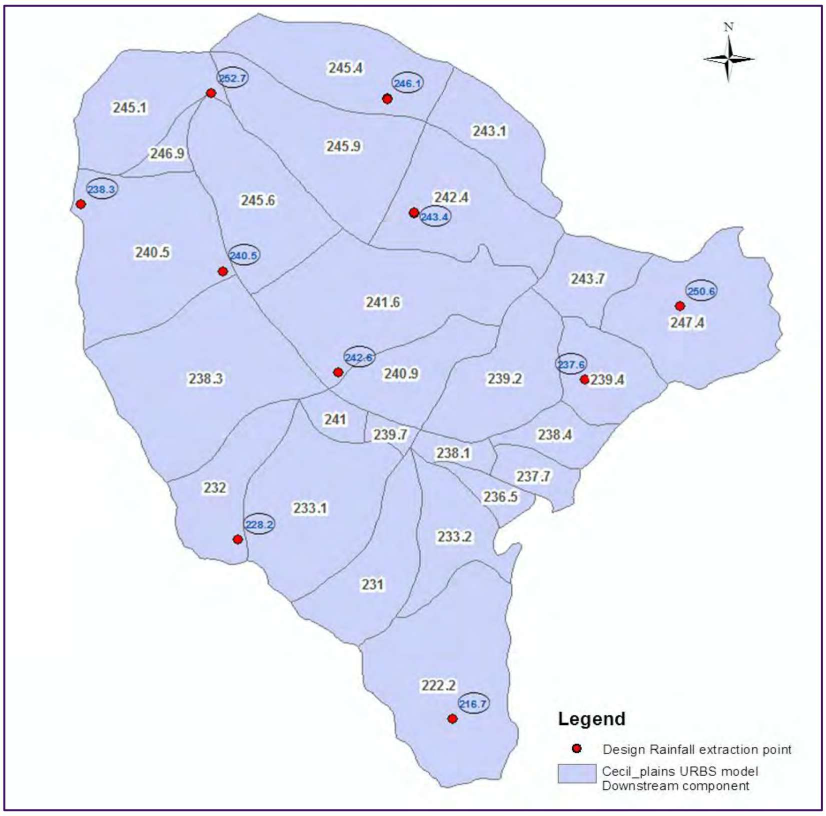


Figure 4-4 100 year ARI point rainfall for each sub-catchment

For the 500 year ARI event, sub-catchment point rainfall depths were derived directly by using the CRC-Forge spatial datasets.

There is very good match between the ARR and CRC Forge estimates. For instance, the ARR 48 hour 100 year rainfall estimates for the entire catchment have a 1.5% difference with the CRC Forge equivalent estimates (221 mm for ARR and 224 mm for CRC-Forge)

4.1.3 Areal Reduction Factor

Areal Reduction Factors (ARFs) were applied to point rainfall depths to convert them to catchment estimates. The existing rainfall data available from the 2012 URBS model for the Condamine catchment to Tummaville already incorporated areal reduction. For the remaining sub-catchments to Cecil Plains, an ARF factor of 0.85 was applied. The same approach was adopted for the 500 year ARI rainfall, to achieve a consistent approach.

4.1.4 Temporal patterns

ARR zone 2 temporal patterns were applied. No filtering was undertaken as a check of the total catchment average rainfall to Cecil Plains did not suggest any embedded bursts that were higher than design estimates.

4.1.5 Design losses

An initial loss value of 30 mm and a continuous loss value of 1.5 mm/hr were adopted, in line with the 2012 URBS model findings.

5. Model Development

5.1 Hydraulic model development

The MIKEFLOOD package developed by DHI (version 2012) was adopted for the investigation. MIKEFLOOD links the two-dimensional hydraulic modelling package, MIKE21, to the one-dimensional hydraulic modelling package MIKE11. This allows for detailed 1D modelling of specific hydraulic structures inside a 2D flood model of the river and floodplain. Figure 5-1 illustrates the adopted model areas.

5.2 TRC Condamine River model development

To create the TRC Condamine River Model, the existing Upper Condamine River model was reduced in area to only cover the area of the TRC local government area. To do this, the following steps we taken.

- The existing bathymetry, viscosity and roughness grids were converted from dfs2 to ASCII using MIKE Toolbox. Analysis was undertaken in ARCGIS to match the model extent to the TRC model boundary shapefile.
- Source points with locations inside the TRC Condamine River Model domain were included in the model.
- The initial water level and downstream boundary were reassigned based on the smaller model boundary. The initial water level and downstream boundary was set to a constant water level of 346.3mAHD based on normal depth calculation at the downstream boundary. Sensitivity tests to the downstream boundary condition found the model to be insensitive at the downstream end of the Cecil Plains Model.

5.2.1 Model area and terrain development

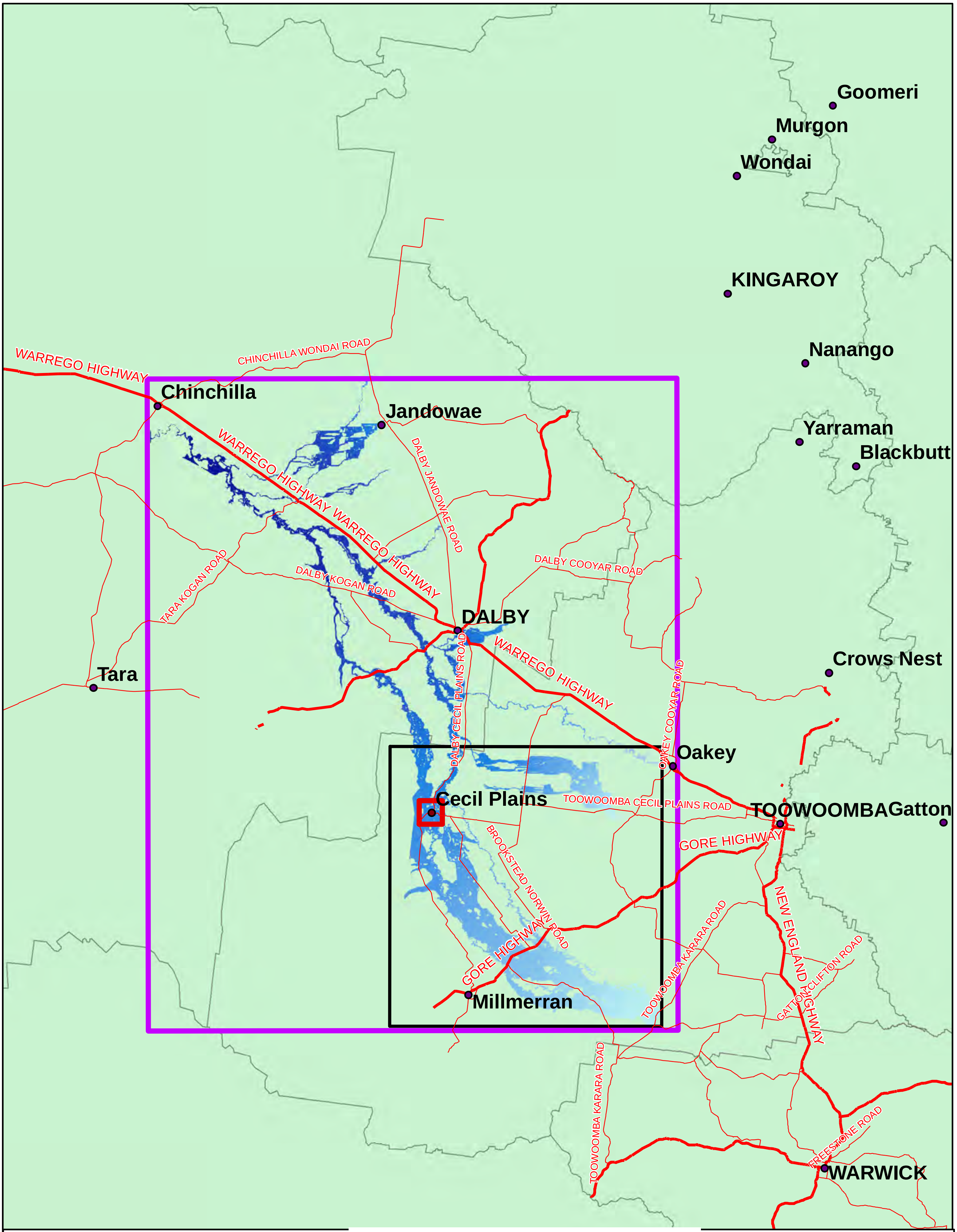
The TRC Condamine River Model extent was based on the local government area boundary. The model was extended slightly downstream of the TRC council boundary to enable a stable downstream boundary location to be selected.

5.2.2 Hydrologic inputs

The model inflows for the TRC Condamine River Model were taken from the 2003 Upper Condamine River model for the 1976 validation event. For the 2010/2011 validation event model inflows were sourced from the 2013 TRC URBS model.

5.2.3 Manning's *n*

The Manning's *n* values in the TRC Condamine River Model were taken from the 2003 Condamine River Model. The original Manning's values were not revised because the 2003 Condamine River model had been previously calibrated to the 1976 event. Hence, the parameters are assumed to be appropriate and any alterations to them could void the calibration.



TOOWOOMBA REGIONAL COUNCIL

N

0 10 20 40 km

Legend

Highway	Regional Council Boundaries
Major Road	**1976 Upper Condamine WSL (mAHD)**
Upper Condamine R Model	**Value**
TRC Condamine R Model	High : 400
Cecil Plains Model	Low : 300

Figure 5-1
Adopted Model Areas
SP051 Flood Studies

Document Path: I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\Fig5-1_Model_Extents_A.mxd

5.2.4 Eddy viscosity

A uniform velocity-based eddy viscosity of 0.3 was applied across the model area for the TRC Condamine River Model. This was taken from the 2003 Condamine River Model, which is calibrated and therefore assumed to contain appropriate parameters.

5.2.5 Boundary conditions

The downstream boundary for the TRC Condamine River Model was located 2.5km downstream of the Toowoomba Regional Council boundary. The model's downstream boundary condition was set to a fixed level based on a normal depth calculation for peak inflow of the validation event. The sensitivity of the model results to downstream boundary water level in the area of interest (Cecil Plains) was tested (for levels between 346.0 and 348.0 m AHD) and it was found that the results were insensitive to the level specified. The selected downstream tailwater level was 346.3 mAHD.

Figure 5-2 illustrates the locations of the downstream boundaries for the TRC Condamine River Model and the Cecil Plains Model respectively.

5.3 Cecil Plains flood model

The MIKE21 model represents the investigation area topography as a terrain grid, with the following parameters input to the model to define flow behaviour:

- Design or historical inflows;
- Terrain roughness (entered as Manning's number M); and
- Eddy Viscosity

5.3.1 Model area and terrain development

The model area was selected based on the extent of LiDAR survey; Council's land use zones and precincts (which were used to identify the potential future development); the likely extent of flooding (to reduce model run times); and the location of model boundaries (to provide model stability). The adopted model areas are illustrated in Figure 5-1.

The 1m LiDAR data was used to develop a 10 m terrain elevation grid for Cecil Plains. The grid cell size was selected based on definition of the major and overland flowpaths and consideration of model run time efficiency. In general, the grid cell size provides at least two grid cells within each major flowpath to provide model stability and channel definition.

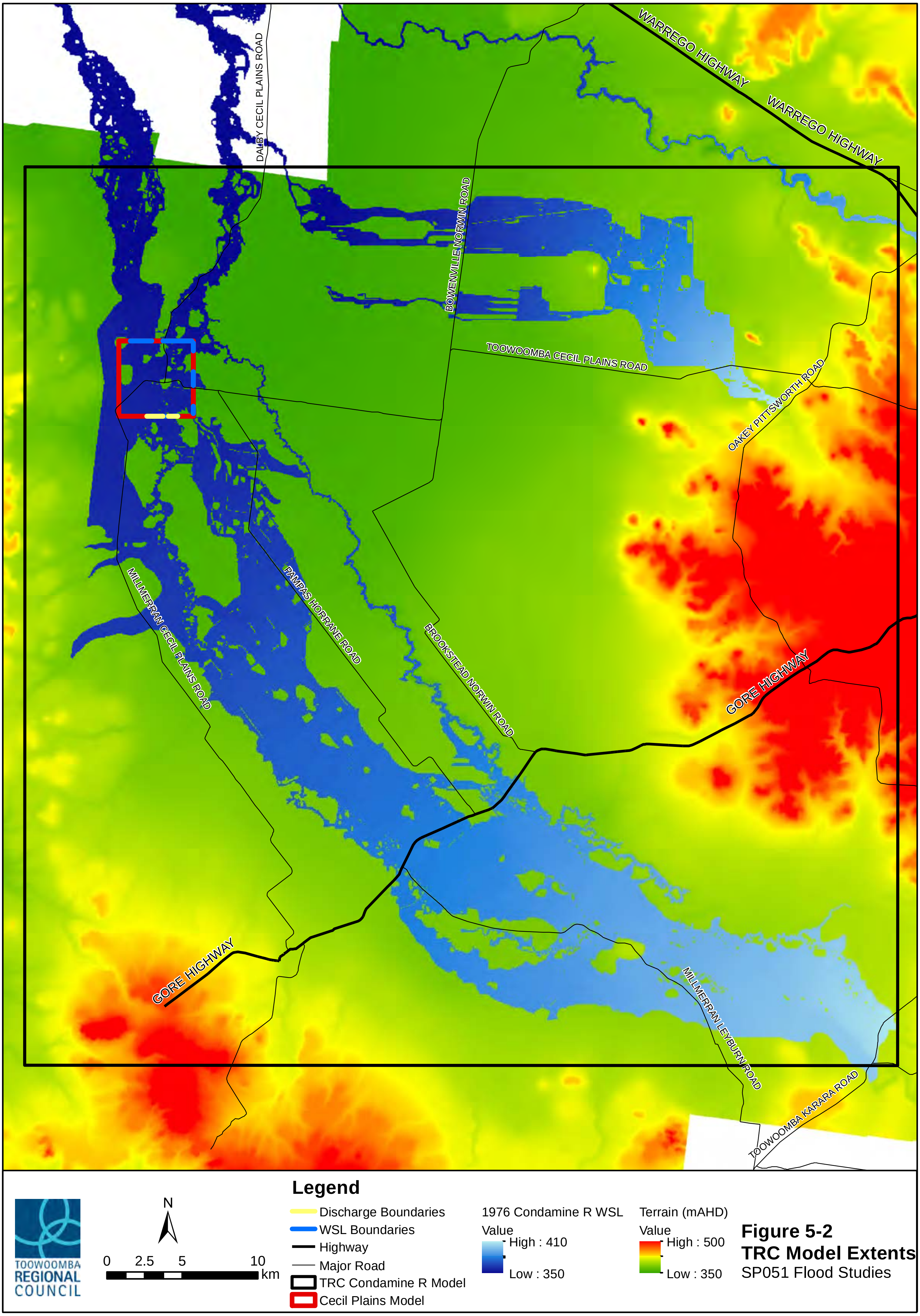


Figure 5-2
TRC Model Extents
SP051 Flood Studies

Document Path: I:\QENV2\Projects\QE06787\Reports\Final Reports\WP7\Figures\mxd\Fig5-2_Model_Extents_TRC.mxd

5.3.2 Hydrologic inputs

The inflows for the Cecil Plains Model simulating the 2010/2011 event were initially taken from the TRC Condamine River model in an attempt to simulate the impacts of the floodplain on flows that could not be built into an URBS model. Following the joint validation process it was found that inflows could be taken directly from the 2013 TRC URBS model at a location in close proximity to the upstream boundary of the Cecil Plains hydraulic model and similar validation results could be achieved.

5.3.3 Manning's n

As the level of detail in the modelling for Cecil Plains was considerably higher than the existing Upper Condamine River model, it was decided that a review of the Manning's *n* values should be undertaken based on current aerial photography. The following values were used in the Cecil Plains model. The roughness characteristics of the model are illustrated in Figure 5-3.

Table 5-1 Manning's *n* values adopted in the Cecil Plains Model

Land use	Manning's *n*
Urban	0.10
Grazing/crops	0.06
Forest	0.08
Creek	0.05

5.3.4 Eddy viscosity

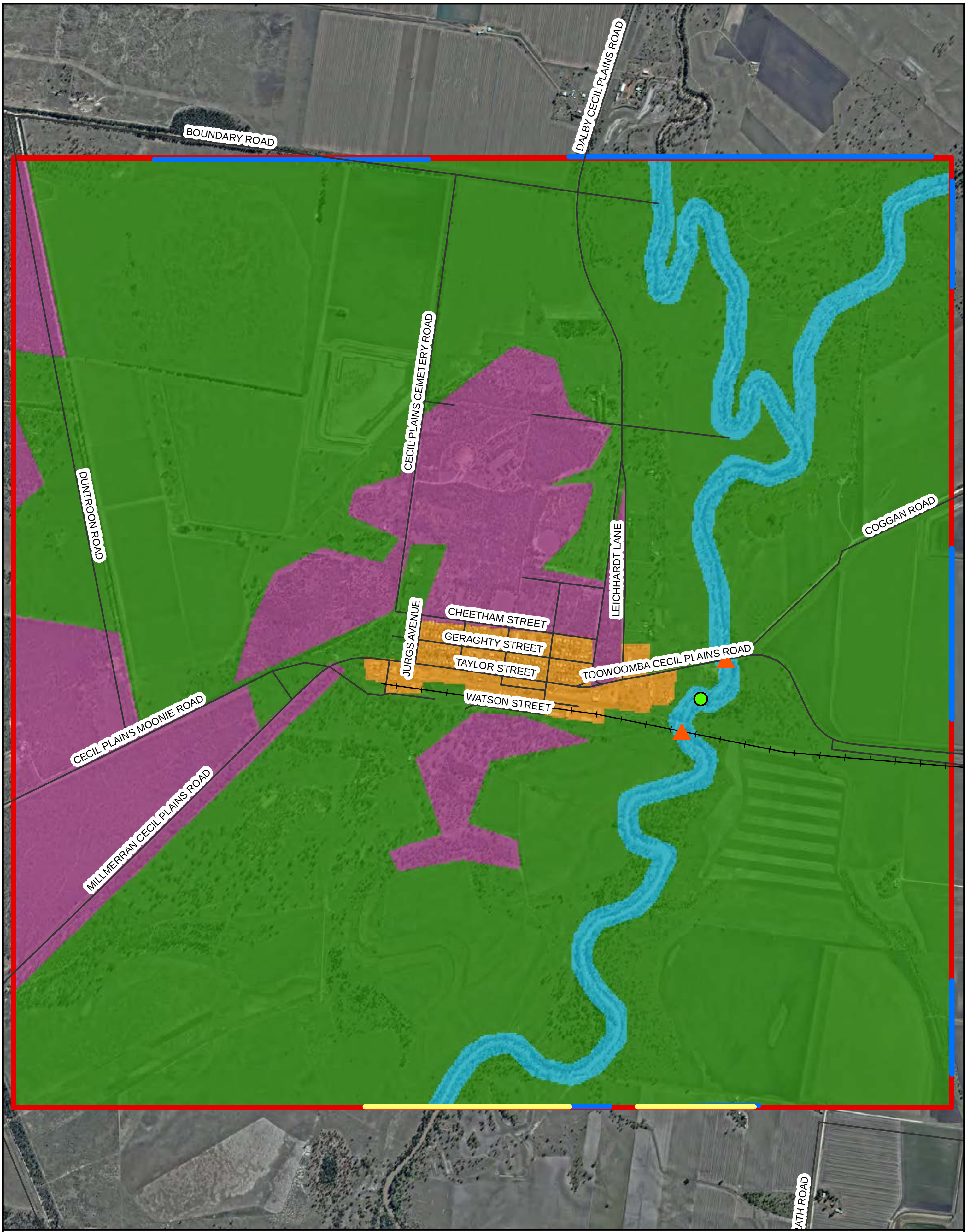
A uniform flux-based eddy viscosity of 2.0 was applied in the Cecil Plains Model. This factor was adjusted due to the change in cell size and model timestep and is within recommended limits for model stability.

5.3.5 Boundary conditions

The Cecil Plains Model downstream boundary was located approximately 2 km downstream of the town centre. This boundary was defined as a level versus time relationship based on the performance of TRC Condamine River Model in the same location when simulating the 1976 and 2010/2011 events.

The Cecil Plains Model has five water level boundaries, two of which of which are constant water level boundaries. These water levels where derived from the peak water levels in the TRC Condamine River Model for each ARI developed.

Figure 5-2 illustrates the locations of the downstream boundaries for the TRC Condamine River Model and the Cecil Plains Model respectively.



TOOWOOMBA
REGIONAL
COUNCIL

Figure 5-3

Cecil Plains Model Set-Up

SP051 Flood Studies

Document Path: I:\QENV2\Projects\QE06787\Reports\Final Reports\WP7\Figures\mxd\Fig5-3_Model_Area_Mannings.mxd

5.3.6 Hydraulic structures

A site visit of Cecil Plains was undertaken on the 13th of September 2013. Two major structures with potential to influence flooding characteristics were identified. These structures have been represented in the hydraulic model through links to one-dimensional structures in MIKE11. These structures are summarised in Table 5-2 below. Invert levels and culvert lengths / bridge widths for all structures were estimated from the LiDAR data and field observations.

The bridges were modelled as culverts in the MIKE11 model, as bridge structures were unstable due to the significant flow volume passing through and over the structures.

Table 5-2 Structure details

Crossing	Structure	Upstream RL (m AHD)	Downstream RL (m AHD)	Length (m)
Toowoomba – Cecil Plains Road	Bridge*	347.65	346.86	10
Railway Line	Bridge*	350.55	350.45	10
Weir	Weir was represented in bathymetry from LiDAR.			

*Modelled as culvert in MIKE11

The weir crest level was retained from the 1 metre resolution data. In addition, the road centreline levels been preserved from the 1 m resolution.

Photos of these structures were obtained on the site visit of Cecil Plains. These are presented below in Figure 5-4 and Figure 5-5.

Figure 5-4 Toowoomba – Cecil Plains Road crossing

Figure 5-5 Railway line crossing

6. Hydraulic Model Validation

The Cecil Plains Model and the TRC Condamine River Model were validated to the 1976 and 2010/2011 flood events. The following sections discuss the validation method and results.

6.1 Cecil Plains model

6.1.1 Validation method

Firstly, the Cecil Plains Model was validated to the 1976 event. The 2003 URBS model was not altered for this validation, as the model was previously calibrated to this event. An inflow hydrograph was created by exporting a result hydrograph from the Upper Condamine River Model at a location comparable with the Cecil Plains Model inflow boundaries. The modelled results were then compared to the peak flood flow and peak flood height recorded at the Cecil Plains weir (GS422316A). This was to determine whether the Cecil Plains Model was replicating the flood behaviour of the existing model.

Secondly, the Cecil Plains Model was validated to the 2010/2011 flood event. The 2013 TRC URBS model was used to generate inflow hydrographs. The model was then jointly validated to the hydraulic model and recorded gauge readings through a process of altering loss rates in URBS and adjusting Manning's n in the hydraulic model.

A summary of the joint model validation process is given below.

- The Cecil Plains detailed MIKE21 model was validated to the 2010/2011 event and then validated to the 1976 event.
- Validation to the 1976 event used the outputs generated from the original 2003 URBS model.
- The most reliable event for validation was the 2010/2011 event, as a recorded hydrograph and spot flood levels were available.
- A joint validation process was required to achieve an acceptable validation of the Cecil Plains hydraulic model to the 2010/2011 event. One of the issues to be addressed was that the Cecil Plains hydraulic model area simulates flooding conditions associated with the south branch of the Condamine River and floodplains. The Condamine River (North Branch) was not represented in the model as it is located outside of the detailed model area. However upstream of the detailed model area there is considerable interaction between the branches. This interaction cannot be reliably simulated in the URBS model. It was also identified that there were issues with the reliability of the rating at the Cecil Plains gauge in major floods. An examination of the cross section used to derive the rating identified that the right overbank section used (approximately 1000m wide) was significantly smaller than the active right overbank area observed in the initial modelling at high flows. The right overbank area in the model was more than 2000m wide with flow depths greater than 1m in the overbank area for the 2010/2011 recorded flood level.

The joint validation iteration process involved:

  - Run 2013 TRC URBS model to produce inflows to the TRC Condamine River Model
  - Run TRC Condamine River model to route the discharge inflow hydrographs from the 2013 TRC URBS model downstream and simulate distribution of flows between the Condamine River (North Branch) and main channel.
  - Extract the routed discharge hydrograph at the location of the upstream boundary of the Cecil Plains model for input to the Cecil Plains Model
  - Run the Cecil Plains Model to route flows to gauging point and through the township.
  - Compare model results to the validation data: recorded stage hydrograph at the gauge site and flood levels in the town.

- Modify the representation of the interaction between the north and south branches in the 2013 TRC URBS model and review other model parameters such as rainfall losses. The percentage of flow which breaks out into the Condamine River (North Branch) and the main channel was modified to replicate the flooding behaviour.
- Repeat the previous steps until the Cecil Plains Model was adequately simulating the recorded stage hydrograph at the gauge site (both hydrograph shape and peak water level) and the other flood levels in the town.

Following validation of the Cecil Plains Model to the 2010/2011 event the initial validation to the 1976 event was reassessed.

6.1.2 Hydraulic validation to the December 2010/ January 2011 flood event

The model was validated to the 2010/2011 flood event to be within 20 mm of the recorded flood level and within 670 m^3/s of the recorded peak flood flow. Figure 6-1 and Figure 6-2 show a comparison of the modelled flood hydrographs and the recorded flow and level.

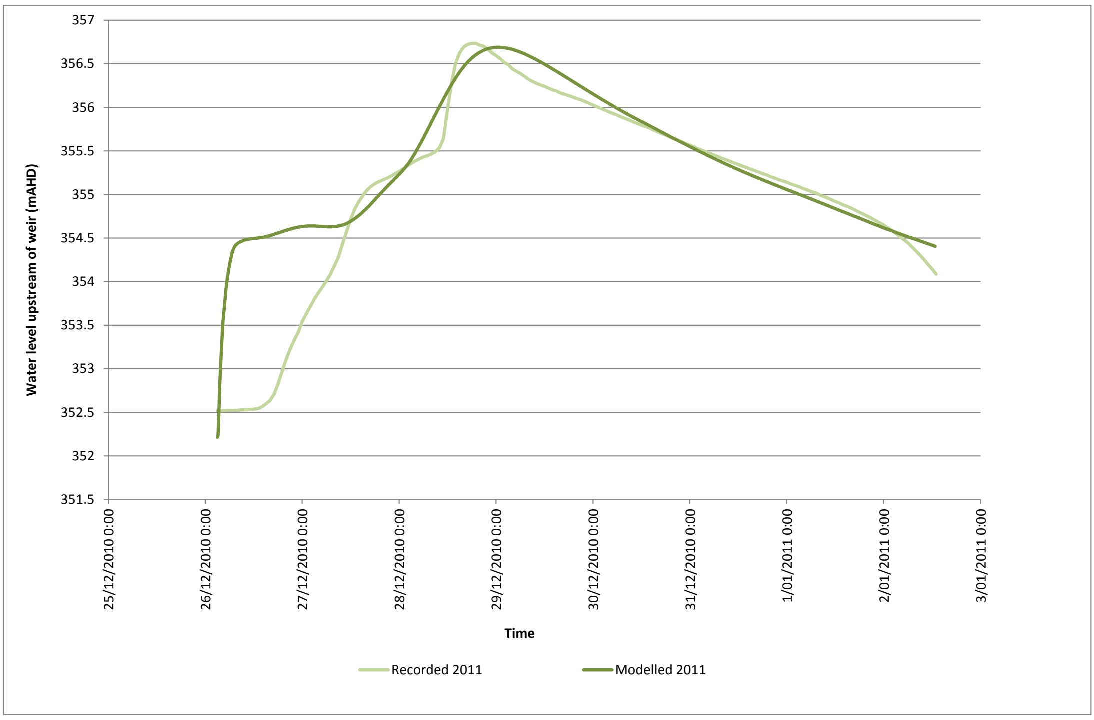


Figure 6-1 2010/2011 flood level validation for gauge GS422316A

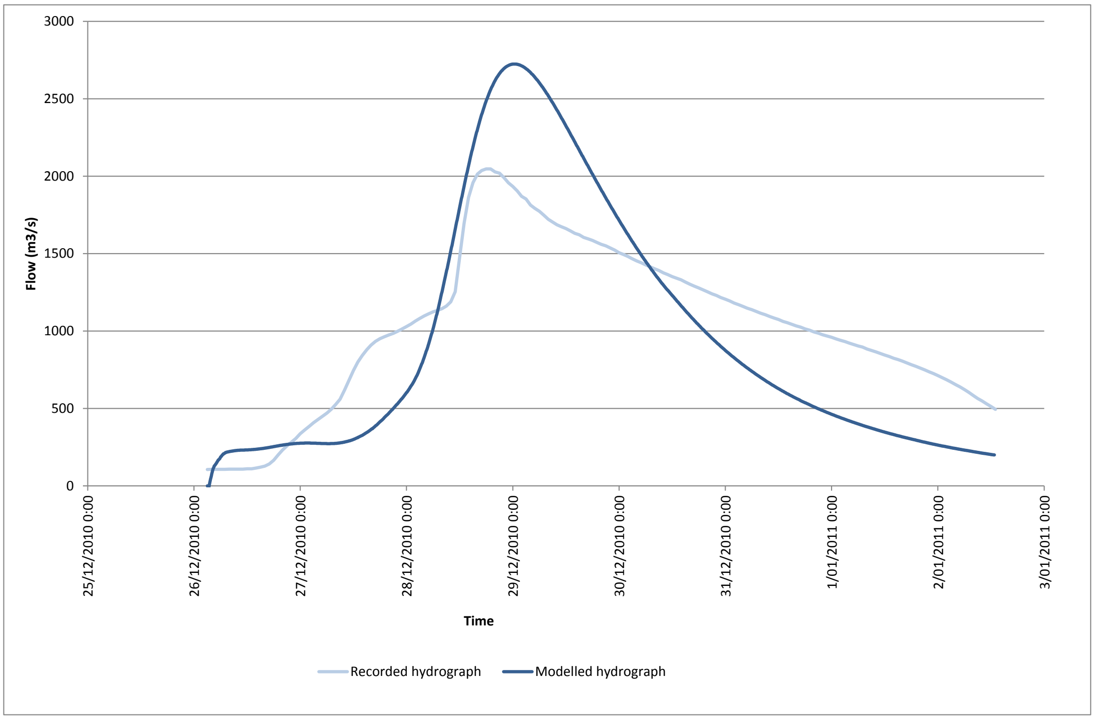


Figure 6-2 2010/2011 flood flow validation for gauge GS422316A at Cecil Plains

6.1.3 Hydraulic validation to the February 1976 flood event

Using the iterative joint validation process the Cecil Plains Model was also validated to the 1976 flood event. The modelled flood level was within 10 mm of the recorded level. However, inflows extracted from the TRC Condamine River Model needed to be scaled up significantly to simulate a modelled peak flood level close to the recorded level. Confidence in the rating curve applicable to the Cecil Plains weir (GS422316A) is considered to be low at major flood levels and is the reason for the inconsistency between flood level and flood flow. This is discussed further in Section 6.3. Figure 6-3 and Figure 6-4 provide comparisons of the modelled flood hydrographs and the recorded flow and level.

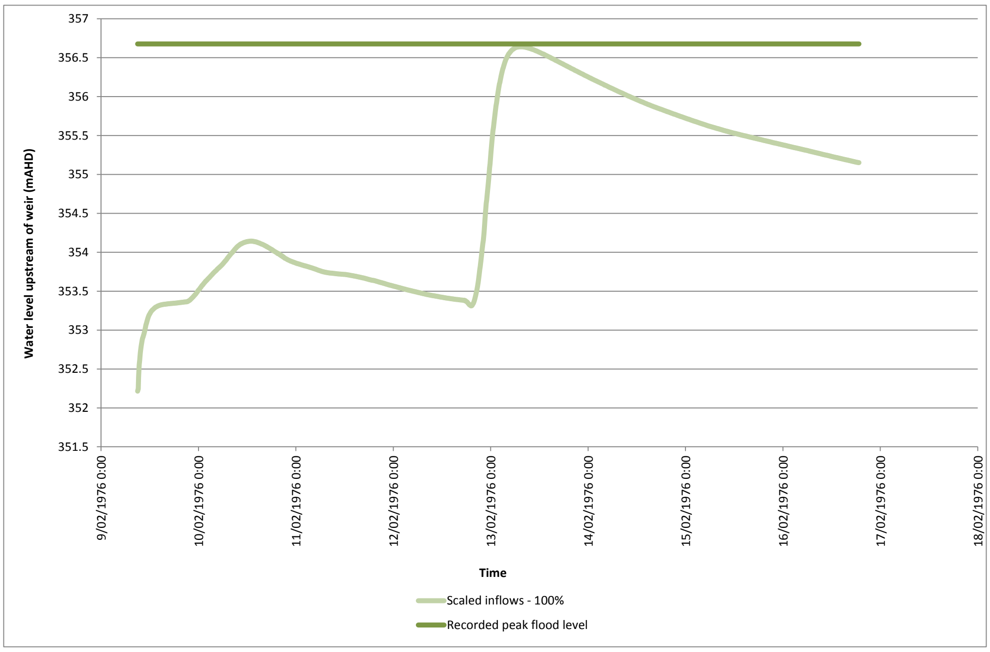


Figure 6-3 1976 flood level validation for gauge GS422316A at Cecil Plains

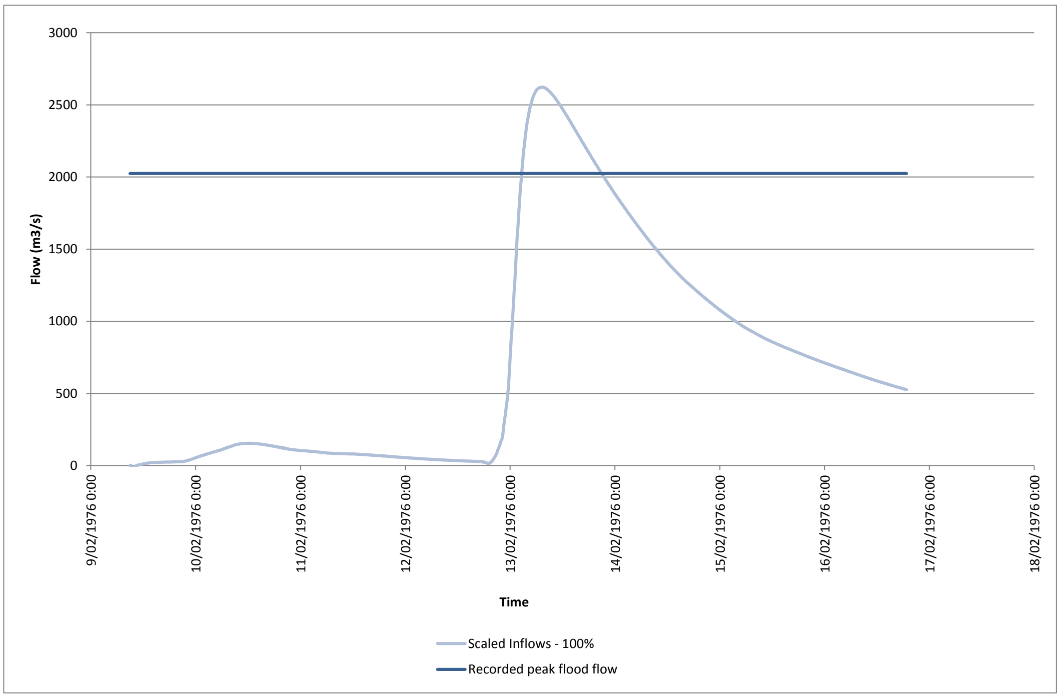


Figure 6-4 1976 flood flow validation for gauge GS422316A at Cecil Plains

6.1.4 Cecil Plains model validation discussion

Throughout the validation process for the 1976 and 2010/2011 event, it became evident that there were inconsistencies between the gauge zero assumed in the original Upper Condamine River Floodplain Broad Scale Hydraulic Model and the current DNRM gauge information. In addition to this matter the reliability of the rating curve used to derive flows for the gauged cross section particularly at major flood levels also came into question. These issues and the model validation performance are discussed in the following sections.

2003 study gauge zero

The original Upper Condamine River Floodplain Broad Scale Hydraulic Model was calibrated at 8 locations within the model domain. The Cecil Plains gauge at the town weir was one of the locations utilised. The weir is shown in Figure 6.5.

Figure 6-5 Photo of the Cecil Plains Weir GS422316A (SKM, 2013)

The data available in the 2003 study identified a gauge zero at this site of 346.5 m AHD. The subsequent calibrated model result was within 450 mm of the recorded flood level of 9.17m (355.67 m AHD). However, updated gauge zero data from DNRM (surveyed in 2009) confirmed that the gauge zero of the Cecil Plains weir is in fact 347.507m AHD, 1.07m higher than the value used in the 2003 study. Therefore, the calibrated flood model results were a total of 1m lower than the recorded level. This difference in levels is shown in table 6-1 below.

Table 6-1 1976 flood level validation at Cecil Plains weir gauge GS422316A.

Study	Adopted Gauge Zero (m AHD)	Recorded gauge height (m)	Recorded flood level (m AHD)	Modelled flood level (m AHD)	Difference (m)
2003	346.5	9.17	355.67	355.22	-0.45
2013 (Current)	347.507	9.17	356.68	356.64	0.04

Reliability of the rating curve

The joint validation process identified that the rating curve was underestimating flows at the major flood levels of the validation events. Good validation to the 2010/2011 event peak flood level of 9.22m on the gauge (356.73m AHD) was achieved. The peak discharge associated with this flood level was 2,717 m^3/s, while the value derived from the rating curve was 2,047 m^3/s. For the 1976 event the peak flood level on the gauge was 9.17m (356.68m AHD) only 50mm lower than the 2010/2011 event. The peak discharge associated with this flood level derived from the rating curve was only 2,024 m^3/s. Given the two floods had very similar peaks it would be expected that peak discharges would be similar.

An assessment of the rating curve was also undertaken, as the gauging site has only been physically rated up to a flow of 1,100 m^3/s. The current rating curve is shown in Figure 6-6.

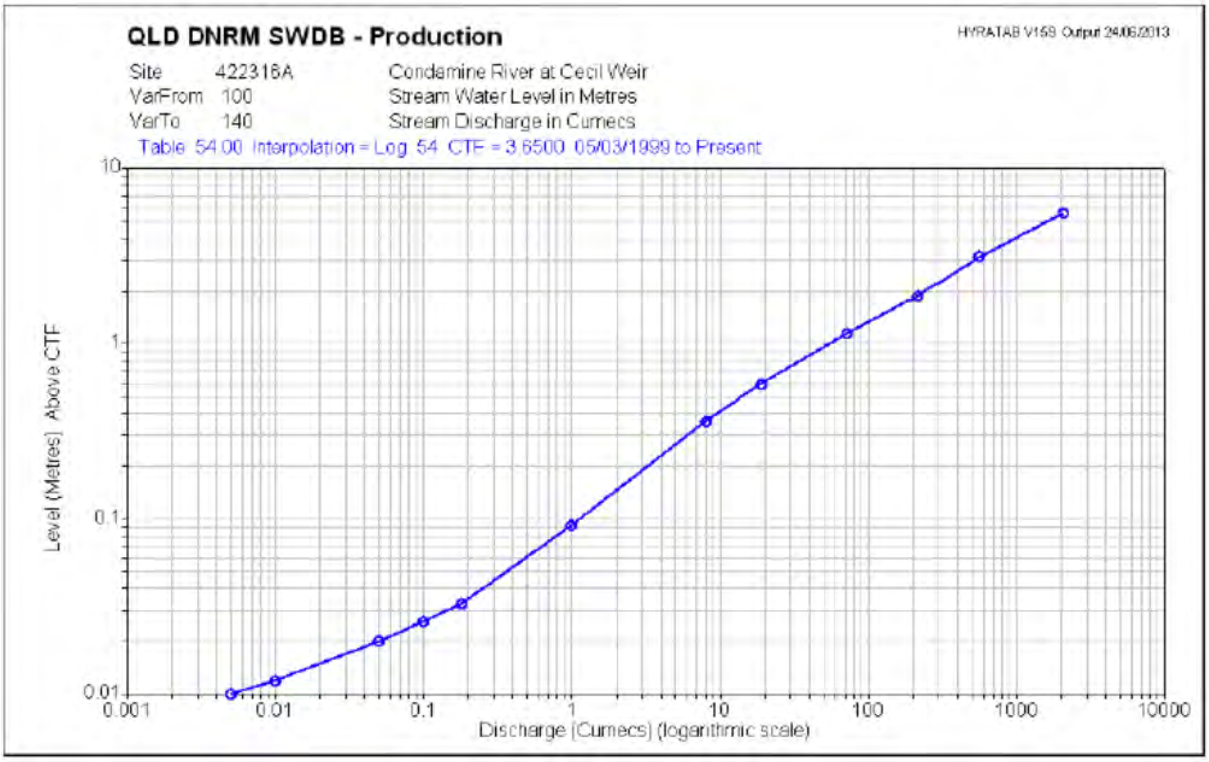


Figure 6-6 Cecil Plains Weir rating curve (GS422316A)

A flow of 1,100 m^3/s corresponds with a gauge height of 5.41m (RL352.45 m AHD). This peak flood discharge is significantly less than the peak flows for 1976 and 2010/2011events which were both in excess of 2,000m^3/s. An examination of the cross section used to derive the rating identified that the right overbank section used (approximately 1000m wide) was significantly smaller than the active right overbank area observed in the initial modelling at high flows. The right overbank area in the model was more than 2000m wide with flow depths greater than 1m in the overbank area for the 2010/2011 recorded flood level.

The 1976 validation runs used the original 2003 URBS model outputs. Outputs from this model only generated a peak discharge at the gauge of 1,437m^3/s. Calibration of the 2013 TRC URBS model as discussed above required the URBS model to be refined to better represent the interaction between the north and south branches of the river to increase flows in the south branch of the river. It was decided that there was limited value in improving the 2003 URBS model to improve its outputs for the 1976 event as the new 2013 TRC URBS model had been created. As such the approach of scaling of the inflows extracted from the TRC Condamine

River Model (generated by inputs from the original 2003 URBS model) was adopted as an efficient approach to providing additional validation to the Cecil Plains Model.

It was noted in the Broad Scale Hydraulic Modelling Report (SKM,2003) that the DNRM rating curve and the recorded flood flows for 1983, 1988, 1996, 1956 and 1976 were conflicting and did not provide confidence that the rating curve was appropriate for use in large floods.

It is concluded that the original Upper Condamine River flood model had been calibrated to within acceptable tolerance. However, due to a combination of the gauge zero data provided at the time of the study being inaccurate, the use of less reliable terrain data (as this was all that was available at the time) and the potentially low reliability of the rating curve at the peak flood level, there was an underestimate of the peak flood levels and peak flood volume in and around Cecil Plains.

TOOWOOMBA REGIONAL COUNCIL

N

0 100 200 400 Meters

Legend

● Cecil Plains Gauge

— Roads

Recorded Level (mAHD)

Modelled Level (mAHD)

Flood Depth (m)

High : 10

Low : 0

Figure 6-7
1976 Flood Model Results

SP051 Flood Studies

1976 flood event validation

Given the potential inaccuracies of the rating curve identified, it was concluded that validation of this event should be based on the peak levels recorded using the updated gauge zero information. As such the estimated flows using the rating curve based on the recorded 1976 flood levels were scaled upward to provide an appropriate representation of flood levels. By scaling the flows to 2615m^3/s, the flood levels were matched to within 10mm of the recorded flood level. Flood modelling results for the 1976 event are illustrated in Figure 6.7.

To check that the result produced by the scaled flows was still within an acceptable range, a flood frequency analysis was carried out to determine the expected peak flow rate at the Cecil Plains weir. The results are illustrated on Figure 6-8.

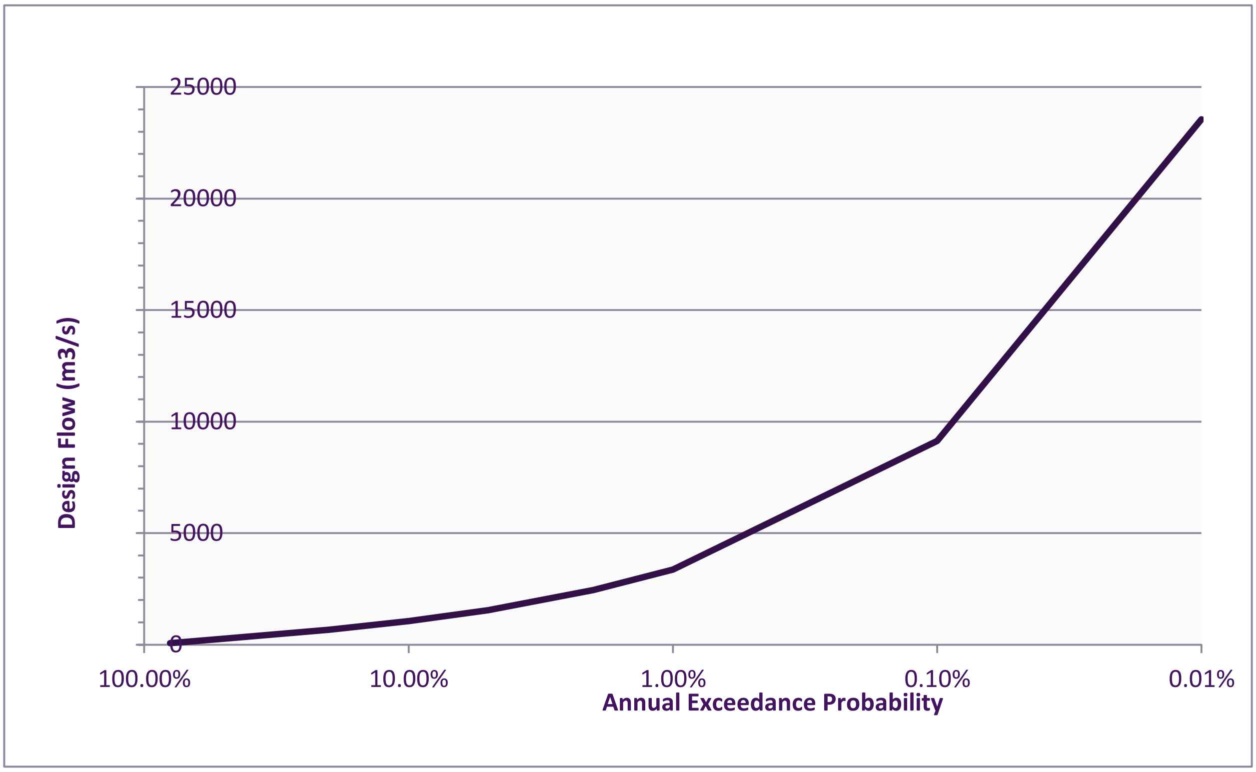


Figure 6-8 Flood Frequency Analysis – Condamine River at Cecil Plains Weir GS422316A.

The flood frequency analysis provided an estimate of peak flood flow of 2407 m^3/s for a 50 year ARI flood and 3,312 m^3/s for a 100 year ARI flood event at Cecil Plains. This correlates well with the estimate of 3,146 m^3/s for a 100 year ARI flood event as published in the Broad Scale Hydraulic Modelling Report (SKM, 2003). It is therefore considered that scaling the inflow hydrograph for the 1976 flood event is appropriate for validation purposes as the event was estimated to be between a 50 to 100 year ARI flood event based on the revised rating curve.

2010/2011 flood event validation

The validation of the 1976 flood event indicated that the rating curve at the Cecil Plains weir may not be reliable in the range of flows above the highest rating level and underestimated peak flow in large events. Therefore, it was suspected that the estimated peak flow of 2,047 m^3/s (using the recorded flood level and rating curve) may be an underestimate of the actual flow experienced in 2010/2011.

The 2010/2011 event at Cecil Plains occurred after several weeks of rainfall. Therefore, the URBS model was run with relatively small assumed losses (10 mm initial loss and 1.5 mm/h continuing losses). This is believed to have provided an accurate representation of a catchment that, in reality, would have been heavily saturated at the commencement of the event. The URBS model gave a peak flow of 3,048 m^3/s at the Cecil Plains gauge.

The peak flow of 3,048 m^3/s is believed to give a more appropriate estimate of the flow experienced in 2010/2011 than the flow derived from the rating curve.

As there is more confidence in the recorded levels than the recorded flows, it was appropriate to validate the model to match the recorded level during the 2010/2011 event. The flow obtained from the URBS model gave levels at Cecil Plains gauge that were within 30 mm of the levels recorded during the 2010/2011 event.

The flood level data provided by TRC at other locations and the SKM collected validation point matched the modelled results within 300 mm in seven of the nine cases. The recorded and modelled flood levels are shown in Figure 6-9 and Table 6-4.

Table 6-4 Recorded and modelled flood levels for 2010/2011 event

Validation point	Observed level (m AHD)	Modelled level (m AHD)	Difference (m)
192	354.09	353.80	-0.29
193	353.84	353.79	-0.05
194	355.97*	357.49	1.52
195	356.68	356.78	0.10
196	356.13**	356.88	0.75
197	356.86	356.73	-0.13
198	356.30	356.48	0.18
199	356.59	356.53	-0.06
SKM collected validation	356.80	356.73	-0.07

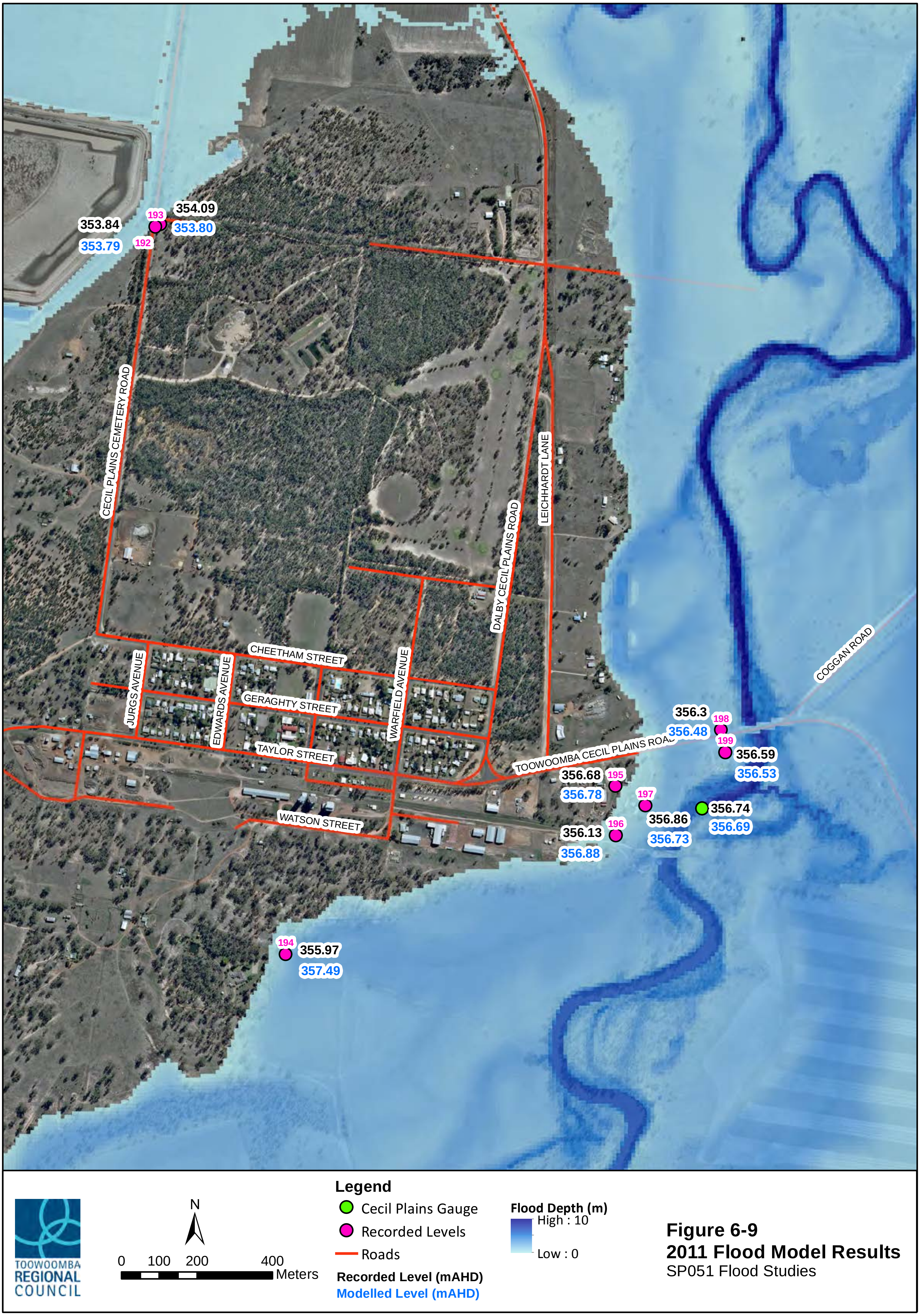
*Ground level is 356.38 mAHD according to digital terrain model - observed level may be unreliable

** Ground level is 356.25 mAHD according to digital terrain model – observed level may be unreliable

Estimated ARI of validation events

The information presented in the above sections outlines that both the 1976 and 2010/2011 flood events were considered to be between a 50 year and 100 year ARI event based on analysis of peak flood flows. Alternatively, when assessing the magnitude of the two validation events based on a comparison of recorded flood levels and simulated design flood levels, the validation events are considered to be between a 20 year and 100 year ARI event. It is worth noting that the flood level difference between the 20 year and 100 year ARI event is approximately 500mm.

Given that the hydraulic model has an accuracy of approximately +/-300mm, the outcome based on flood levels (between 20 year and 100 year ARI) is not inconsistent with the magnitude of the flood events determined from the flood frequency analysis where both validation events were between the 50 and 100 year ARI flows.



TOOWOOMBA REGIONAL COUNCIL

Figure 6-9
2011 Flood Model Results
SP051 Flood Studies

Document Path: I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\Fig 6-9_Model_Results_2011.mxd

6.2 TRC Condamine River Model

The TRC Condamine River Model was used to characterise the flooding conditions for the localities of Pampas, Yandilla and Tummaville, found in the upper reaches of this model. This part of the model was validated to the 1976 event during the 2003 study. The validation was based on matching the stage hydrograph recorded at Tummaville (hydrograph shape and peak) and a peak water level recorded at Centenary Bridge (on the Gore Highway) near Yandilla. Figure 6.10 presents a comparison of the model simulated water level hydrograph and the recorded hydrograph at Tummaville.

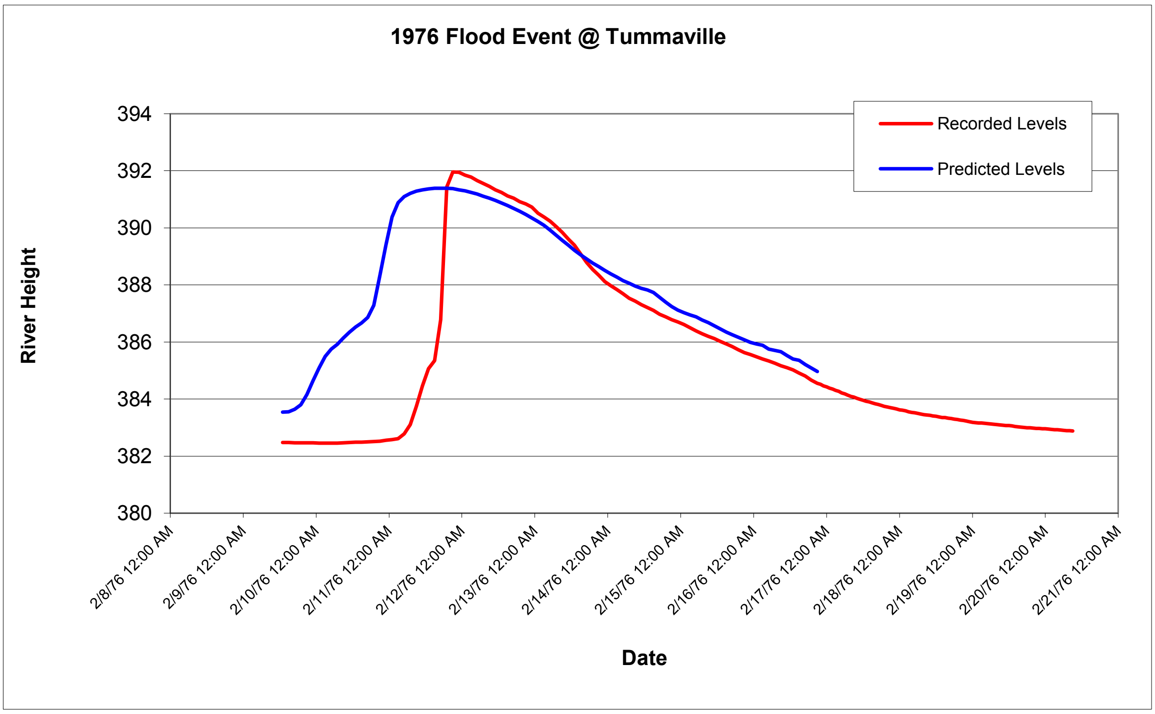


Figure 6-10 Recorded and simulated stage hydrographs 1976 event at Tummaville (gauge GS422323A)

The peak water level for the 1976 event recorded at Centenary Bridge 378.2 m AHD was matched by the model.

The validation result indicated that the model was adequately representing river and floodplain behaviour in this area. The modifications required to the URBS model to achieve calibration of the 2010/2011 event were in the sub catchments downstream of this area and would not change the validation outcomes of the upper reaches of the model.

Notwithstanding this, validation data relevant to this region of the model was sourced for the 2010/2011 flood event. In this part of the catchment this event was of similar magnitude to the 1976 event. Figure 6.11 presents a comparison of the model simulated water level hydrograph and the recorded hydrograph at Tummaville for the 2010/2011 event.

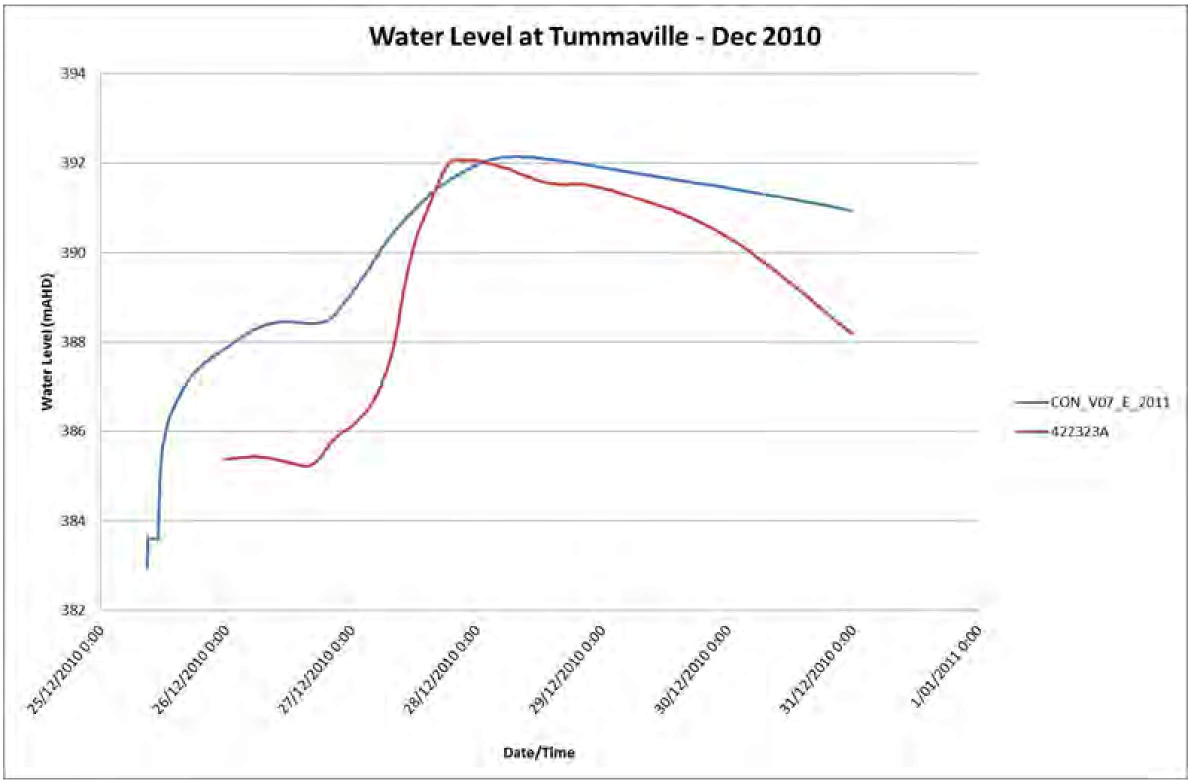


Figure 6-11 Recorded and simulated stage hydrographs 2010/2011 event at Tummaville

A comparison of the simulated and recorded hydrographs indicates that the model is adequately representing the flood peak and timing of the event.

Model results were also compared with other data available for this part of the model. These results along with available results for the 1976 event are presented in Table 6-5.

In regard to the validation of the TRC Condamine River Model and the recorded gauge levels, please see the comparison tabulated below.

Table 6-5 Recorded and modelled flood levels for 2010/2011 and 1976 events - TRC Condamine River Model

Gauge	Gauge Zero	Recorded December 2010	Modelled December 2010	Difference (m)	Recorded Feb 1976	Modelled Feb 1976	Difference (m)
Lone Pine	365.09	371.46	369.5	1.96	NA	369.3	NA
Tummaville	380.93	392.06	392.11	-0.05	391.77	391.4	0.37
Centenary Bridge	370.99	379.59	378.85	0.44	378.2	378.2	0
Pampas	379	382.59	382.18	0.41	NA	381.9	NA

The results in Table 6.5 demonstrate that the TRC Condamine River Model is adequately validated. At Tummaville the model simulated levels within 50mm of those recorded. At Centenary Bridge and Pampas simulated levels were within approximately 400mm of those recorded. The lower simulated levels, in these two locations, is likely to be due to the model not implicitly representing the bridge structures and embankments in these locations due to the 60m grid size.

At Lone Pine the poor modelling result is suspected to be due to the lack of definition in the terrain to represent the 2D breakout flow behaviour between the Condamine River (North Branch) and Condamine River. While validation is less reliable in this area, the result is not considered significant as there are no urban localities in this vicinity and in the urban areas of Cecil Plains, Pampas, Tummaville and Yandilla an adequate validation was achieved.

7. Design Event Flood Behaviour

The following section provides a summary of the flood behaviour of the Condamine River at Cecil Plains, Pampas, Yandilla and Tummaville. Mapping of design events is provided in Appendix B.

7.1 Cecil Plains

Cecil Plains is one of the larger townships located within the study area. The township is perched above the surrounding Condamine River floodplain. During the 10 year ARI event, the flood extent does not impact on small township allotments. The land located to the west of the Cecil Plains weir and gauging station is inundated to depths of approximately 2 metres and is considered to be a high hazard floodway. The flood extent on the western bank for the 20 to 500 year flood events is very similar. However, for these same events flood depths increase significantly.

As flood magnitude increases, the flood extent wraps around the township and results in Cecil Plains becoming an isolated island on the floodplain.

7.2 Pampas

The township of Pampas is small with limited residential or commercial properties. A small historical subdivision exists to the south of the Gore Highway. The modelled 10 year event shows the town to be elevated above the floodwaters originating from the Condamine River. Two residential properties are inundated at shallow depths (up to 250mm). The modelled 10 year event shows floodwater starting to breakout from the Condamine River (north branch) and traverse westward across the floodplain.

There is not a significant change in flood extent for the modelled 20 year ARI event. Floodwaters start to encroach on a historical subdivision located to the south of the Gore Highway. The modelled 100 year ARI flood event inundated the Gore Highway to the east and west of the township. The Pampas township becomes isolated by this flood water with the flood depth in excess of 1 metre. The 500 year ARI further isolates the township with floodwaters increasing in depth.

7.3 Yandilla

Yandilla does not have a distinct township. The locality Yandilla is located to the south-west of the Condamine River and Centenary Bridge near the intersection of the Gore Highway and Millmerran-Leyburn Road. The modelled 10 year ARI event shows that Condamine River breaks its banks and the floodplain located between the two waterways is inundated. Inundation of the Gore Highway also occurs. The flood extent does not alter significantly between the 10 and 20 year ARI events.

The modelled 100 year ARI event shows significantly greater flood depths of between 1 metre and 3.5 metres on the floodplain between Condamine River and smaller creek systems. However, the extent of flooding is still confined to the north of the Yandilla locality. Flood water depth is further increased for the 500 year ARI event, with the extent encroaching on the Yandilla locality.

7.4 Tummaville

Tummaville is located on the Condamine River. No distinct township exists. The floodplain is significantly inundated during a 10 year ARI flood event. No significant change in flood extent occurs between the 20 year ARI and 100 year ARI events. However, an “island” does form on the floodplain to the south of the Condamine River at the Tummaville gauging station. The extent of the 500 year ARI flood event is significant, covering most of the area surrounding the township with the floodplain at depths of up to 3 metres.

8. Isolation and Evacuation

The following section outlines isolation and evacuation risk for community members and critical infrastructure. It should be noted that commentary on flood risk can only be provided for areas inside the model boundary. Some discussion of broader isolation risk is provided. However, this information is only based on topographical information and locations of roads, and cannot be provided with certainty due to the lack of location specific flood information.

8.1 Cecil Plains

The township of Cecil Plains is location on land of higher elevation, bordered by the Condamine River to the east and the expansive floodplain to the south, west and north.

Within the study area, modelling has shown that township residential allotments (small town allotments) and all emergency services provided in Cecil Plains are not inundated up to the modelled 500 year ARI flood event.

The study area is mostly affected by high hazard floodwaters to the east, with riverine flooding backing up around the town from the north and south. Cecil Plains becomes isolated due to flooding of the Cecil Plains-Moonie Road, Toowoomba-Cecil Plains Road, Dalby-Cecil Plains Road and Millmerran-Cecil Plains Road. Some rural dwellings located along Dalby-Cecil Plains Roads could be affected by high hazard floodwaters and/or significant flood depth.

The township of Cecil Plains has an evacuation centre, SES, Rural Fire Station, and Police Station. That being said, due to the isolated nature of the township, it is considered that lack of mobility, supplies and access to medical assistance would be the largest risk to the community. No critical infrastructure has been identified within the modelled inundation extent up to the 500 year ARI event.

8.2 Pampas

The township of Pampas is located on land of slightly higher elevation, bordered by the Condamine River (North Branch) to the east. The township is located in the middle of the floodplain which is approximately 12km wide. Brookstead is the largest closest township to Pampas.

Within the study area, modelling has shown that township's residential allotments (historic subdivision) would be inundated by events greater than the modelled 500 year ARI flood event.

The study area is mostly affected by significant flood hazard floodwaters to the east, with a significant volume of water conveyed through floodplain flows. Pampas becomes isolated due to flooding of all roads, including the Gore Highway. Numerous rural dwellings located within the locality could be inundated.

The township of Pampas has a Rural Fire Station which is not inundated by the modelled ARI events. Brookstead is nearby and has a Rural Fire Station and Evacuation Centre. It is more appropriate those persons within the Pampas locality be evacuated to Brookstead which is located above the floodplain. Access to Pittsworth via the Gore Highway may be possible. Pittsworth has a Police Station, Fire Station, SES and a district hospital which would be of benefit to persons in the Pampas and Brookstead locality.

It must be noted that evacuation to Brookstead would need to occur early in an event, as the Gore Highway becomes un-trafficable even in the 10 year ARI event.

No critical infrastructure was identified in Pampas.

8.3 Yandilla

The township of Yandilla is located on land of higher elevation, bordered by the Condamine River to the east.

Within the study area, modelling has shown that the locality is located on the edge of the floodplain. The north eastern portion of the locality becomes inundated, with extreme hazard floodwaters in the area immediately surrounding Grasstree Creek and the Condamine River. Some rural dwellings located on the floodplain could be affected by significant flood hazard floodwaters and significant flood depth.

There is no specific township of Yandilla. The nearest centre is Millmerran where there is an evacuation centre, SES, Police Station, Ambulance and Hospital. It is considered that with enough warning, residents could be evacuated to Millmerran where there is sufficient emergency services support. No critical infrastructure has been identified within the modelled inundation extent up to the 500 year ARI event.

8.4 Tummaville

The Tummaville locality is location on the Condamine River floodplain.

Within the study area, modelling has shown that locality is affected by floodwaters being conveyed on the floodplain. The study area is mostly affected by high and extreme hazard floodwaters to the east. There are very sparse rural settlements in the locality, the majority of these are located outside of the high/extreme hazard flood extent.

There is no specific township of Tummaville. The nearest major centre is Millmerran, Pittsworth or Leyburn. Millmerran and Pittsworth have an evacuation centre, SES, Police Station, Ambulance and Hospital. It is considered that with enough warning and preparedness, residents may be evacuated to Millmerran where there is appropriate emergency services support. No critical infrastructure has been identified within the modelled inundation extent up to the 500 year ARI event.

9. Flood Hazard Mapping Methodology

The flood hazard criteria used in the flood hazard maps is based on Schedule 4 on page 45 in the Queensland Reconstruction Authority's *Planning for stronger, more resilient floodplains Part 2 – Measures to support floodplain management in future planning schemes*.

(see http://www.qldreconstruction.org.au/u/lib/cms2/resilient-floodplains-part2-full.pdf).

The flood hazard criteria has been prepared for use in preparing flood investigations (level 2), and planning evaluations based on latest available engineering guidance. In the absence of other more appropriate flood hazard definitions, the criteria below may be used.

The basis of the flood hazard criterion is the relationship between flood depth and flood velocity. The depth of flow multiplied by the velocity of the flood flow is used to understand how hazardous the flow is to life and property. For instance, flood water which is 1.5 metres deep, with a very small velocity may be less hazardous than a flow at 0.5 metres with a high velocity which could sweep persons off their feet.

The "Low Hazard" category was mainly based on the *ARR Revision Project 10: Appropriate Safety Criteria for People Stage 1 Report*. A proper understanding of what is meant by Low Hazard can be gained by reviewing these reports. For example, it is noted in the *ARR Revision Project 10: Appropriate Safety Criteria for People* that for the Low Hazard category -

> *'Stability uncompromised for persons within laboratory test program at these flows (to maximum flow depth of 0.5 m for children and 1.2 m for adults and a maximum velocity of 3.0 m/s at shallow depths).'*

It is further noted that 'loss of stability could occur in lower flows when adverse conditions are encountered including:

- **Bottom conditions**: uneven, slippery, obstacles;
- **Flow conditions**: floating debris, low temperature, poor visibility, unsteady and flow aeration;
- **Human subject**: standing or moving, experience and training, clothing and footwear, physical attributes additional to height and mass including muscular development and/or disability, psychological factors;
- **Others**: strong wind, poor lighting, definition of stability limit (i.e. felling unsafe or complete loss of footing).'

There are also caveats on the criteria for stability of vehicles. It should be noted that the low flow criteria applies to large 4WD vehicles. Small passenger vehicles may not be safe in this category.

It should be noted that the QldRA flood hazard criteria are only interim guidelines and local authorities may wish to use a different criteria based on local experience. One alternative is given in Appendix J of *Floodplain Management in Australia: best practice principles and guidelines SCARM Report 73*

(see http://www.publish.csiro.au/Books/download.cfm?ID=2260).

The mapping outputs of this study are found in **Appendix B** of this report.

10. Sensitivity Assessments

The hydraulic modelling was assessed for sensitivity to flow (m^3/s) and land roughness values. As prescribed by the brief, +/- 30% flow and +/- 30% change in roughness was applied to the 100 year ARI hydraulic model for Cecil Plains. The change in flood level was compared at each validation point. A summary of the results are shown below in Table 10-1.

Table 10-1 Sensitivity testing results for Cecil Plains

Validation point	100 year ARI Event	30% increase in flow	30% decrease in flow	30% increase in roughness	30% decrease in roughness
192	354.59	354.59	354.58	354.59	354.59
193	354.59	354.59	354.58	354.59	354.59
194	357.98	358.36	357.48	358.45	357.66
195	357.20	357.49	357.31	357.62	357.31
196	357.33	357.65	356.92	357.78	357.018
197	357.16	357.47	356.77	357.6	356.85
198	356.88	357.18	356.53	357.28	356.64
199	356.97	357.25	356.57	357.34	356.68

The results show that the model is slightly sensitive to variations in flow. Validation point ID 198 and 199 were the most sensitive to changes in flow as they are located on and near the main bridge structure affected by changes in afflux associated with changes in flow. The model is equally sensitive to +/- 30% changes in Mannings n and flow, with a change of +/-300-400mm from the original model result.

11. Conclusions

The validation of the Cecil Plains Model indicates that the rating curve provided for the Cecil Plains weir may not be reliable. It was found that the peak flow that relates to a given flood level is probably underestimated by the rating curve for large events.

It was considered appropriate to validate the model to achieve the observed flood levels for the 2010/2011 and 1976 flood events because there was uncertainty around the recorded flow data. Both of the events validated closely (within 30 mm) to the observed flood levels at the Cecil Plains gauge. However, the flows were significantly higher than the estimated flows for both flood events.

The 2010/2011 model produced results within 300 mm of the TRC observed flood levels in six out of the eight locations where flood level estimates were available. The two flood levels provided that were not within 300 mm of the modelled results were both found to be below ground level according to the digital terrain model provided. Therefore, it is likely that these observed levels are not reliable.

In conclusion, it is considered that the TRC Condamine River Model is appropriately validated for the towns of Tummaville, Pampas and Yandilla. In addition, the Cecil Plains Model has been appropriately validated to the flood level information available and provides a good representation of the flood behaviour of the township.

11.1 Disclaimer

While every care is taken by the Toowoomba Regional Council (TRC) to ensure the accuracy of the data used in the study and published in the report, Toowoomba Regional Council makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of data being inaccurate or incomplete.

12. References

The State of Queensland (Queensland Reconstruction Authority) 2011-2012, *Planning for stronger, more resilient floodplains.*

Queensland Floods Commission of Inquiry, 2012, *Queensland Floods Commission of Inquiry Final Report.*

Australian Rainfall and Runoff, 2001, *A Guide to Flood Estimation, Vol 1.*

Department of Local Government and Planning, 2003, *State Planning Policy 1/03 Mitigating the adverse impacts of Flood, Bushfire and Landslide.*

Engineers Australia Water Engineering, *2010, ARR Revision Project 10: Appropriate Safety Criteria for People Stage 1 Report* http://www.ncwe.org.au/arr/Website_links/ARR_Project_10_Stage1_report_Final.pdf

Engineers Australia Water Engineering*, 2010, ARR Revision Project 10: Appropriate Safety Criteria for Vehicles Stage 2 Report* (Draft) http://www.ncwe.org.au/arr/Website_links/ARR_Project_10_Stage2_Report_Final.pdf.

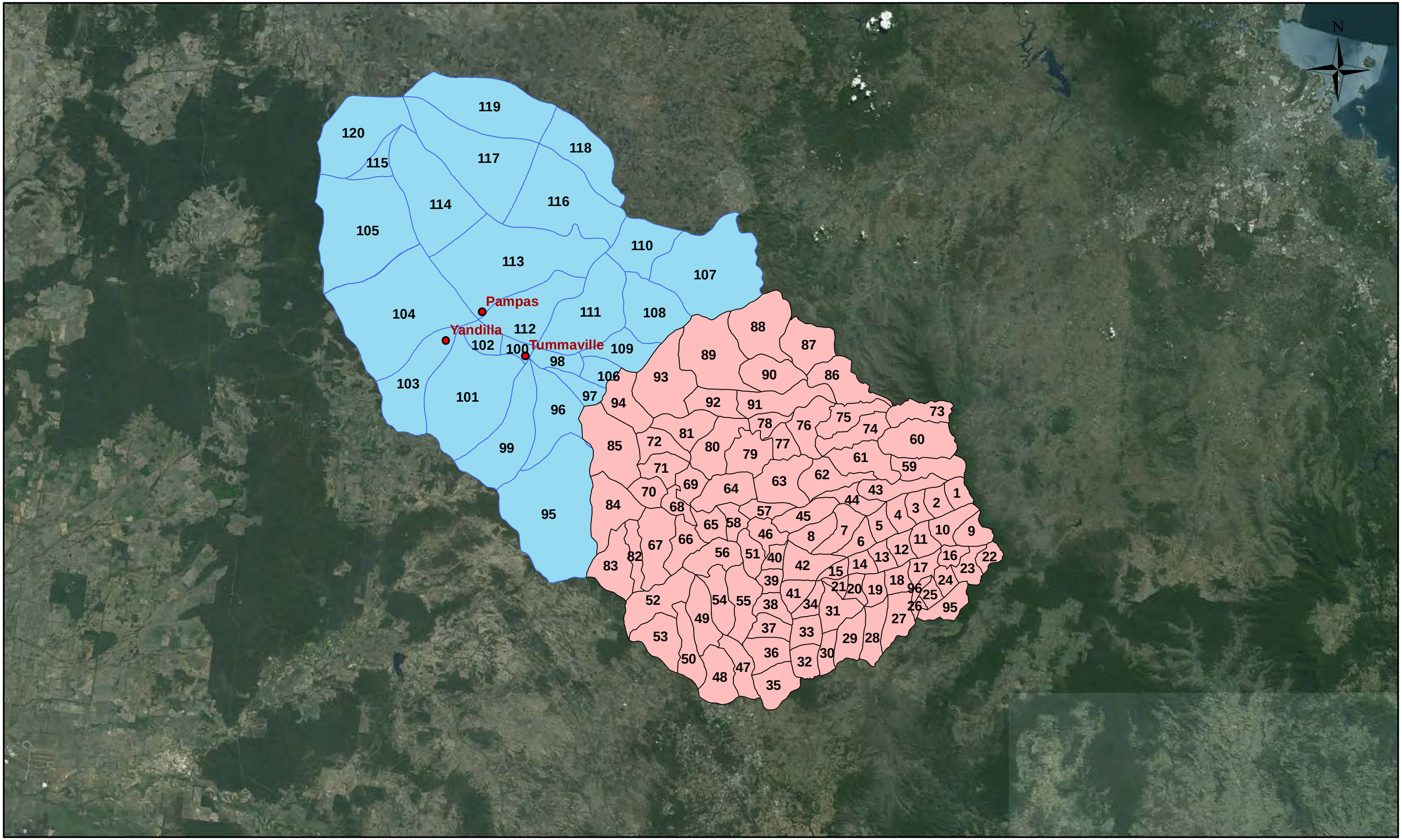
Sinclair Knight Merz, 2003, *Upper Condamine Floodplain Management Project – Condamine River Broad Scale Hydraulic Model Development Report*.

Sinclair Knight Merz, 2012, *Condamine River and Tributaries Report*.

Bureau of Meteorology, 2014, *Flood summary for Toowoomba – December 2010 and January 2011,* http://www.bom.gov.au/qld/flood/fld_reports/toowoomba_fact_sheet_2011.pdf

Bureau of Meteorology, 2014, *Queensland Rainfall and River Conditions,* accessed 11th January 2011, http://www.bom.gov.au/qld/flood/index.shtml

Appendix A. URBS sub catchments



TOOWOOMBA REGIONAL COUNCIL

0 5 10 20
Km

GDA 94

Legend

● Towns

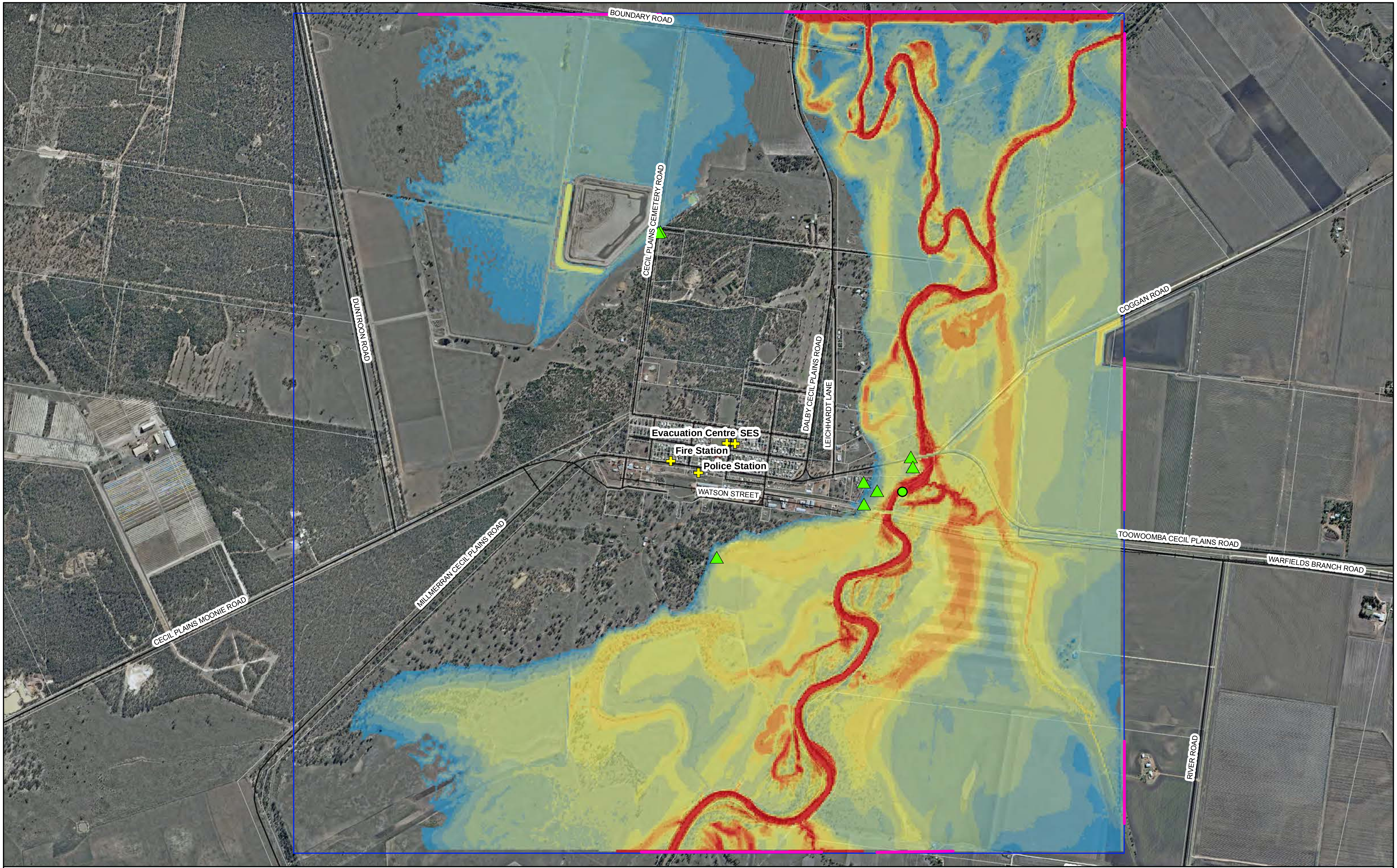
🟥 2011 URBS model

🟦 2013 URBS model

URBS modelling catchments

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\General\URBS-catchment_names.mxd
Author/Date: ekordomenidi 7/05/2014

Appendix B. Mapping Results



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

- ● Cecil Plains Gauge
- ✚ Emergency Locations
- Road Centreline
- Rail Centreline
- ▲ Validation Points
- Model Boundaries
- ☐ Model Extent
- ☐ Cadastre

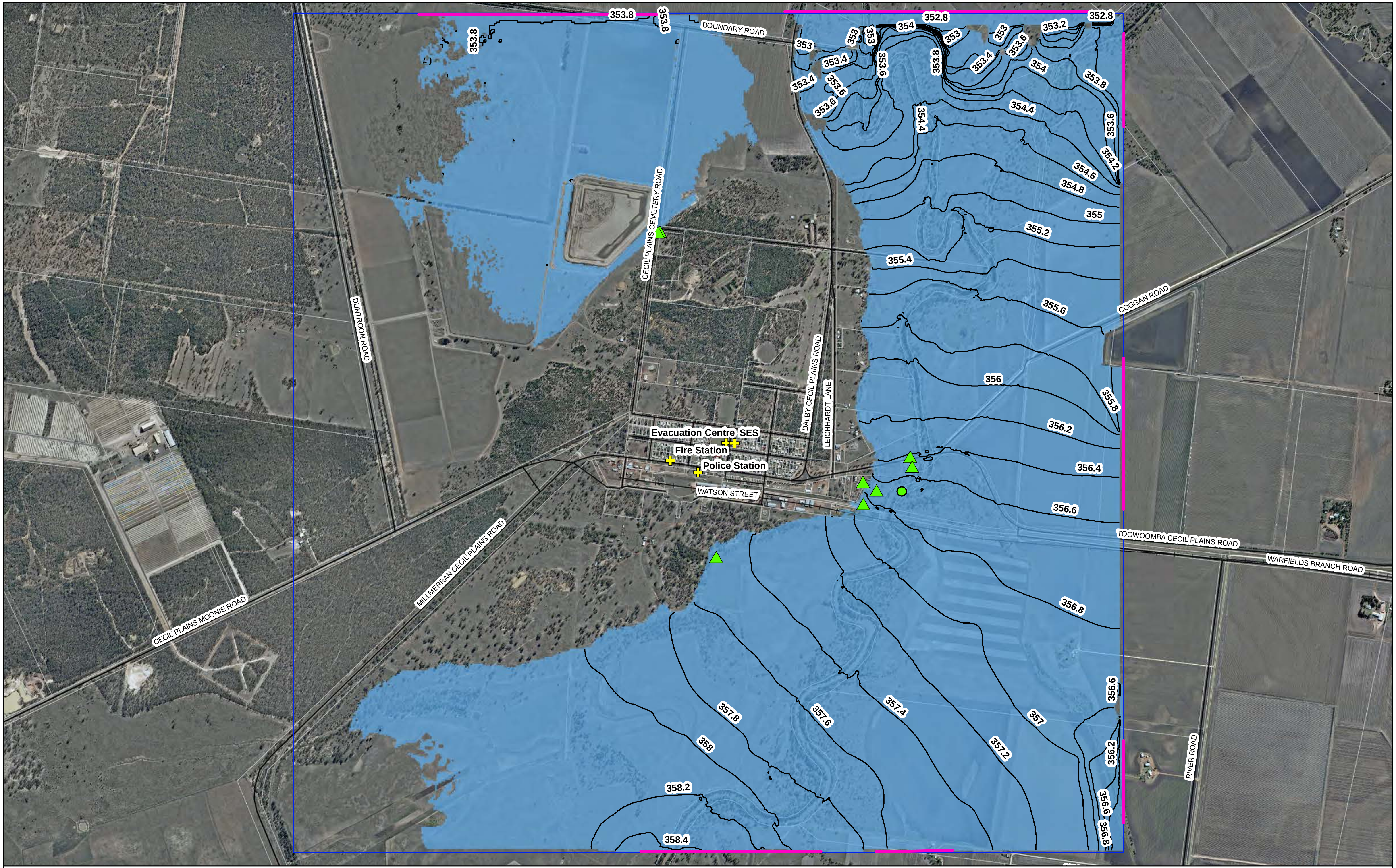
Peak Depth (m)

- < 0.1
- 0.1- 0.25
- 0.25 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- 4.0 - 4.5
- 4.5 - 5.0
- > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Cecil Plains
1976 Validation Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CEC_V21_E_1976_D.mxd
Date Saved: 14/03/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

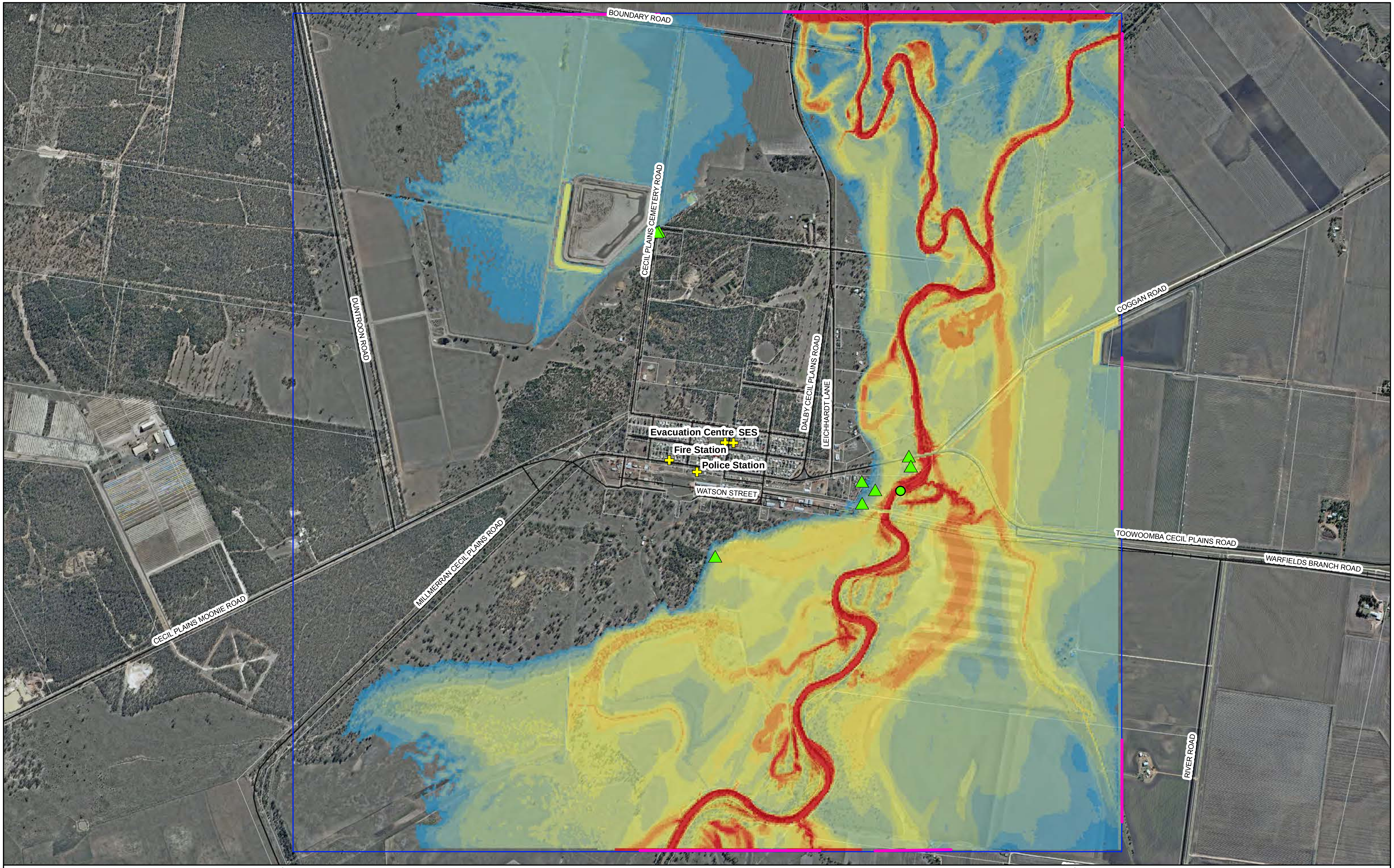
N

Legend

- ● Cecil Plains Gauge
- ✚ Emergency Locations
- — Road Centreline
- ┼ Rail Centreline
- ▲ Validation Points
- — Model Boundaries
- ☐ Model Extent
- ☐ Cadastre
- — Water Level Contours (mAHD)
- ▨ Inundation Extent

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Cecil Plains
1976 Validation Event Peak Water Level



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

● Cecil Plains Gauge
✚ Emergency Locations
— Road Centreline
┼ Rail Centreline
▲ Validation Points

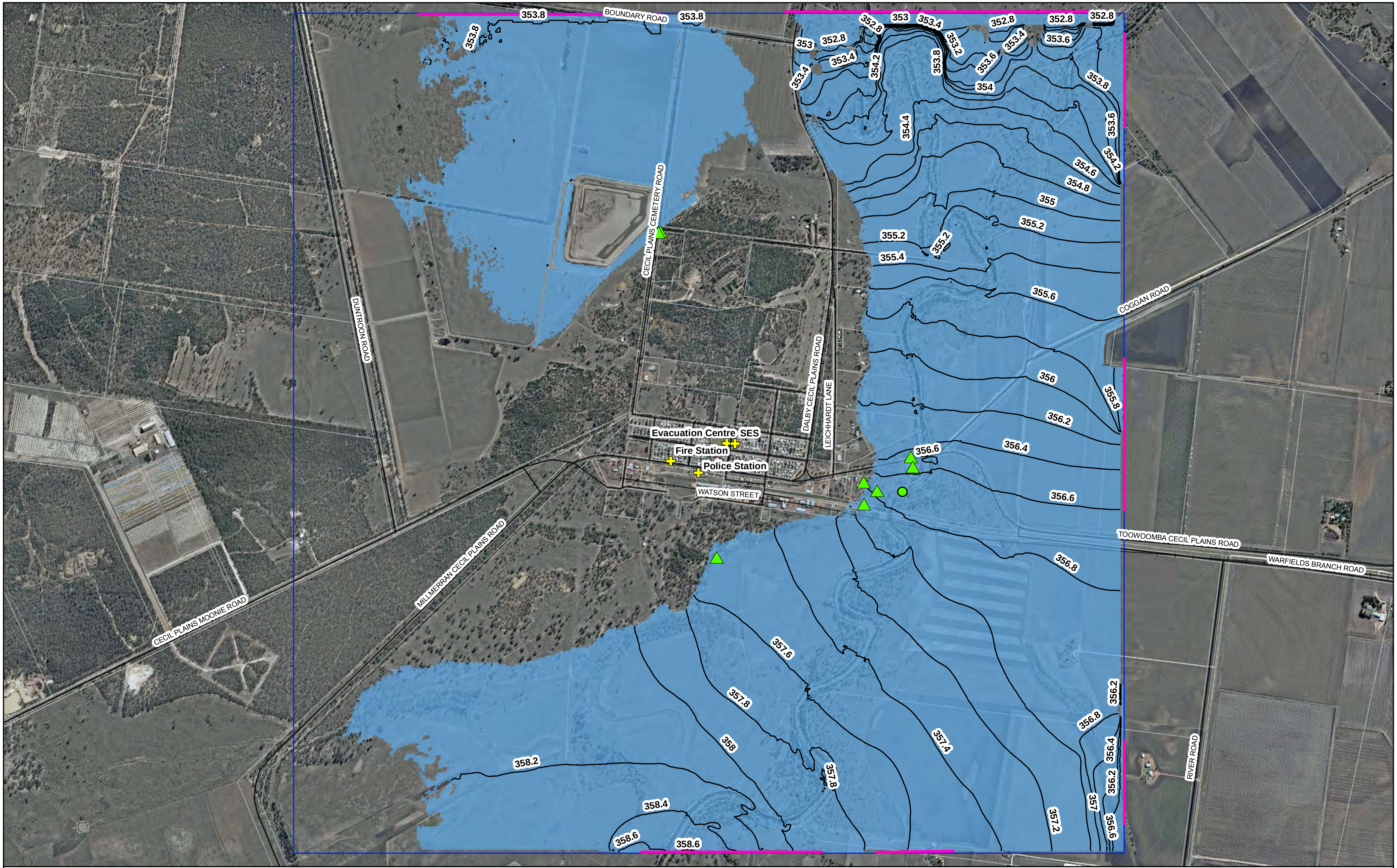
— Model Boundaries
☐ Model Extent
☐ Cadastre

Peak Depth (m)
▨ < 0.1
▨ 0.1- 0.25
▨ 0.25 - 0.5
▨ 0.5 - 1.0
▨ 1.0 - 1.5
▨ 1.5 - 2.0
▨ 2.0 - 2.5
▨ 2.5 - 3.0
▨ 3.0 - 3.5
▨ 3.5 - 4.0
▨ 4.0 - 4.5
▨ 4.5 - 5.0
▨ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Cecil Plains
2011 Validation Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CEC_V21_E_2011_D.mxd
Date Saved: 14/03/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500

Metres

GDA 1994 MGA Zone 56

N

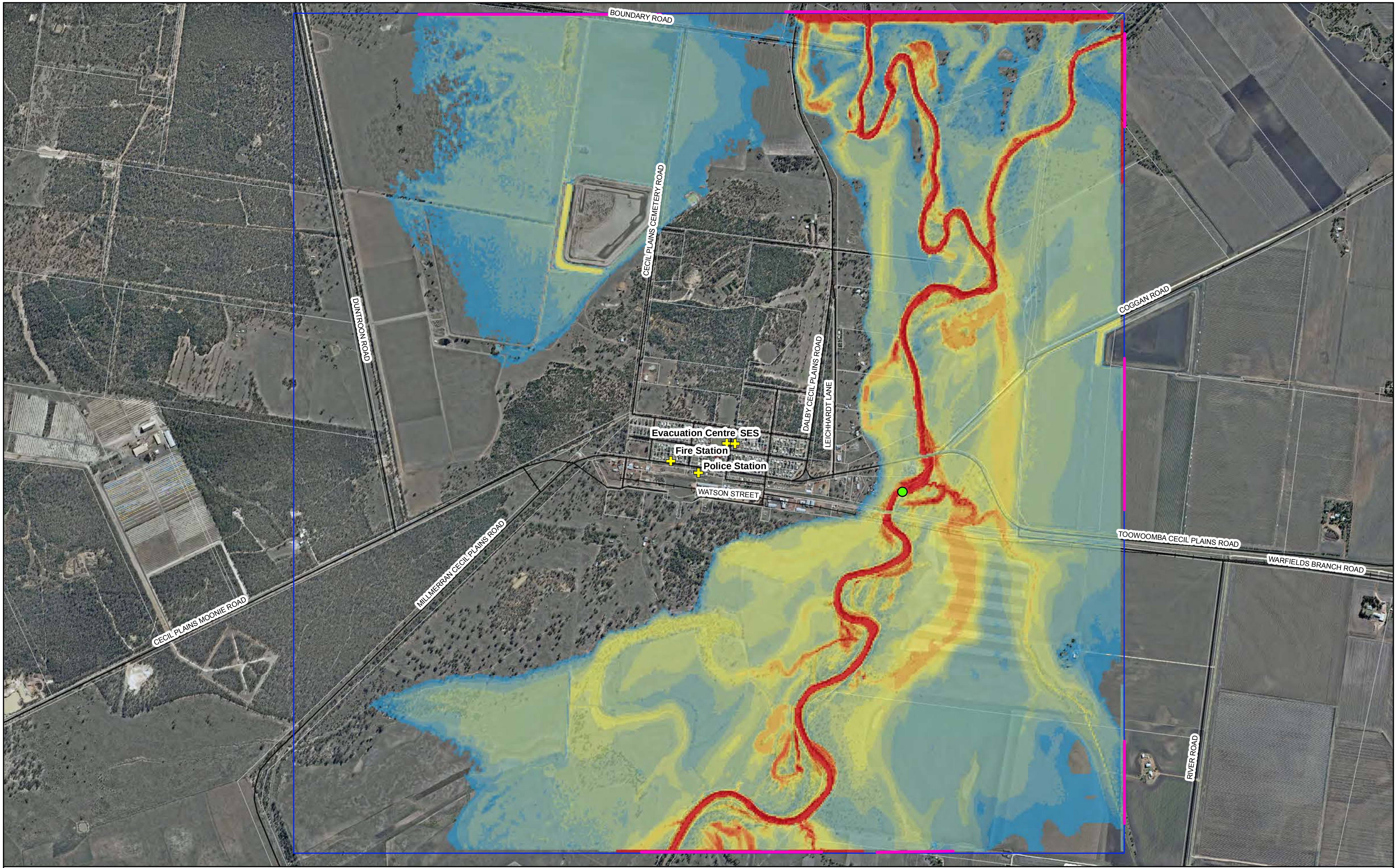
Legend

● Cecil Plains Gauge
✚ Emergency Locations
— Road Centreline
┼ Rail Centreline
▲ Validation Points
— Model Boundaries
☐ Model Extent
☐ Cadastre
— Water Level Contours (mAHD)
▨ Inundation Extent

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Cecil Plains
2011 Validation Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CEC_V21_E_2011_H.mxd
Date Saved: 14/03/2014



TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

- ● Cecil Plains Gauge
- ✚ Emergency Locations
- — Road Centreline
- ┼ Rail Centreline
- — Model Boundaries
- ☐ Model Extent
- ☐ Cadastre

Peak Depth (m)

- ▨ < 0.1
- ▨ 0.1- 0.25
- ▨ 0.25 - 0.5
- ▨ 0.5 - 1.0
- ▨ 1.0 - 1.5
- ▨ 1.5 - 2.0
- ▨ 2.0 - 2.5
- ▨ 2.5 - 3.0
- ▨ 3.0 - 3.5
- ▨ 3.5 - 4.0
- ▨ 4.0 - 4.5
- ▨ 4.5 - 5.0
- ▨ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Cecil Plains
10 Year ARI Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CEC_V24_E_10Y_D.mxd
Date Saved: 6/03/2014

TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

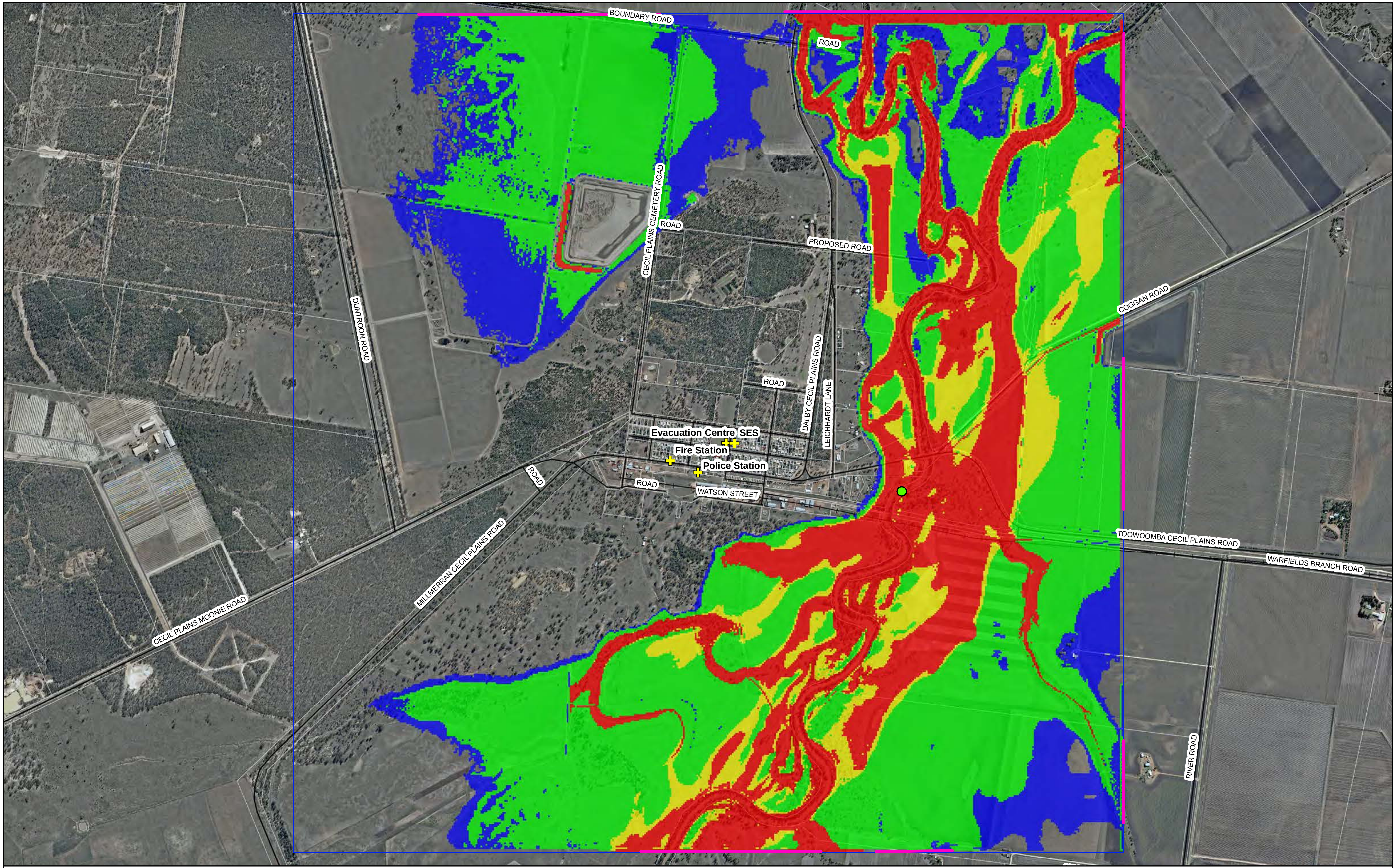
Legend

●	Cecil Plains Gauge
✚	Emergency Locations
—	Road Centreline
┼	Rail Centreline
—	Model Boundaries
☐	Model Extent
☐	Cadastre
—	Water Level Contours (mAHD)
▨	Inundation Extent

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Cecil Plains
10 Year ARI Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CEC_V24_E_10Y_H.mxd
Date Saved: 6/03/2014



TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

- ● Cecil Plains Gauge
- ✚ Emergency Locations
- — Road Centreline
- ┼ Rail Centreline
- — Model Boundaries

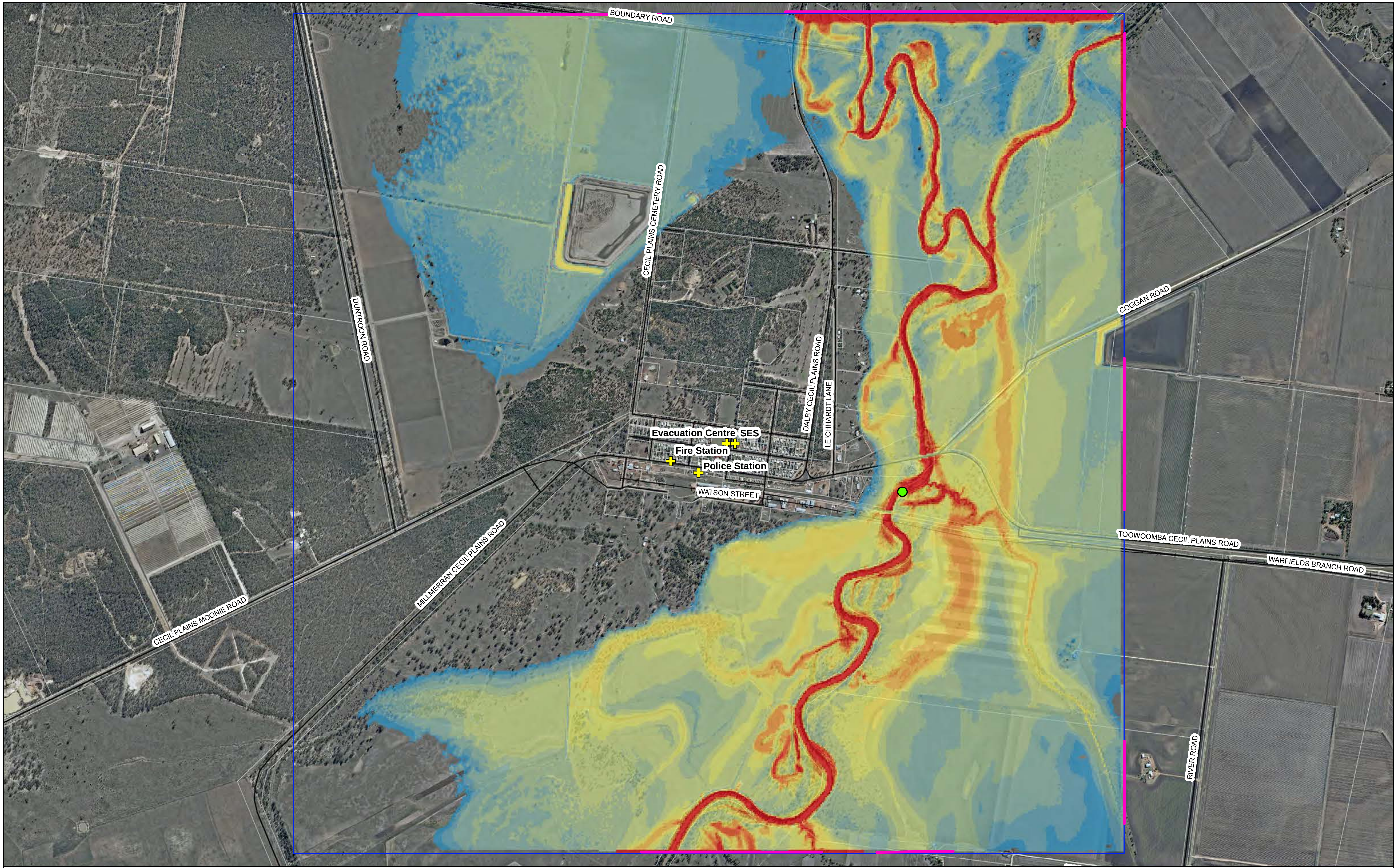
Hazard Categories

- 🟦 Low
- 🟩 Significant
- 🟨 High
- 🟥 Extreme
- ☐ Model Extent
- ☐ Cadastre

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Cecil Plains
10 Year ARI Event Peak Hazard

I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\CEC_V24_E_10Y_Haz.mxd
Date Saved: 16/06/2014



TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

- ● Cecil Plains Gauge
- ✚ Emergency Locations
- — Road Centreline
- ┼ Rail Centreline
- — Model Boundaries
- ☐ Model Extent
- ☐ Cadastre

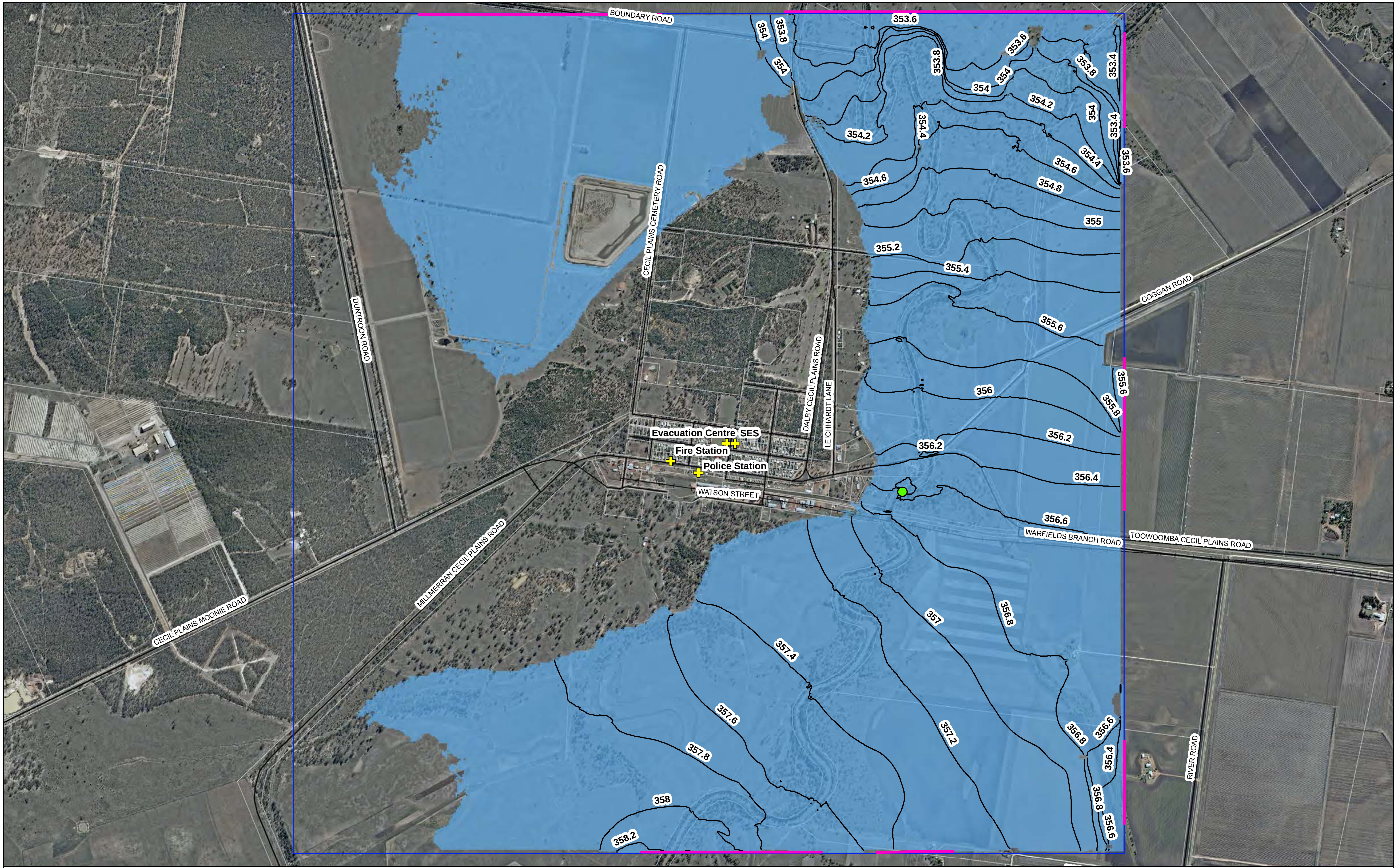
Peak Depth (m)

- ▨ < 0.1
- ▨ 0.1- 0.25
- ▨ 0.25 - 0.5
- ▨ 0.5 - 1.0
- ▨ 1.0 - 1.5
- ▨ 1.5 - 2.0
- ▨ 2.0 - 2.5
- ▨ 2.5 - 3.0
- ▨ 3.0 - 3.5
- ▨ 3.5 - 4.0
- ▨ 4.0 - 4.5
- ▨ 4.5 - 5.0
- ▨ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Cecil Plains
20 Year ARI Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CEC_V24_E_20Y_D.mxd
Date Saved: 6/03/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500

Metres

GDA 1994 MGA Zone 56

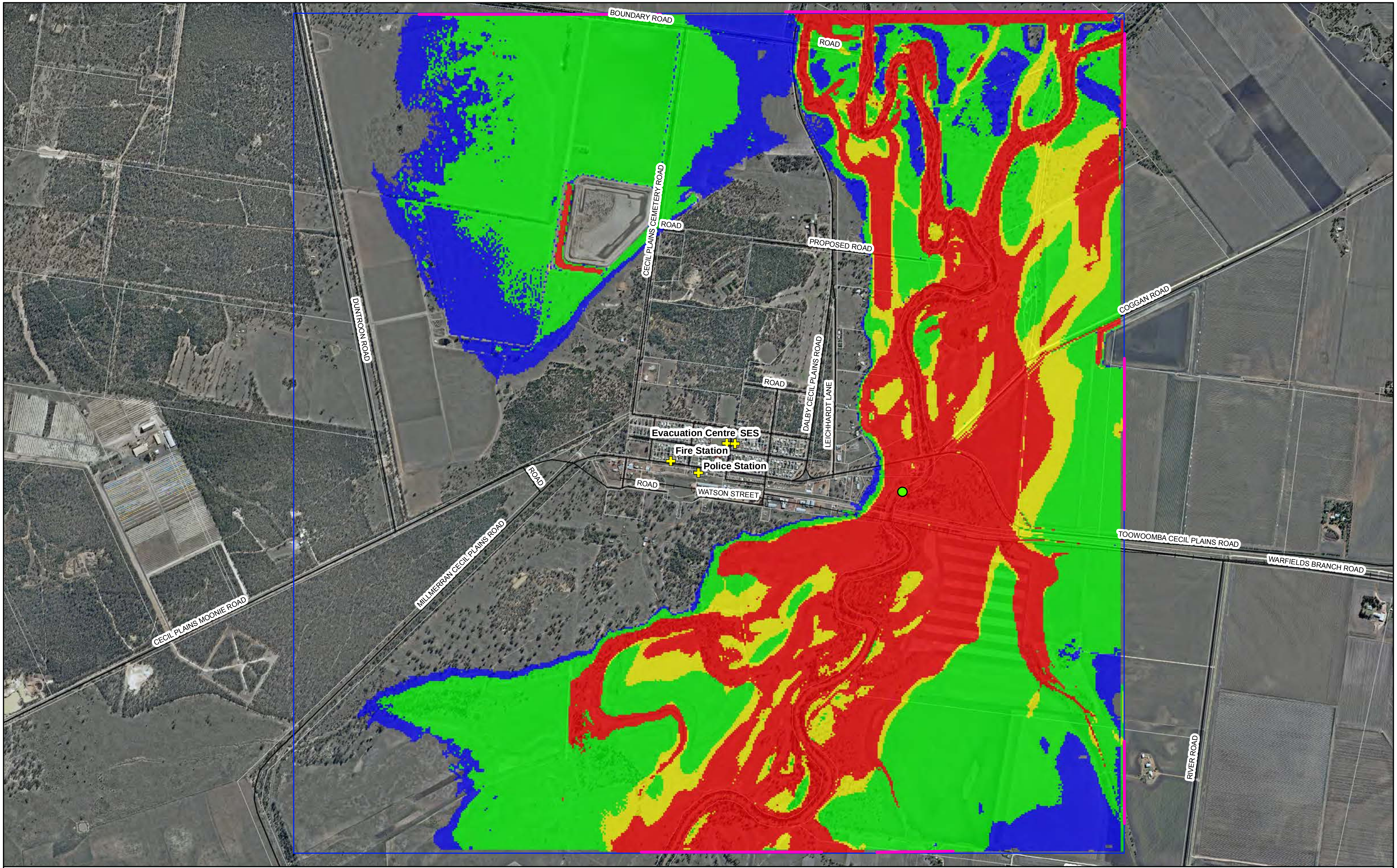
N

Legend

● Cecil Plains Gauge	✚ Emergency Locations
— Road Centreline	—+— Rail Centreline
— Model Boundaries	☐ Model Extent
☐ Cadastre	— Water Level Contours (mAHD)
▨ Inundation Extent	

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Cecil Plains
20 Year ARI Event Peak Water Level



TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

- ● Cecil Plains Gauge
- ✚ Emergency Locations
- — Road Centreline
- ┼ Rail Centreline
- — Model Boundaries

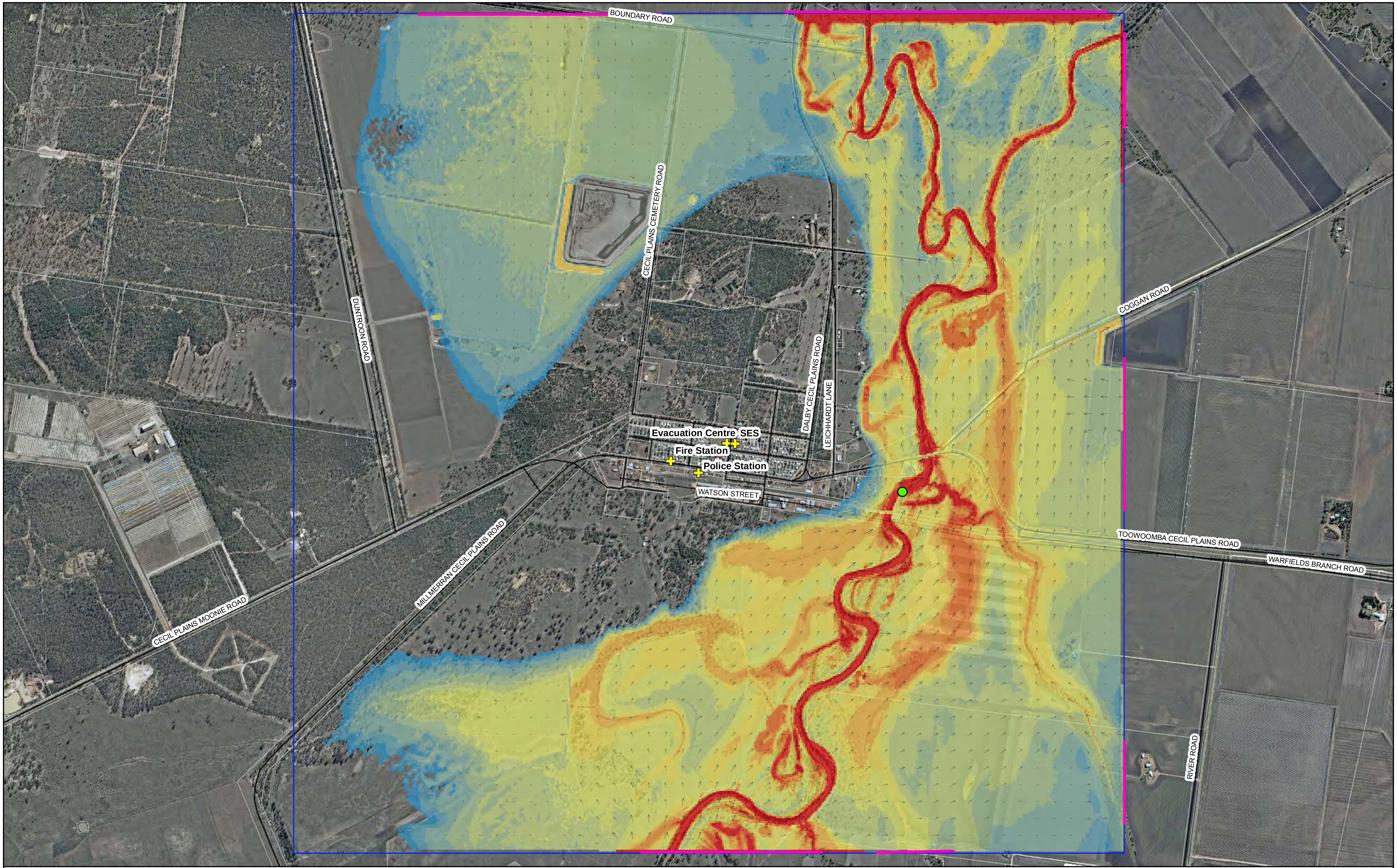
Hazard Categories

- 🟦 Low
- 🟩 Significant
- 🟨 High
- 🟥 Extreme
- ☐ Model Extent
- ☐ Cadastre

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Cecil Plains
20 Year ARI Event Peak Hazard

I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\CEC_V24_E_20Y_Haz.mxd
Date Saved: 16/06/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

- ● Cecil Plains Gauge
- ✚ Emergency Locations
- — Road Centreline
- ┼ Rail Centreline
- — Model Boundaries
- ☐ Model Extent
- ☐ Cadastre
- ↑ Velocity Vectors

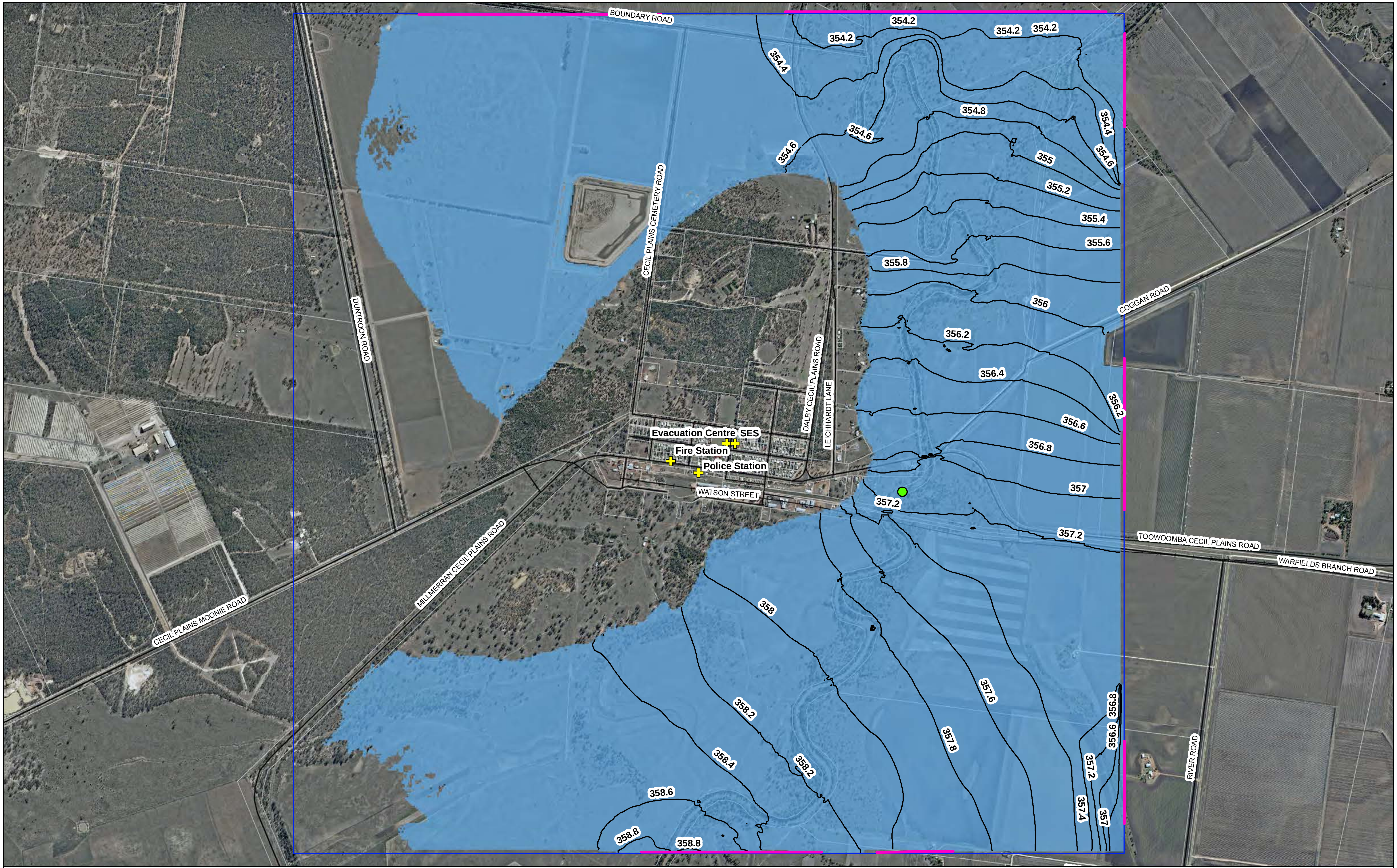
Peak Depth (m)

- ■ < 0.1
- ■ 0.1- 0.25
- ■ 0.25 - 0.5
- ■ 0.5 - 1.0
- ■ 1.0 - 1.5
- ■ 1.5 - 2.0
- ■ 2.0 - 2.5
- ■ 2.5 - 3.0
- ■ 3.0 - 3.5
- ■ 3.5 - 4.0
- ■ 4.0 - 4.5
- ■ 4.5 - 5.0
- ■ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Cecil Plains
100 Year ARI Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CEC_V24_E_100Y_D.mxd
Date Saved: 6/03/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

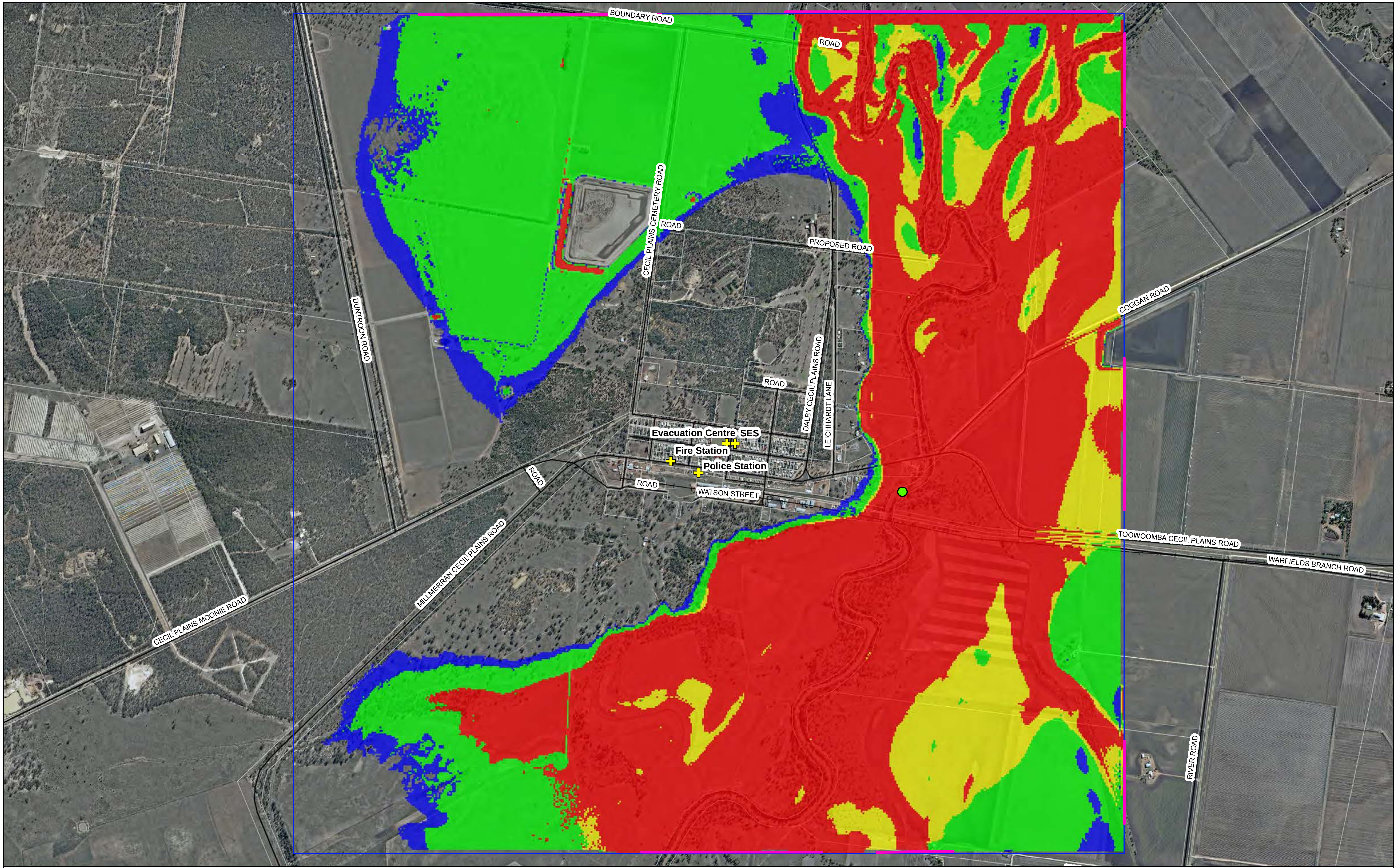
N

Legend

- ● Cecil Plains Gauge
- ✚ Emergency Locations
- — Road Centreline
- —+— Rail Centreline
- — Model Boundaries
- ☐ Model Extent
- ☐ Cadastre
- — Water Level Contours (mAHD)
- ▨ Inundation Extent

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Cecil Plains
100 Year ARI Event Peak Water Level



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

● Cecil Plains Gauge
✚ Emergency Locations
— Road Centreline
┼ Rail Centreline
— Model Boundaries

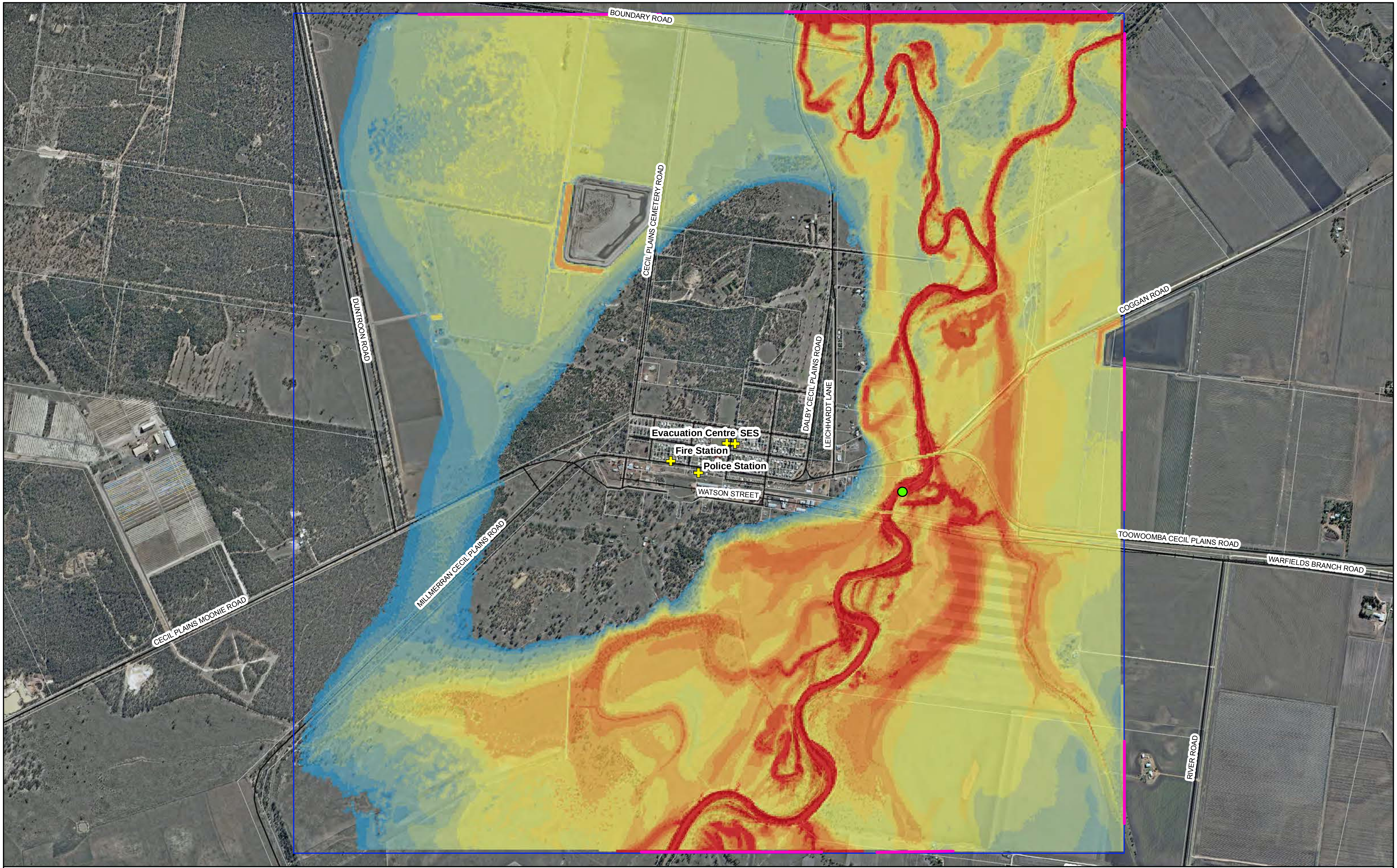
Hazard Categories

🟦 Low
🟩 Significant
🟨 High
🟥 Extreme
☐ Model Extent
☐ Cadastre

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Cecil Plains
100 Year ARI Event Peak Hazard

I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\CEC_V24_E_100Y_Haz.mxd
Date Saved: 16/06/2014



1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

● Cecil Plains Gauge	Model Boundaries	
✚ Emergency Locations	Model Extent	
Road Centreline	Cadastre	
Rail Centreline		

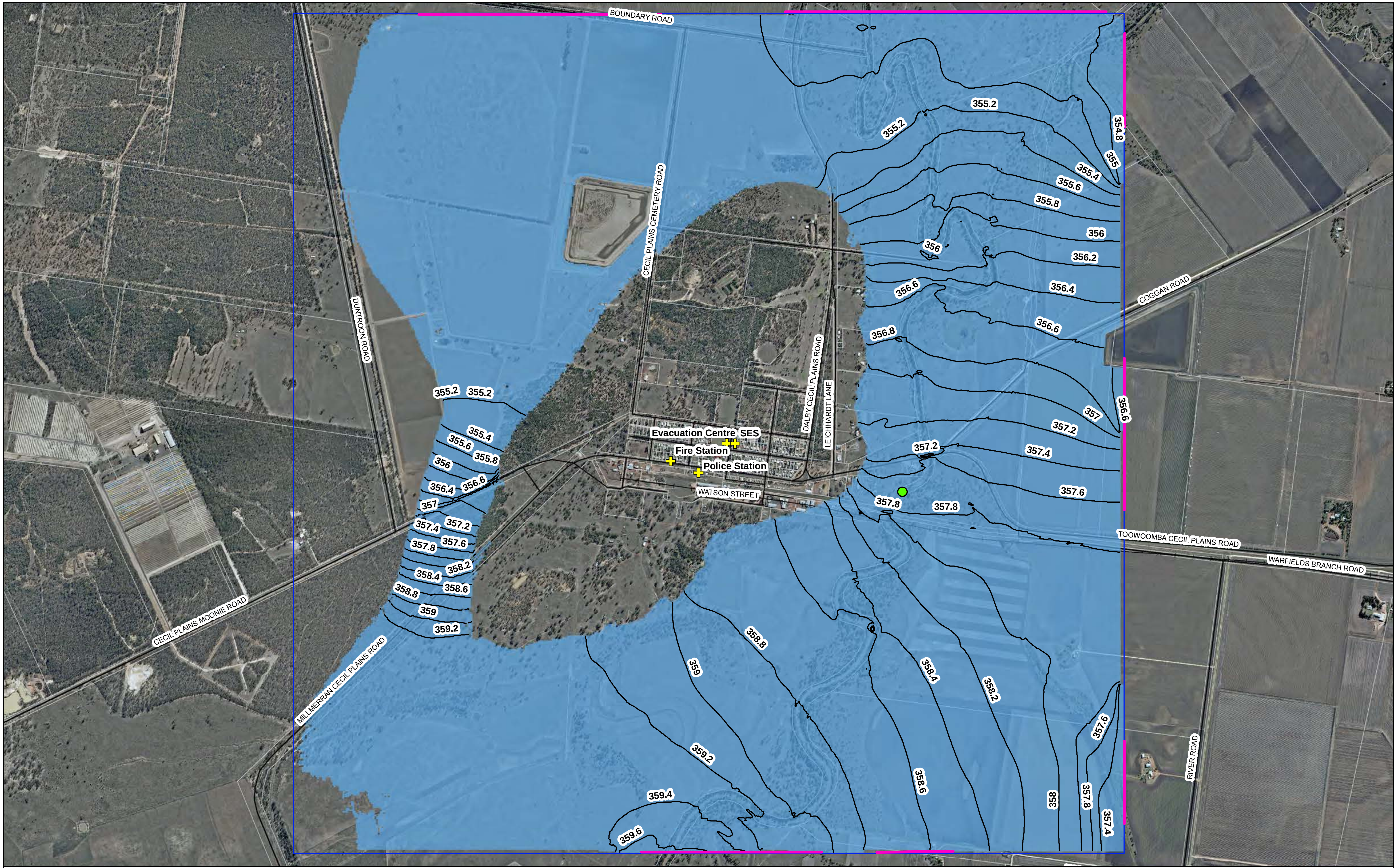
Peak Depth (m)

< 0.1	0.5 - 1.0	2.5 - 3.0	4.5 - 5.0
0.1- 0.25	1.0 - 1.5	3.0 - 3.5	> 5.0
0.25 - 0.5	1.5 - 2.0	3.5 - 4.0	
	2.0 - 2.5	4.0 - 4.5	

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Cecil Plains
500 Year ARI Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CEC_V24_E_500Y_D.mxd
Date Saved: 6/03/2014



1:20,000 (at A3)

0 125 250 500

Metres

GDA 1994 MGA Zone 56

N

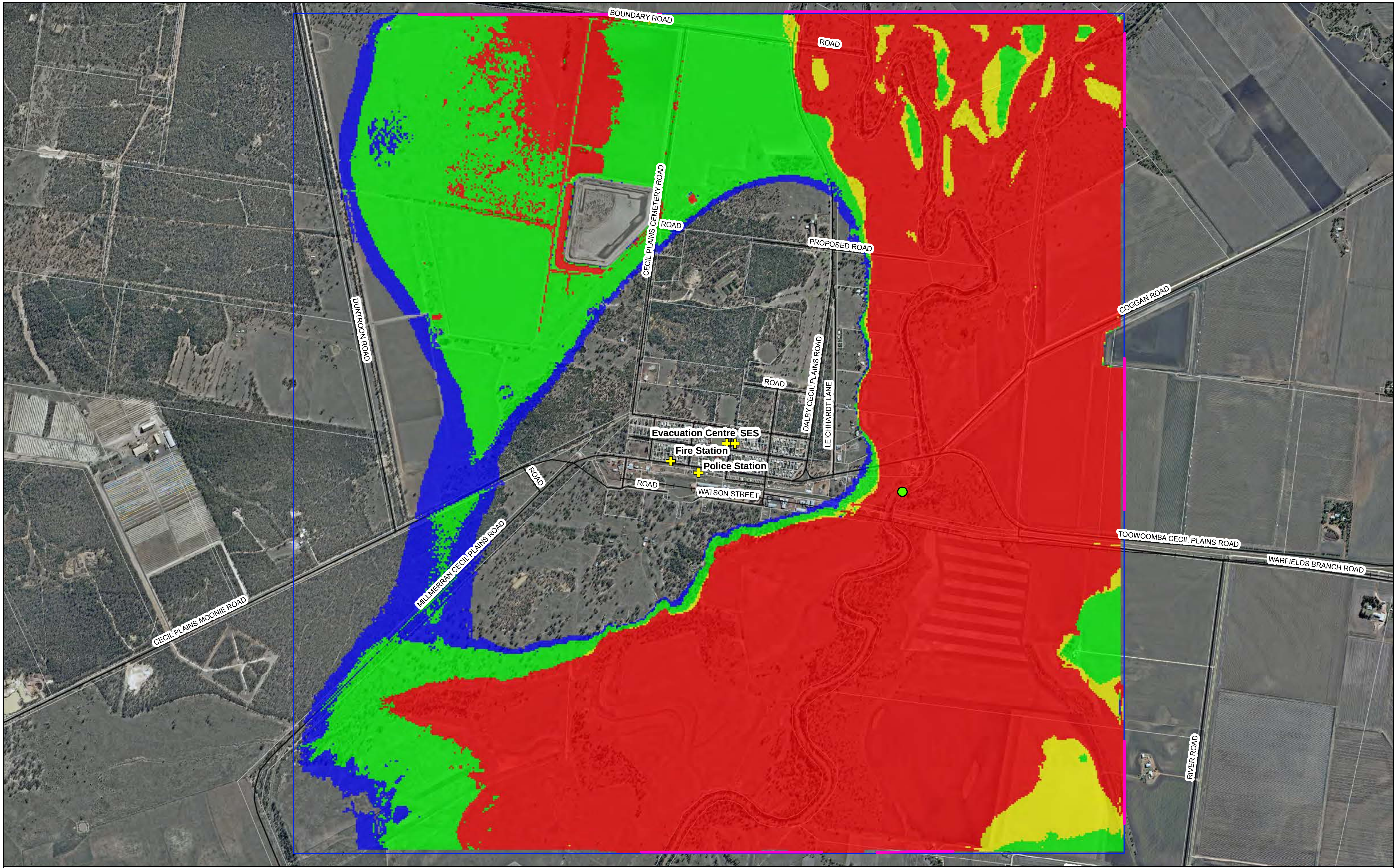
TOOWOOMBA
REGIONAL
COUNCIL

Legend

- ● Cecil Plains Gauge
- ✚ Emergency Locations
- — Road Centreline
- ┼ Rail Centreline
- — Model Boundaries
- ☐ Model Extent
- ☐ Cadastre
- — Water Level Contours (mAHD)
- ▨ Inundation Extent

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Cecil Plains
500 Year ARI Event Peak Water Level



TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

● Cecil Plains Gauge
✚ Emergency Locations
— Road Centreline
┼ Rail Centreline
— Model Boundaries

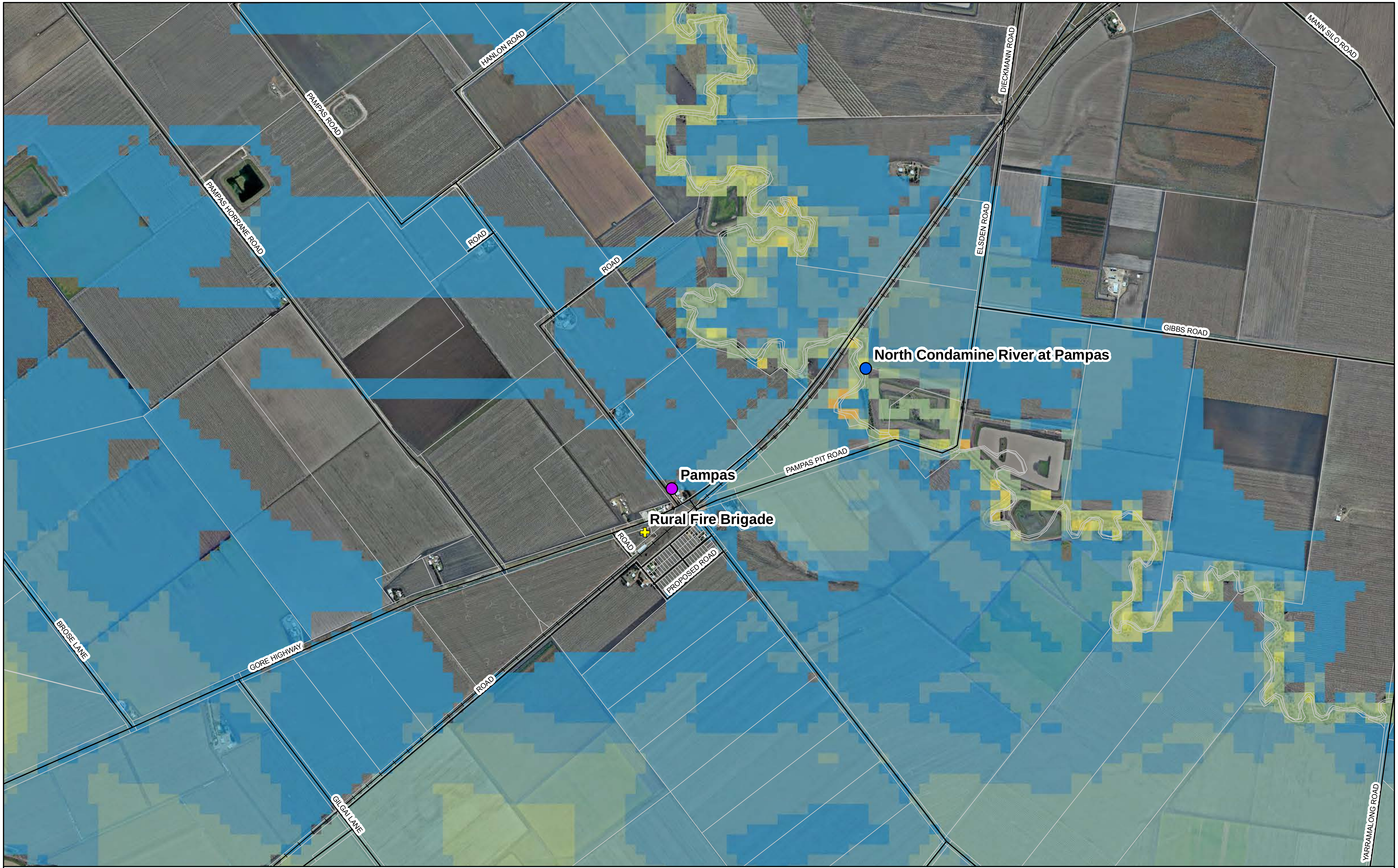
Hazard Categories

🟦 Low
🟩 Significant
🟨 High
🟥 Extreme
☐ Model Extent
☐ Cadastre

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Cecil Plains
500 Year ARI Event Peak Hazard

I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\CEC_V24_E_500Y_Haz.mxd
Date Saved: 16/06/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

- ● Town Centre
- ● Streamflow Gauge
- ✚ Emergency Locations
- ☐ Cadastre
- — Road Centreline
- ┼ Rail Centreline

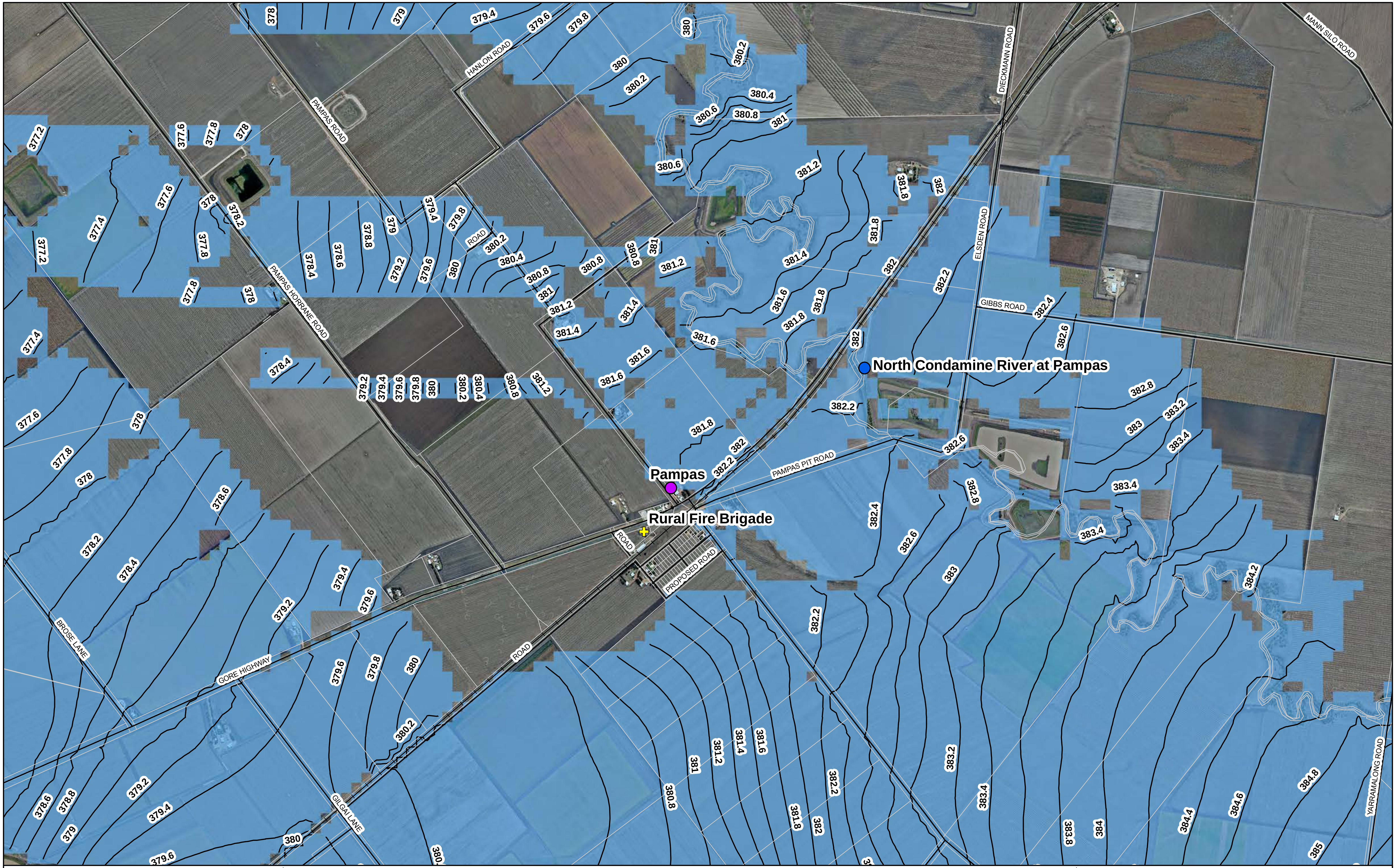
Peak Depth (m)

- ▨ < 0.1
- ▨ 0.1- 0.25
- ▨ 0.25 - 0.5
- ▨ 0.5 - 1.0
- ▨ 1.0 - 1.5
- ▨ 1.5 - 2.0
- ▨ 2.0 - 2.5
- ▨ 2.5 - 3.0
- ▨ 3.0 - 3.5
- ▨ 3.5 - 4.0
- ▨ 4.0 - 4.5
- ▨ 4.5 - 5.0
- ▨ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Pampas
1976 Validation Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V02_E_1976_D_Pam.mxd
Date Saved: 17/03/2014



Legend

● Town Centre
● Streamflow Gauge
✚ Emergency Locations
☐ Cadastre
— Road Centreline
┼ Rail Centreline
— Water Level Contours (mAHD)
▨ Inundation Extent

1:20,000 (at A3)

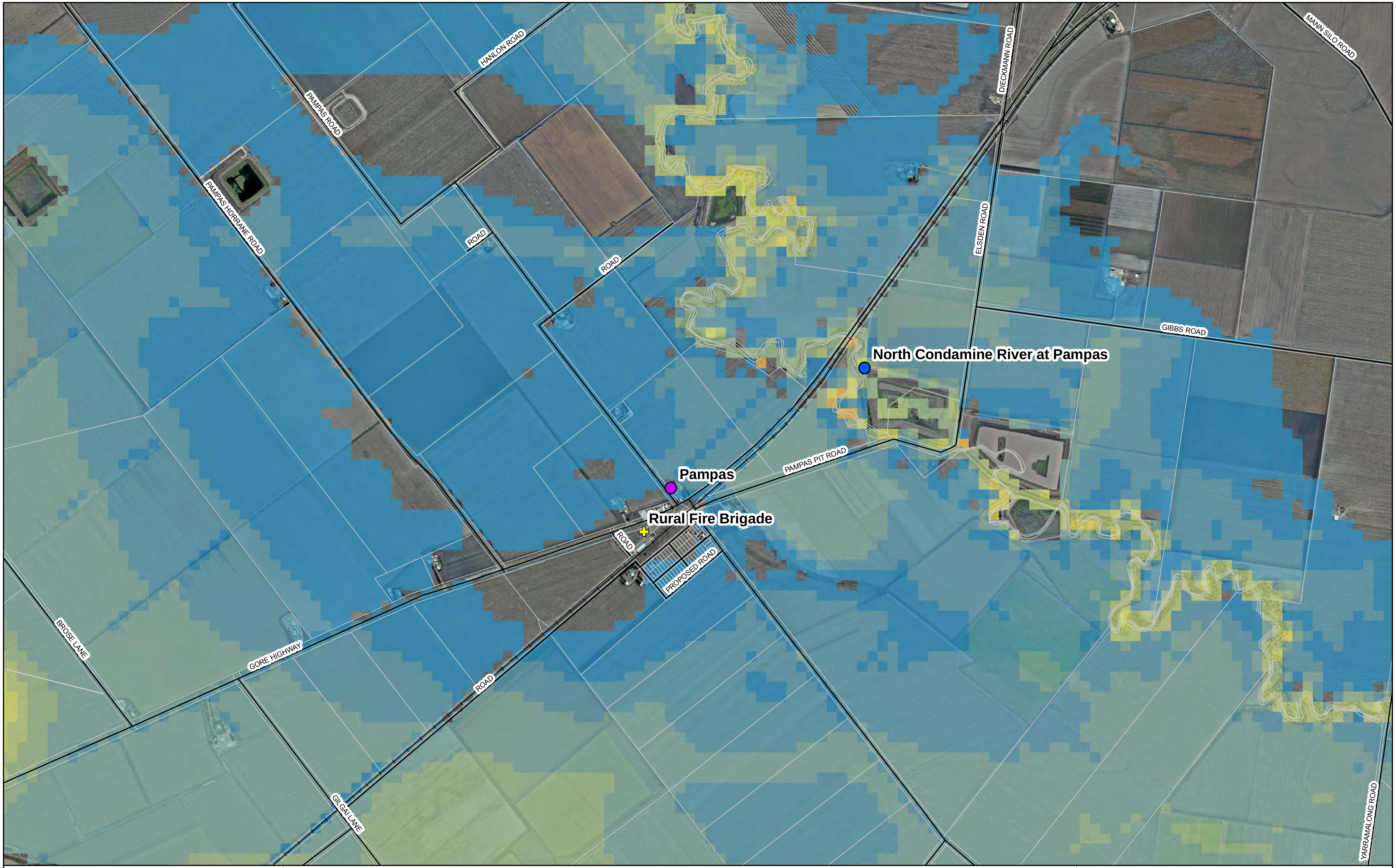
0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

TOOWOOMBA
REGIONAL
COUNCIL

SP 051 Flood Studies
Work Package 7 - Pampas
1976 Validation Event Peak Water Level



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

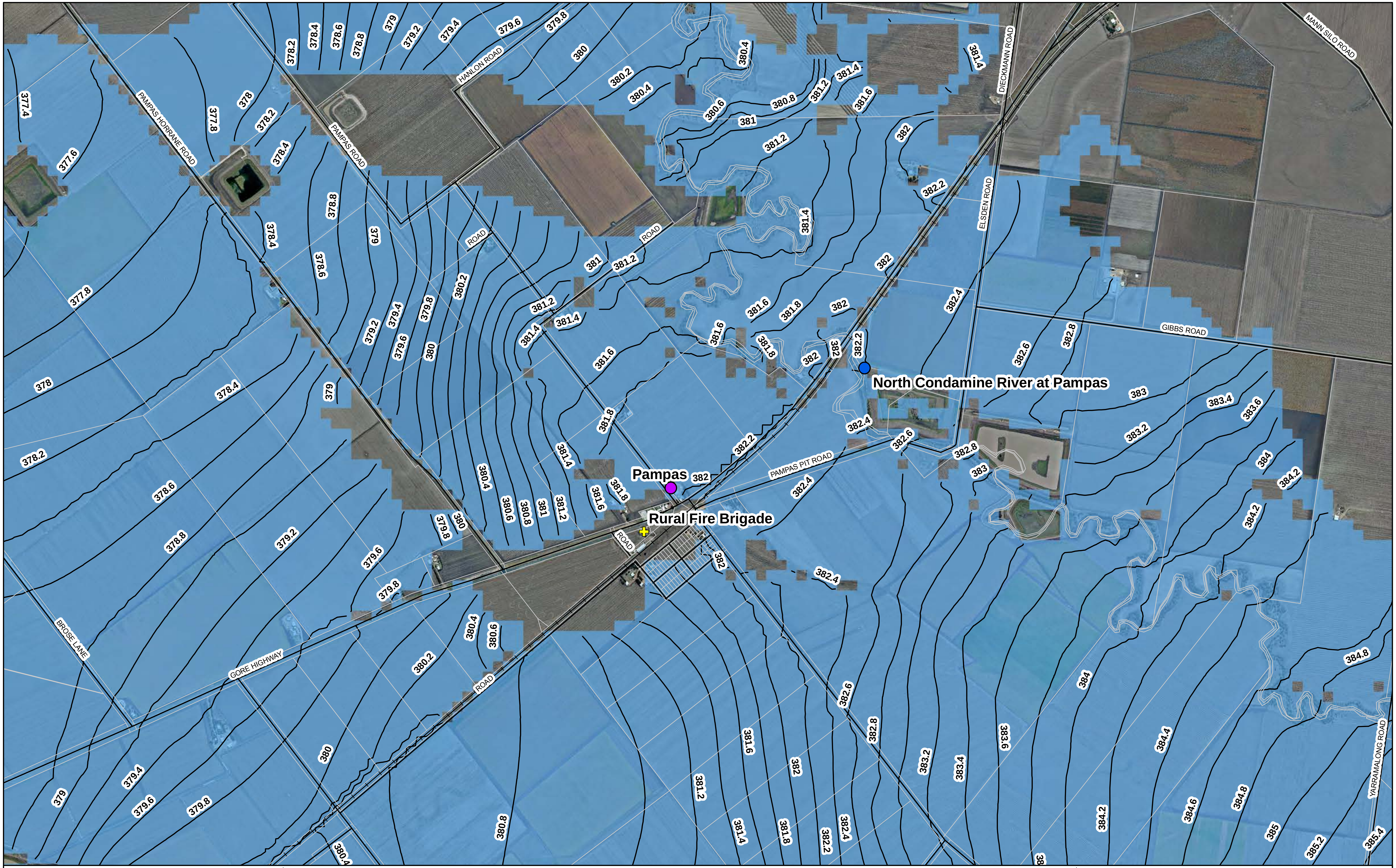
- ● Town Centre
- ● Streamflow Gauge
- ✚ Emergency Locations
- ☐ Cadastre
- — Road Centreline
- ┼ Rail Centreline

Peak Depth (m)

- ▨ < 0.1
- ▨ 0.1- 0.25
- ▨ 0.25 - 0.5
- ▨ 0.5 - 1.0
- ▨ 1.0 - 1.5
- ▨ 1.5 - 2.0
- ▨ 2.0 - 2.5
- ▨ 2.5 - 3.0
- ▨ 3.0 - 3.5
- ▨ 3.5 - 4.0
- ▨ 4.0 - 4.5
- ▨ 4.5 - 5.0
- ▨ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Pampas
2011 Validation Event Peak Depth



1:20,000 (at A3)

0 125 250 500

Metres

GDA 1994 MGA Zone 56

N

TOOWOOMBA REGIONAL COUNCIL

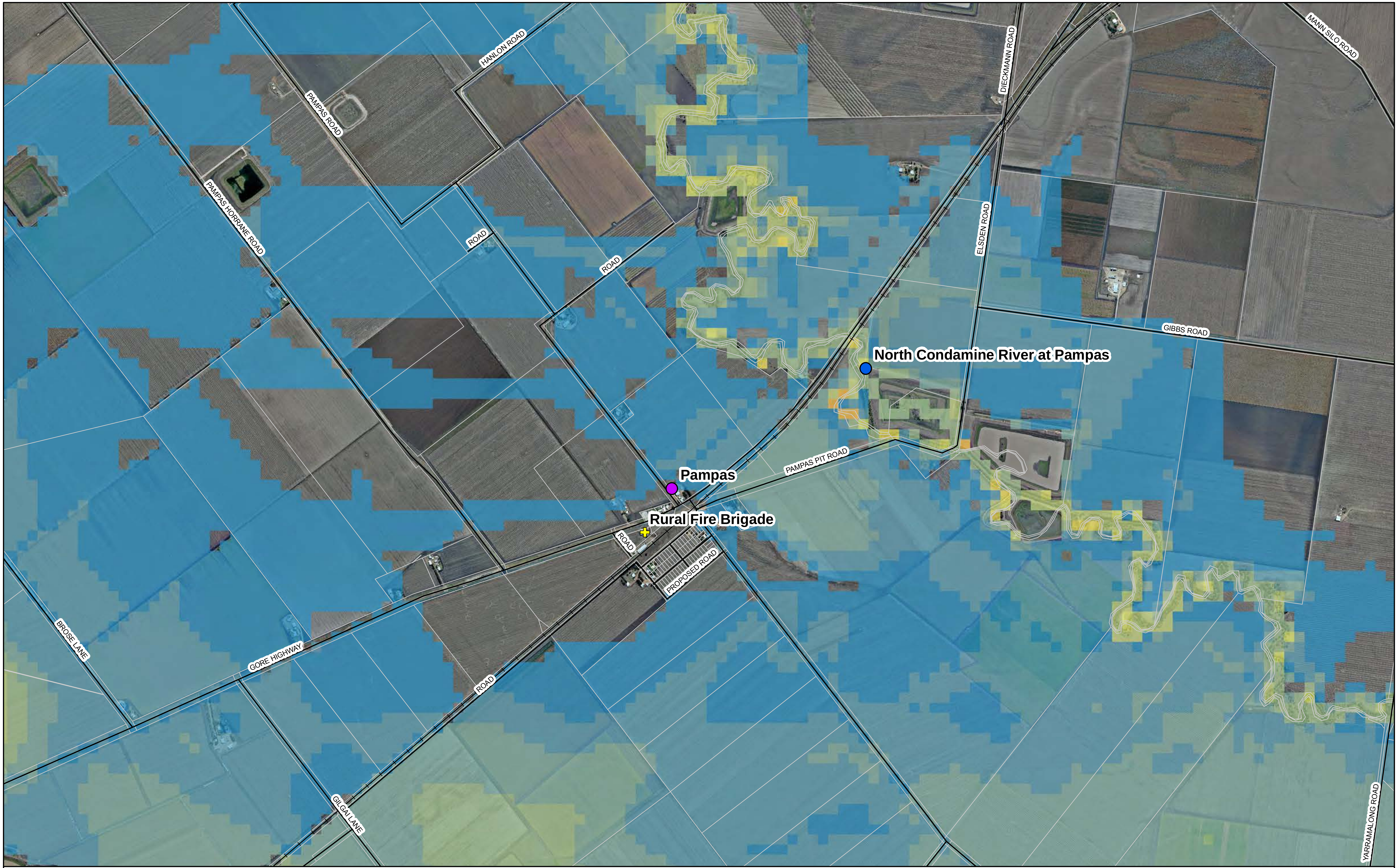
Legend

●	Town Centre
●	Streamflow Gauge
✚	Emergency Locations
☐	Cadastre
—	Road Centreline
┼	Rail Centreline
—	Water Level Contours (mAHD)
▨	Inundation Extent

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Pampas
2011 Validation Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_2011_H_Pam.mxd
Date Saved: 17/03/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

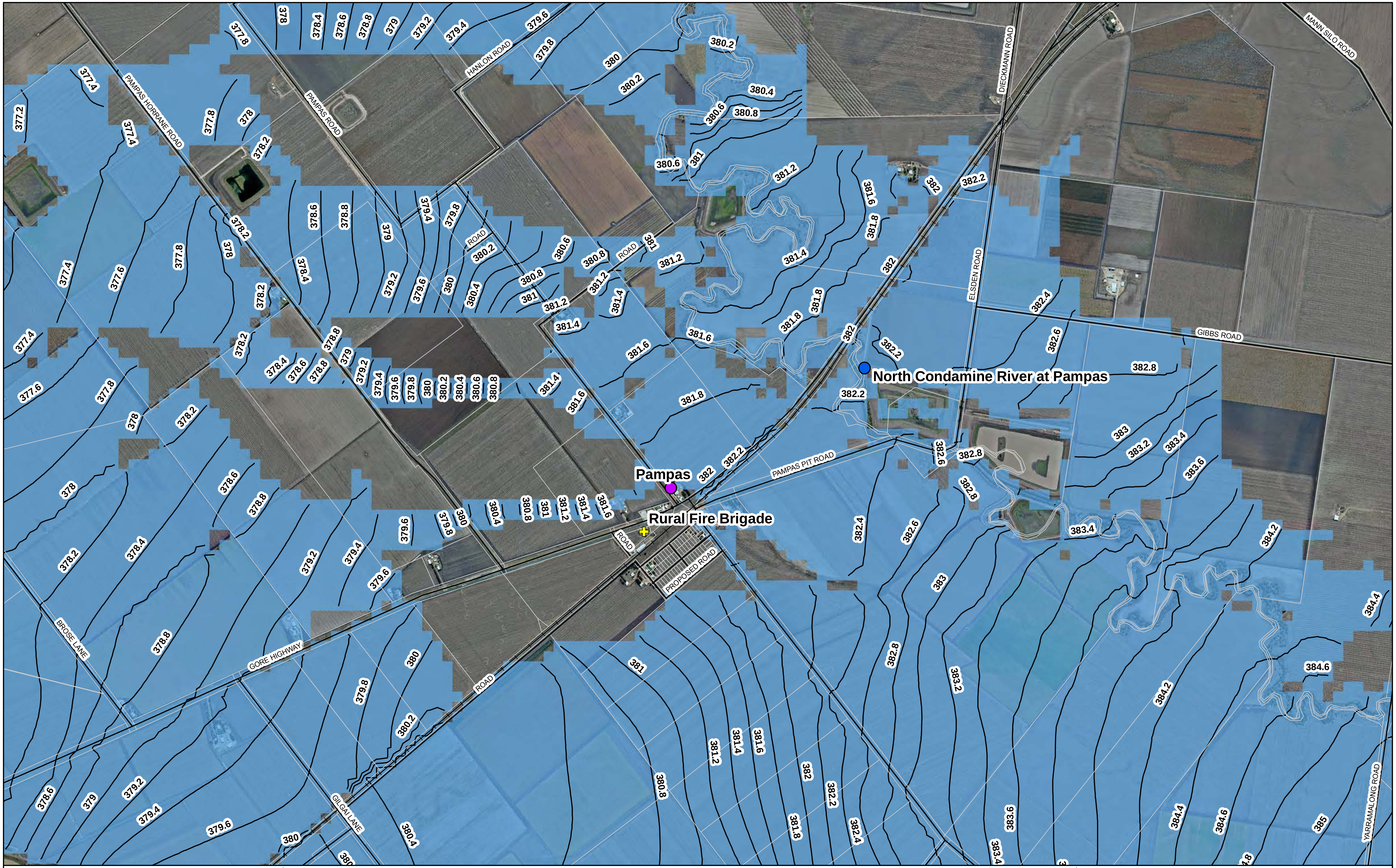
- ● Town Centre
- ● Streamflow Gauge
- ✚ Emergency Locations
- ☐ Cadastre
- — Road Centreline
- ┼ Rail Centreline

Peak Depth (m)

- ▨ < 0.1
- ▨ 0.1- 0.25
- ▨ 0.25 - 0.5
- ▨ 0.5 - 1.0
- ▨ 1.0 - 1.5
- ▨ 1.5 - 2.0
- ▨ 2.0 - 2.5
- ▨ 2.5 - 3.0
- ▨ 3.0 - 3.5
- ▨ 3.5 - 4.0
- ▨ 4.0 - 4.5
- ▨ 4.5 - 5.0
- ▨ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Pampas
10 Year ARI Event Peak Depth



1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

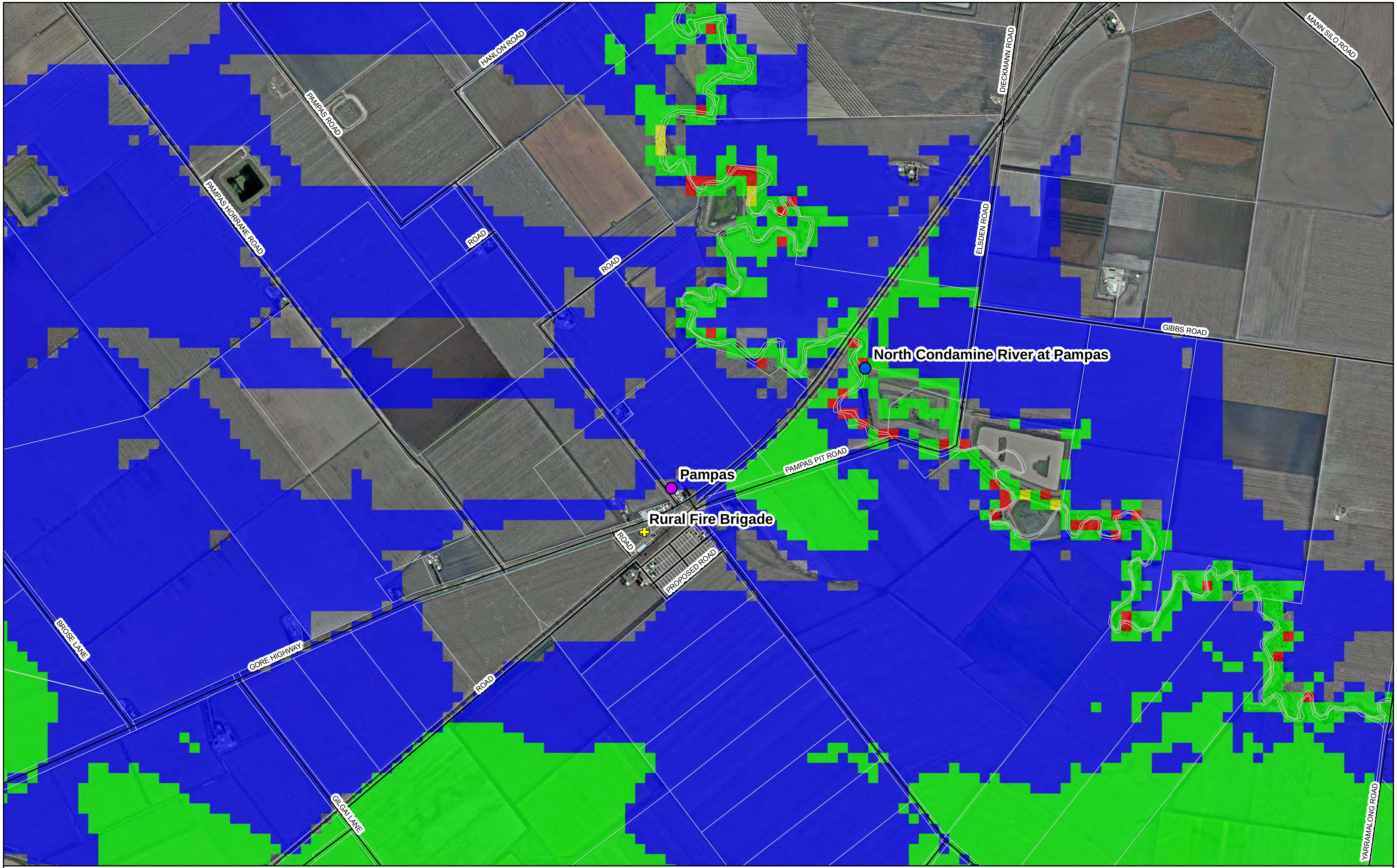
Legend

● Town Centre	▭ Cadastre	— Water Level Contours (mAHD)
● Streamflow Gauge	— Road Centreline	▨ Inundation Extent
✚ Emergency Locations	┼ Rail Centreline	

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Pampas
10 Year ARI Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_10Y_H_Pam.mxd
Date Saved: 7/03/2014



TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

● Town Centre	Cadastre	
● Streamflow Gauge	— Road Centreline	
✚ Emergency Locations	┼ Rail Centreline	

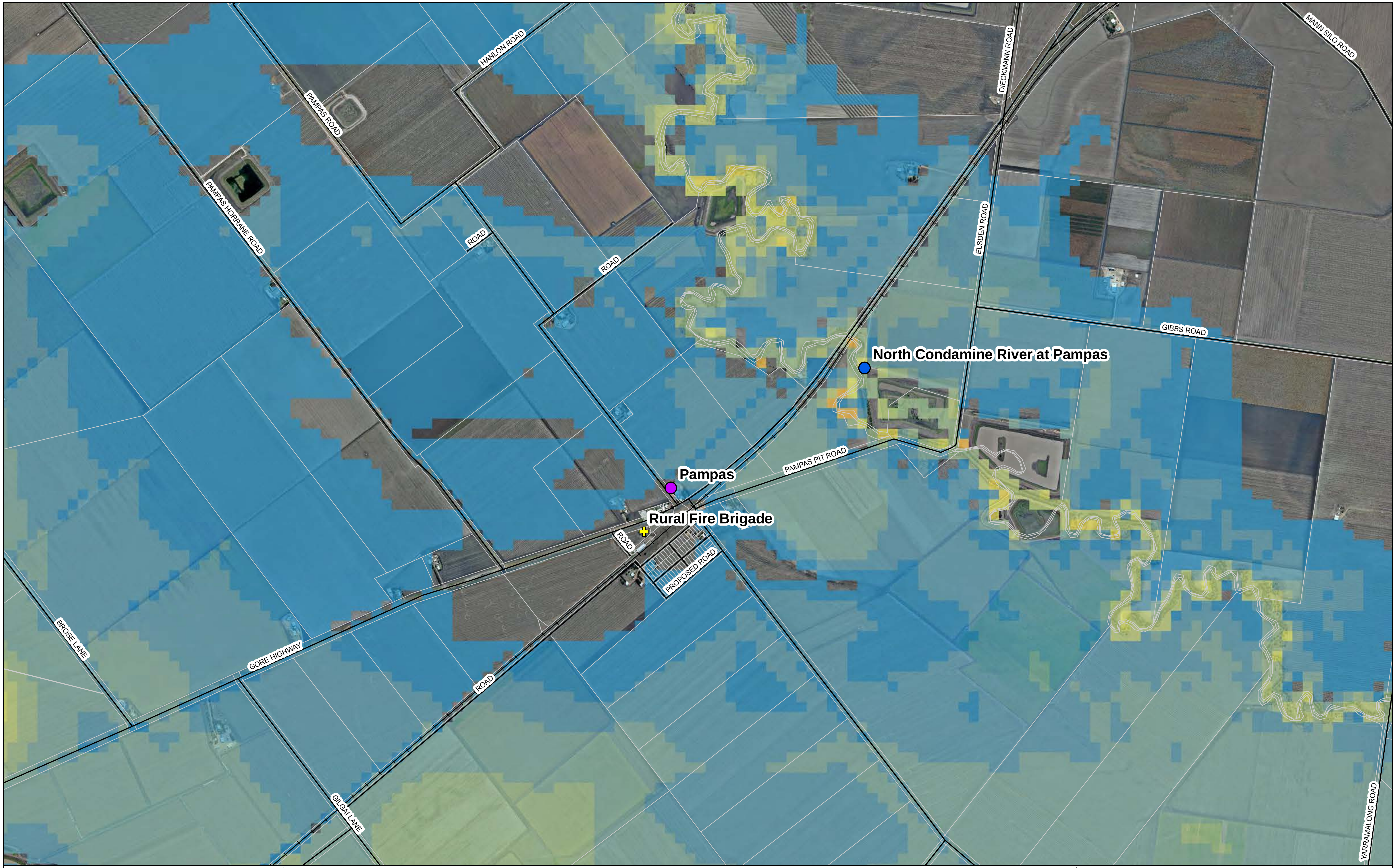
Hazard Categories

- 🟦 Low
- 🟩 Significant
- 🟨 High
- 🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Pampas
10 Year ARI Event Peak Hazard

I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\CON_V08_E_10Y_Haz_Pam.mxd
Date Saved: 16/06/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500

Metres

GDA 1994 MGA Zone 56

N

Legend

- ● Town Centre
- ● Streamflow Gauge
- ✚ Emergency Locations
- ☐ Cadastre
- — Road Centreline
- ┼ Rail Centreline

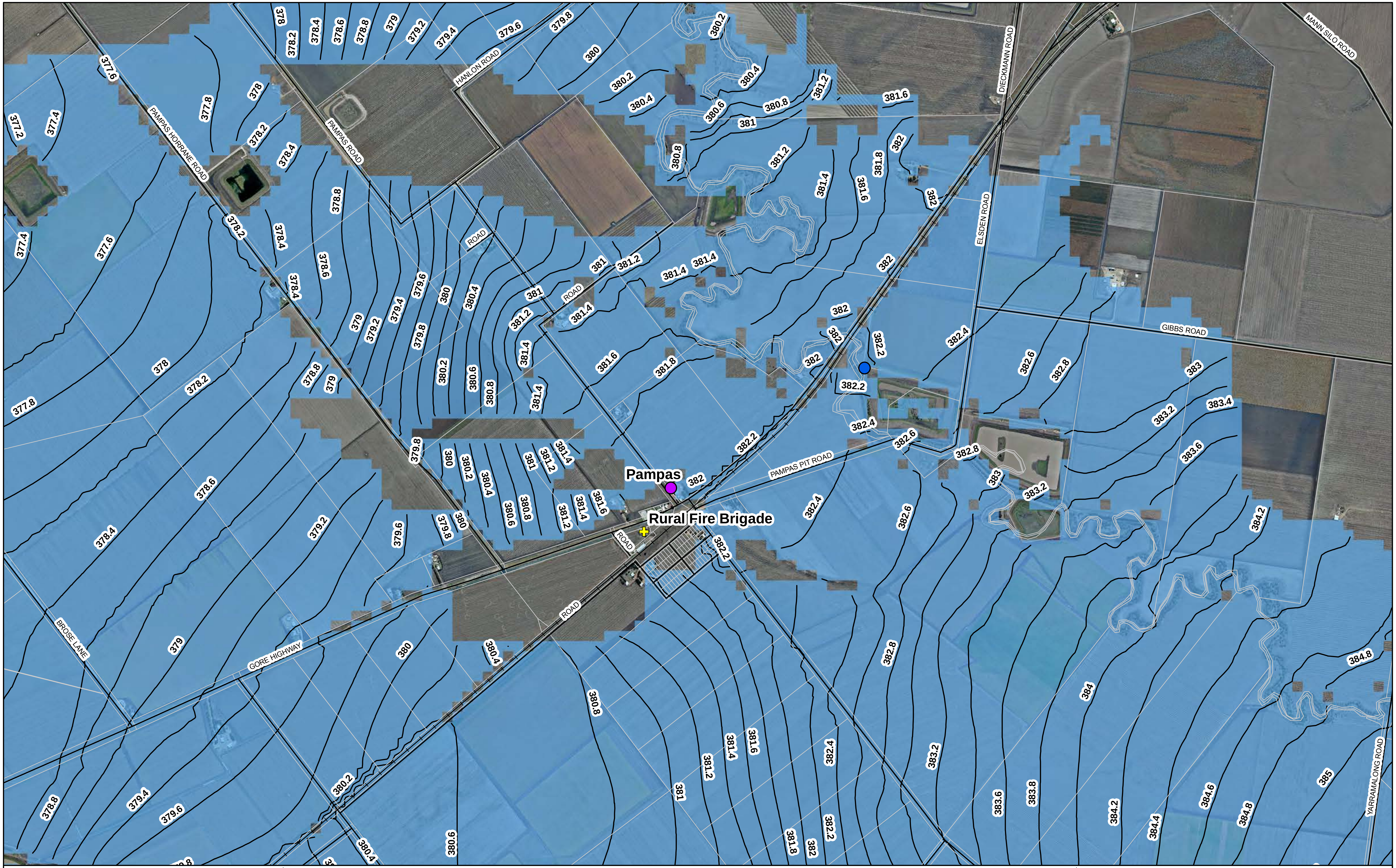
Peak Depth (m)

- ▨ < 0.1
- ▨ 0.1- 0.25
- ▨ 0.25 - 0.5
- ▨ 0.5 - 1.0
- ▨ 1.0 - 1.5
- ▨ 1.5 - 2.0
- ▨ 2.0 - 2.5
- ▨ 2.5 - 3.0
- ▨ 3.0 - 3.5
- ▨ 3.5 - 4.0
- ▨ 4.0 - 4.5
- ▨ 4.5 - 5.0
- ▨ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Pampas
20 Year ARI Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_20Y_D_Pam.mxd
Date Saved: 7/03/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500

Metres

GDA 1994 MGA Zone 56

N

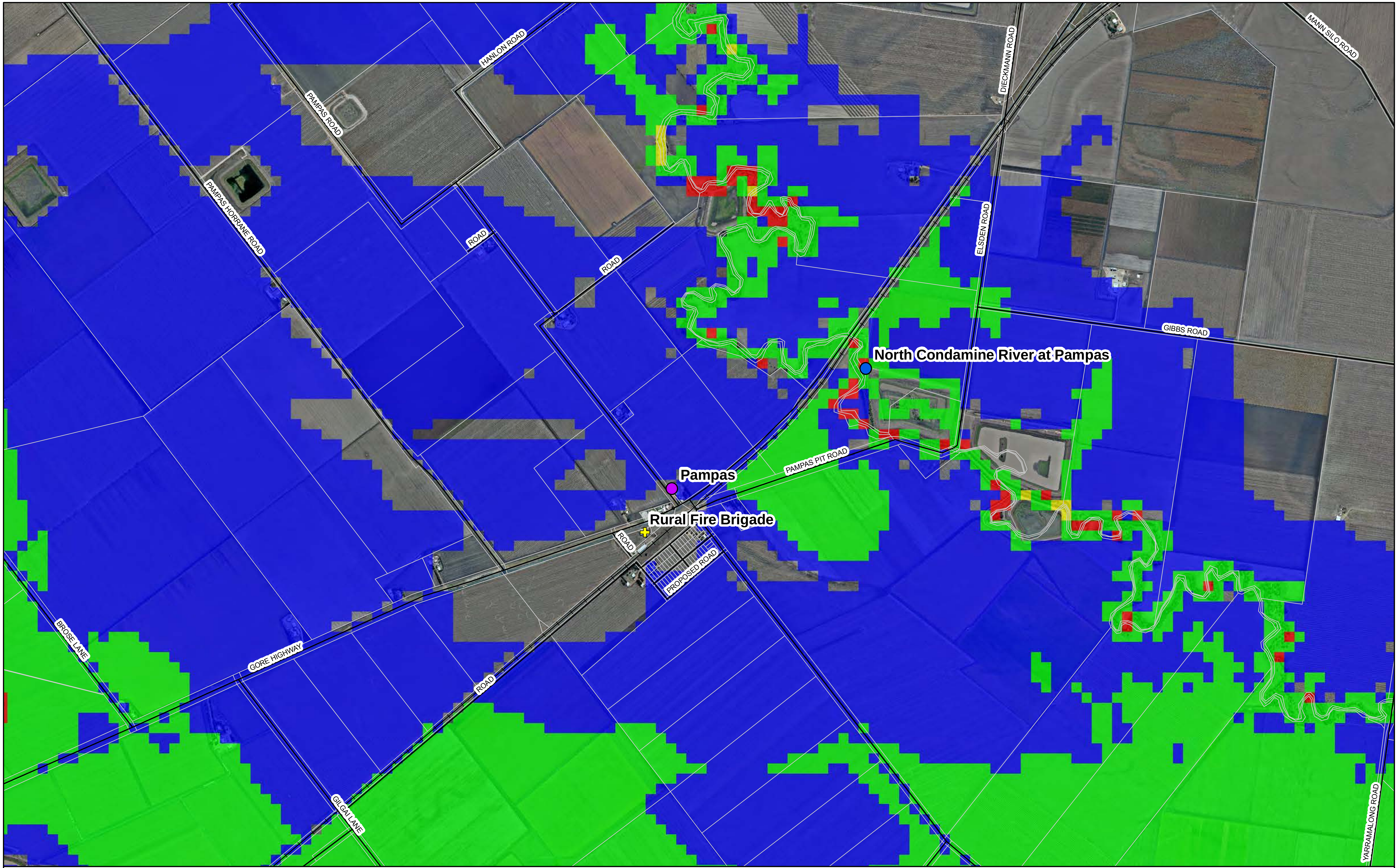
Legend

- ● Town Centre
- ● Streamflow Gauge
- ✚ Emergency Locations
- ☐ Cadastre
- — Road Centreline
- —+— Rail Centreline
- — Water Level Contours (mAHD)
- ▨ Inundation Extent

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Pampas
20 Year ARI Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_20Y_H_Pam.mxd
Date Saved: 7/03/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

Town Centre
● Town Centre
● Streamflow Gauge

✚ Emergency Locations
☐ Cadastre
— Road Centreline

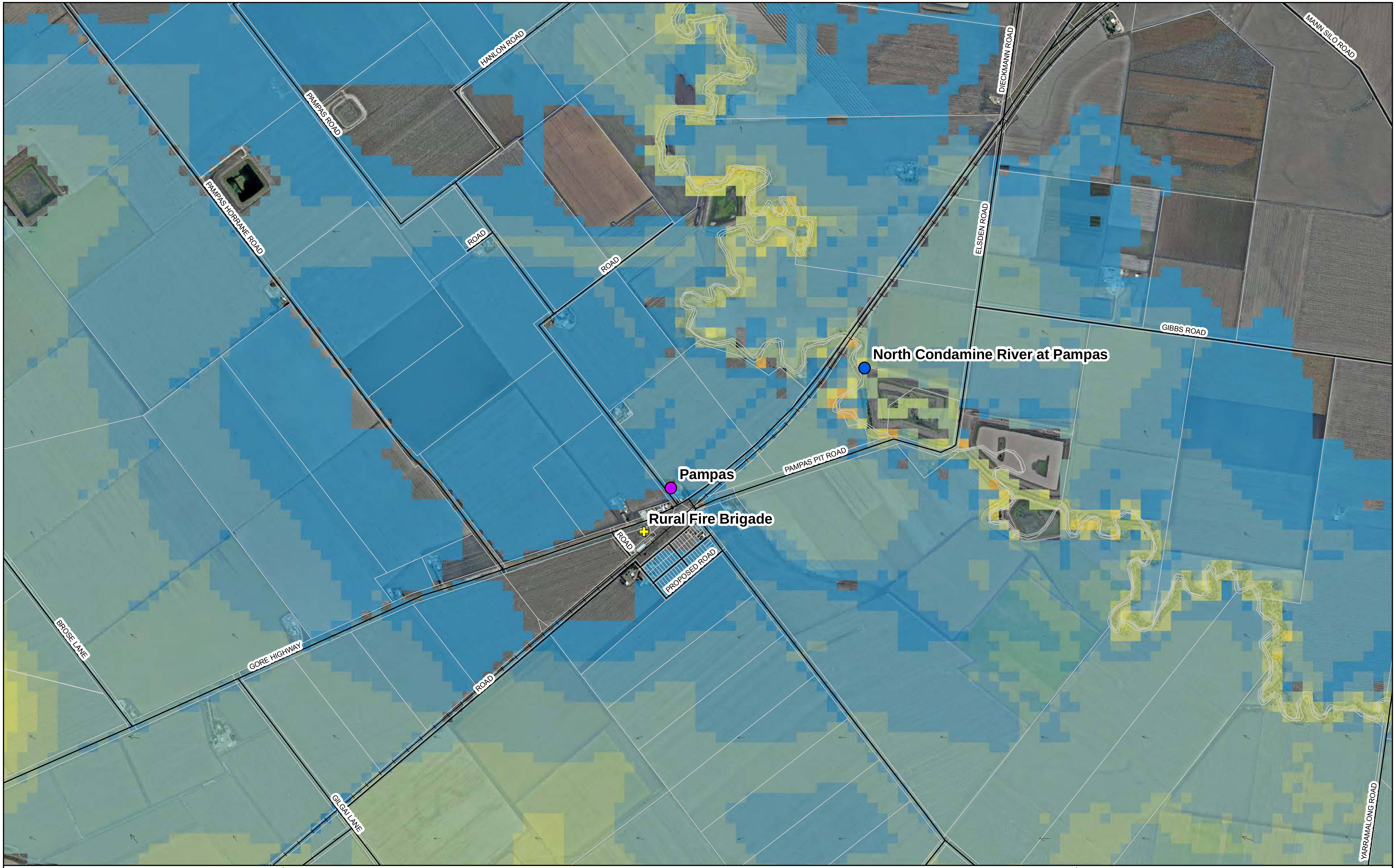
+ Rail Centreline
Hazard Categories
🟦 Low

🟩 Significant
🟨 High
🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Pampas
20 Year ARI Event Peak Hazard

I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\CON_V08_E_20Y_Haz_Pam.mxd
Date Saved: 16/06/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

- ● Town Centre
- ● Streamflow Gauge
- ✚ Emergency Locations
- ☐ Cadastre
- — Road Centreline
- ┼ Rail Centreline
- ↑ Velocity Vectors

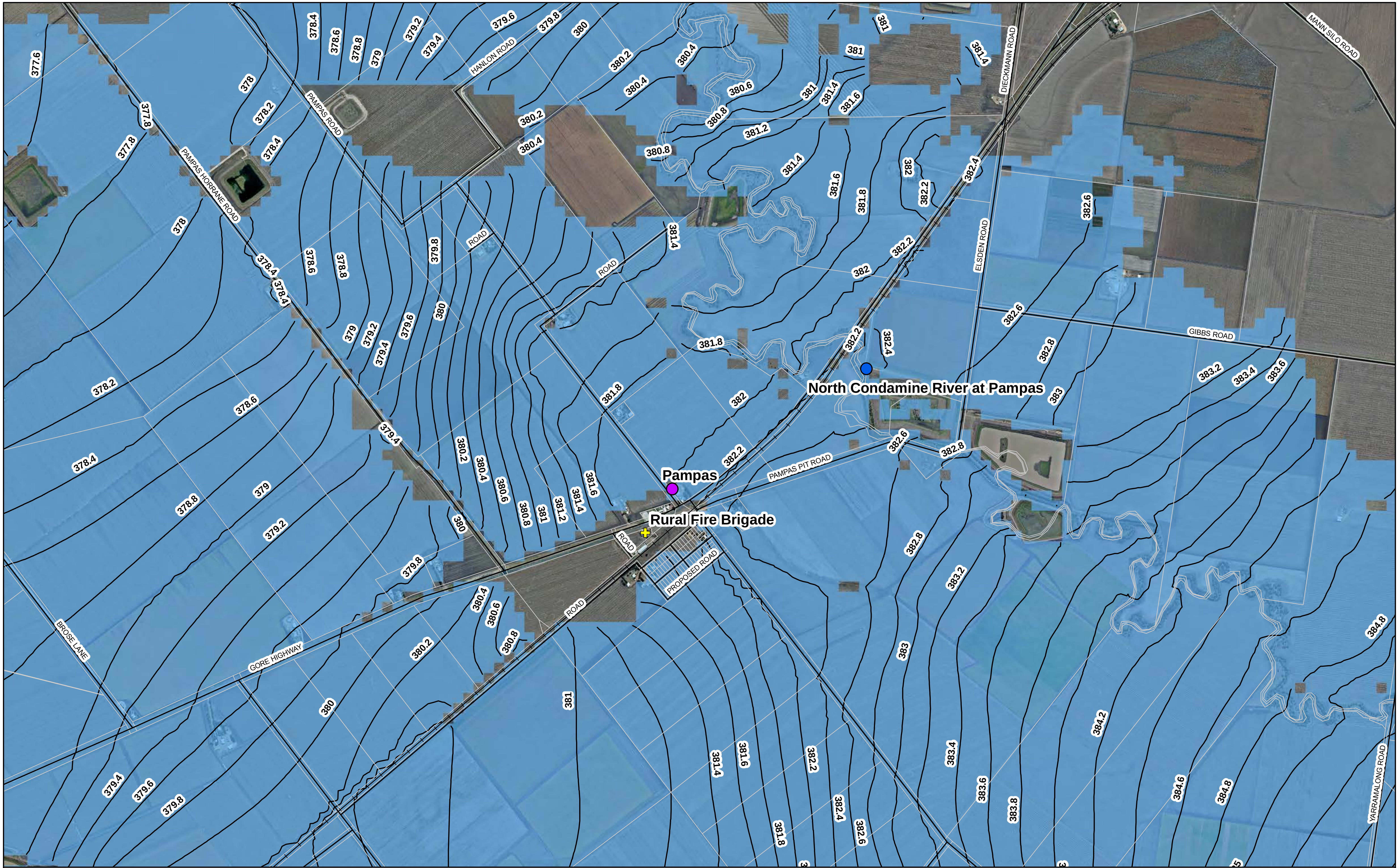
Peak Depth (m)

- ■ < 0.1
- ■ 0.1- 0.25
- ■ 0.25 - 0.5
- ■ 0.5 - 1.0
- ■ 1.0 - 1.5
- ■ 1.5 - 2.0
- ■ 2.0 - 2.5
- ■ 2.5 - 3.0
- ■ 3.0 - 3.5
- ■ 3.5 - 4.0
- ■ 4.0 - 4.5
- ■ 4.5 - 5.0
- ■ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Pampas
100 Year ARI Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_100Y_D_Pam.mxd
Date Saved: 11/04/2014



Legend

- ● Town Centre
- ● Streamflow Gauge
- ✚ Emergency Locations
- ▭ Cadastre
- — Road Centreline
- ┼ Rail Centreline
- — Water Level Contours (mAHD)
- ▭ Inundation Extent

1:20,000 (at A3)

0 125 250 500

Metres

GDA 1994 MGA Zone 56

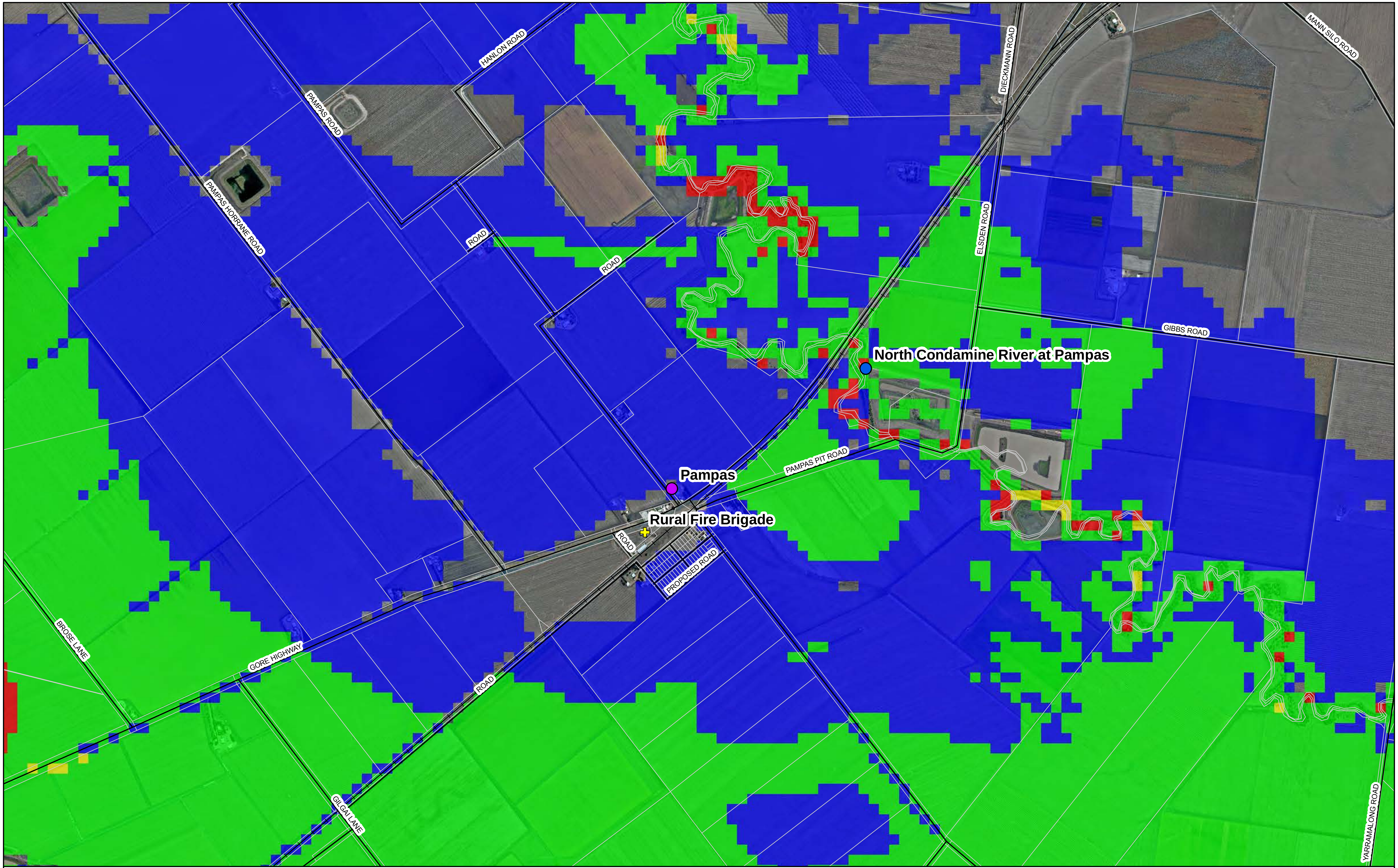
N

TOOWOOMBA
REGIONAL
COUNCIL

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Pampas
100 Year ARI Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_100Y_H_Pam.mxd
Date Saved: 7/03/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

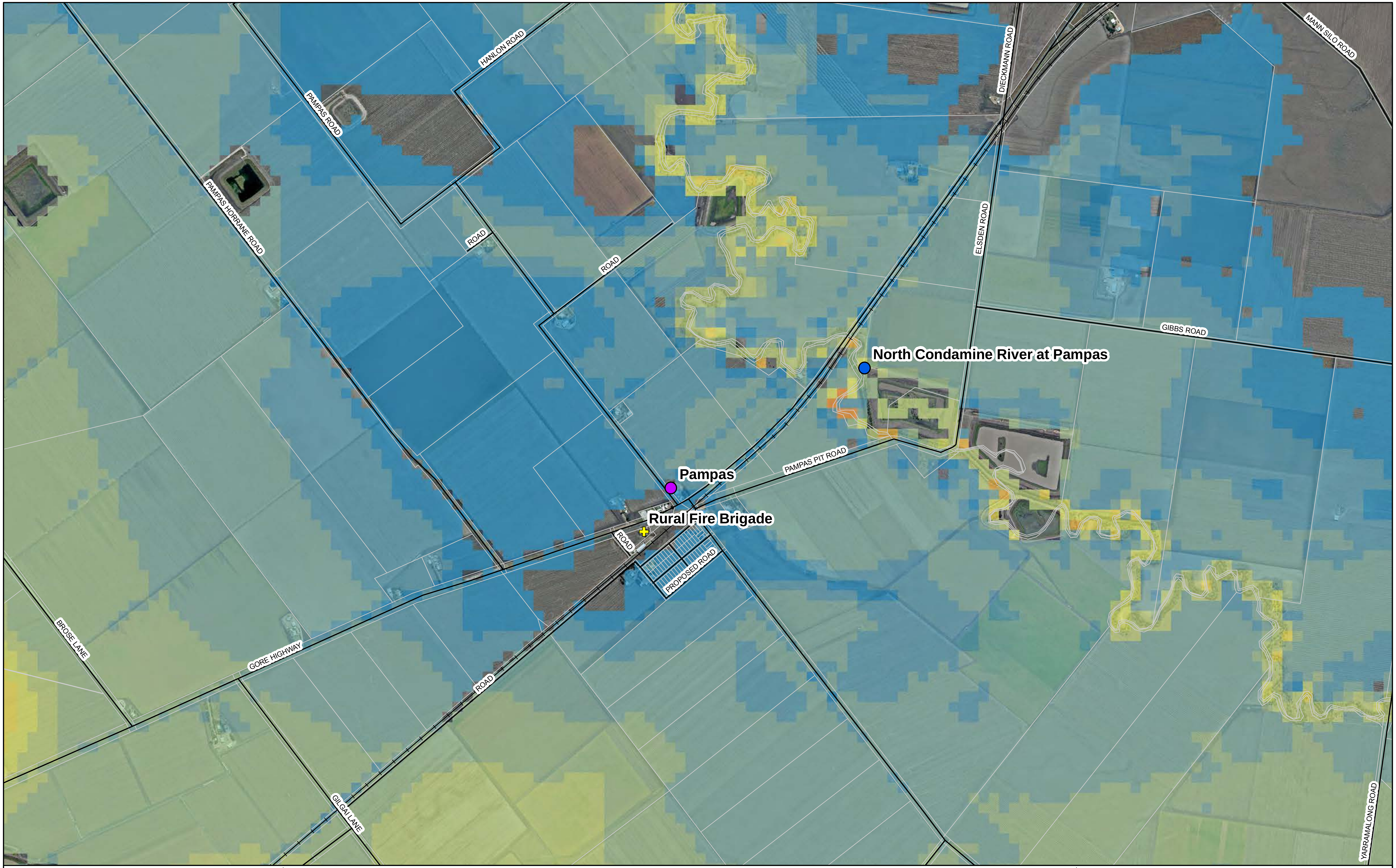
● Town Centre
● Streamflow Gauge
✚ Emergency Locations
☐ Cadastre
— Road Centreline
┼ Rail Centreline

Hazard Categories
🟦 Low
🟩 Significant
🟨 High
🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Pampas
100 Year ARI Event Peak Hazard

I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\CON_V08_E_100Y_Haz_Pam.mxd
Date Saved: 16/06/2014



TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

● Town Centre
● Streamflow Gauge
✚ Emergency Locations
☐ Cadastre
— Road Centreline
┼ Rail Centreline

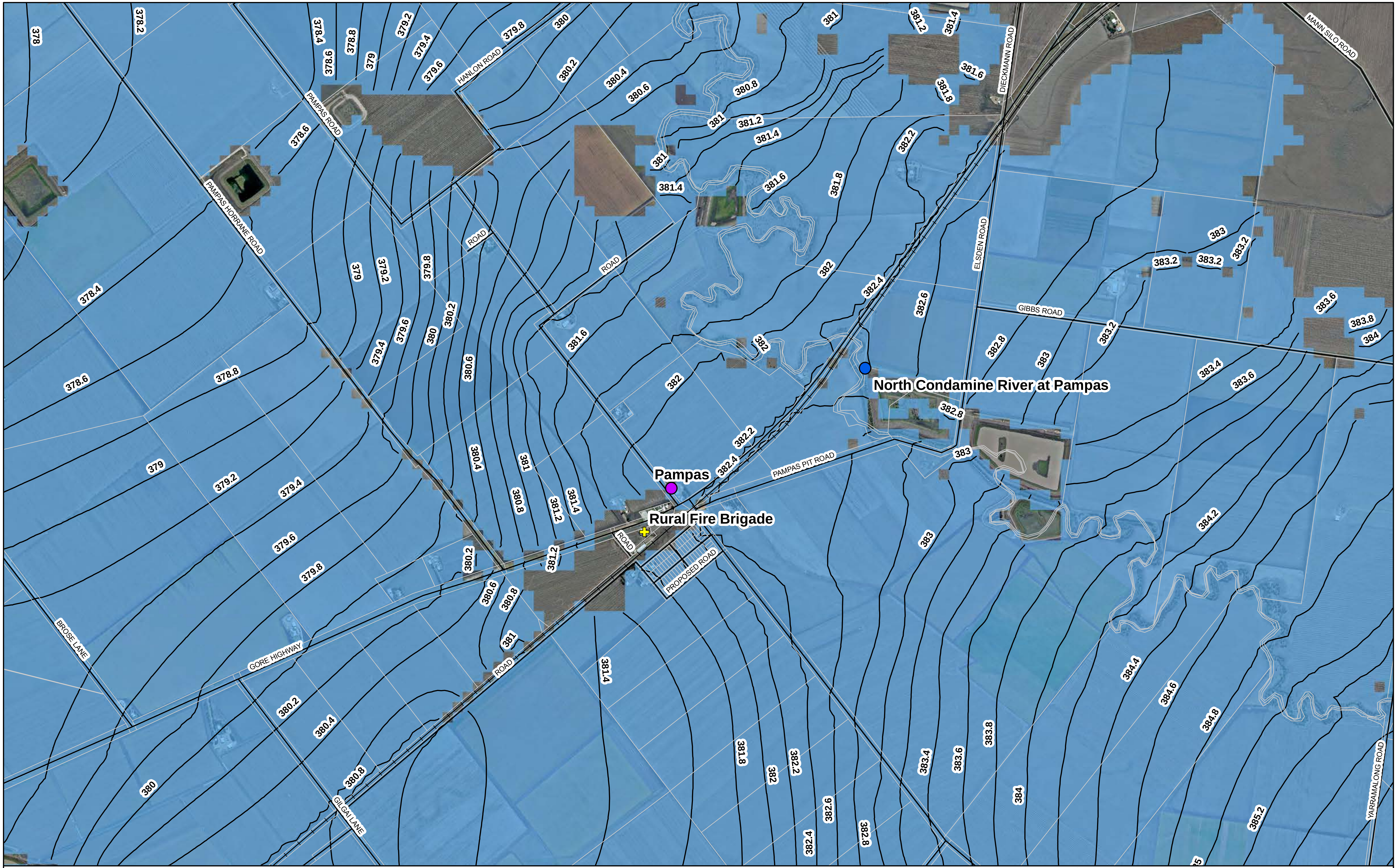
Peak Depth (m)

- < 0.1
- 0.1- 0.25
- 0.25 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- 4.0 - 4.5
- 4.5 - 5.0
- > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Pampas
500 Year ARI Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_500Y_D_Pam.mxd
Date Saved: 7/03/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500

Metres

GDA 1994 MGA Zone 56

N

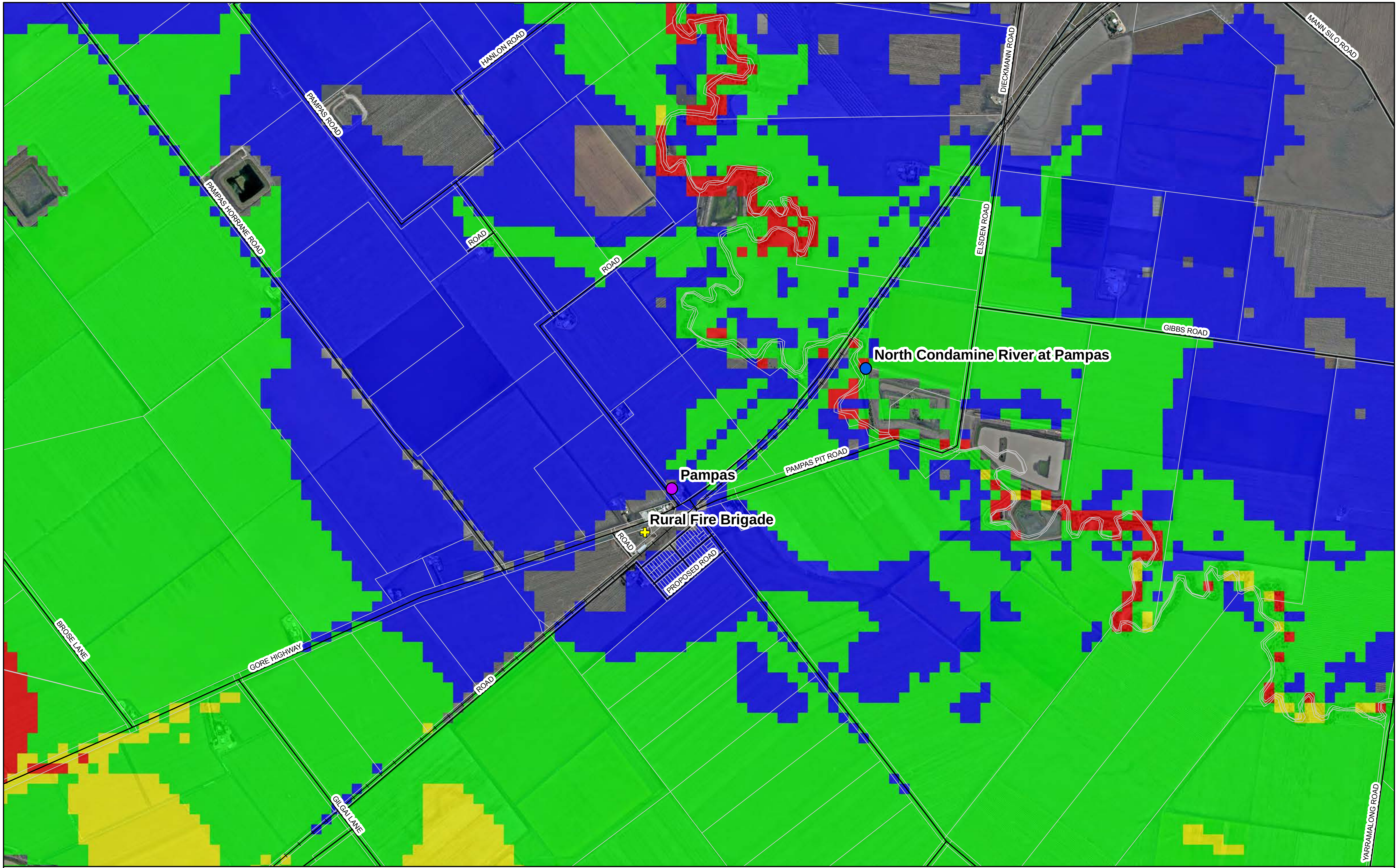
Legend

- ● Town Centre
- ● Streamflow Gauge
- ✚ Emergency Locations
- ☐ Cadastre
- — Road Centreline
- ┼ Rail Centreline
- — Water Level Contours (mAHD)
- ▨ Inundation Extent

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Pampas
500 Year ARI Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_500Y_H_Pam.mxd
Date Saved: 7/03/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

● Town Centre

● Streamflow Gauge

✚ Emergency Locations

☐ Cadastre

— Road Centreline

–+– Rail Centreline

Hazard Categories

🟦 Low

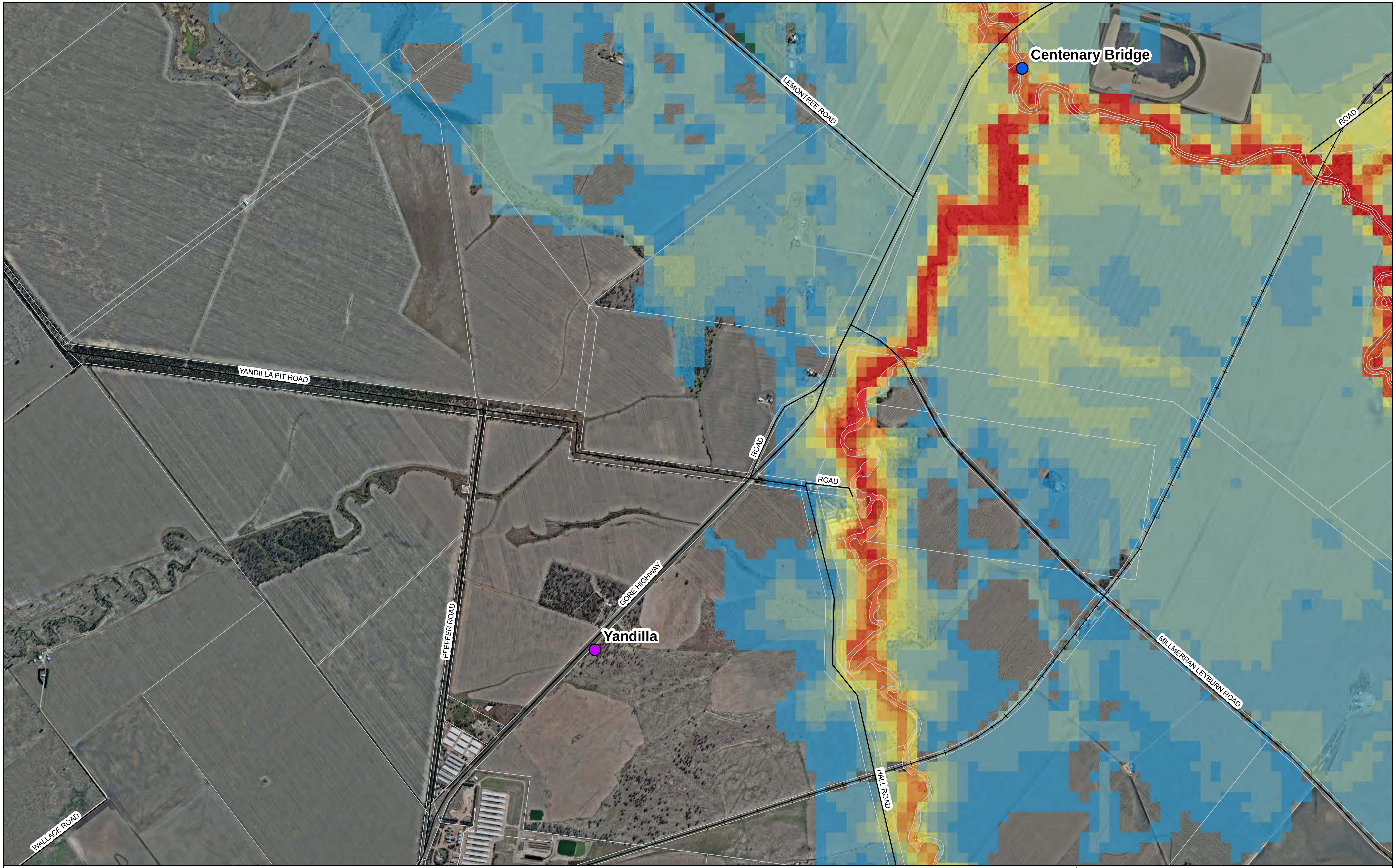
🟩 Significant

🟨 High

🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Pampas
500 Year ARI Event Peak Hazard



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

GDA 1994 MGA Zone 56

Legend

● Town Centre
● Streamflow Gauge
☐ Cadastre
— Road Centreline
–+– Rail Centreline

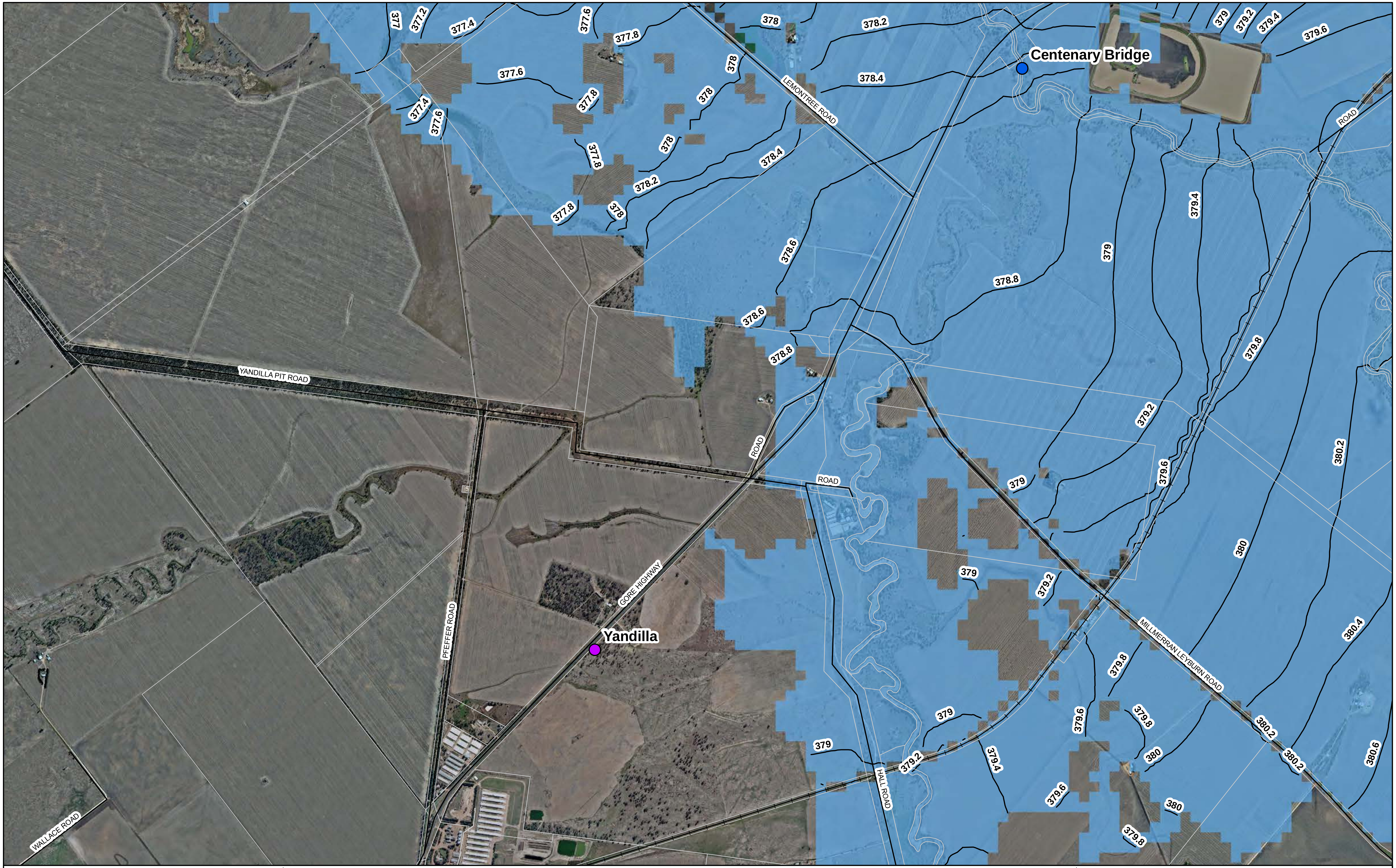
Peak Depth (m)

- < 0.1
- 0.1- 0.25
- 0.25 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- 4.0 - 4.5
- 4.5 - 5.0
- > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Yandilla
1976 Validation Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V02_E_1976_D_Yan.mxd
Date Saved: 17/03/2014



TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

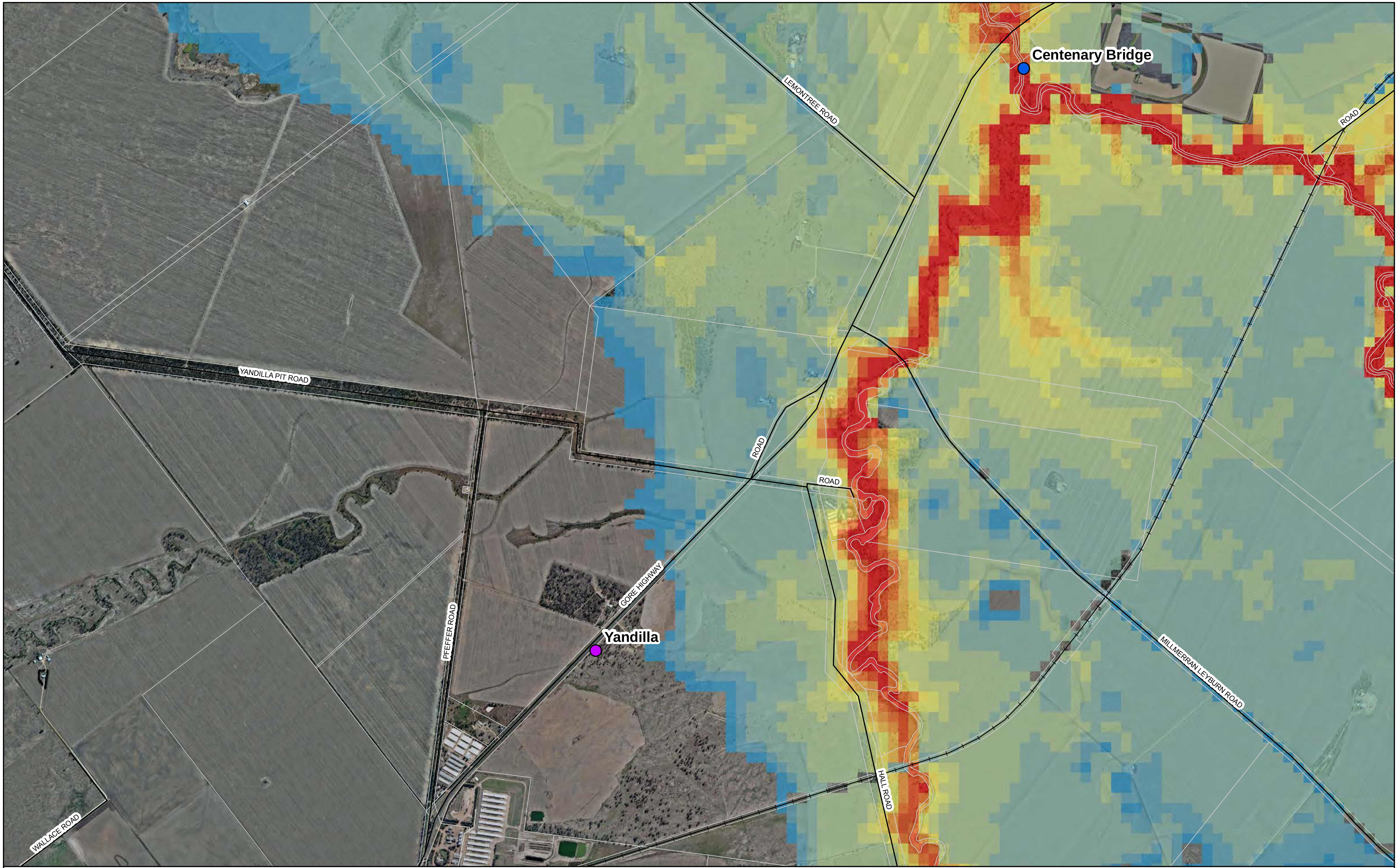
Legend

● Town Centre	● Streamflow Gauge
☐ Cadastre	— Road Centreline
—+— Rail Centreline	— Water Level Contours (mAHD)
▨ Inundation Extent	

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Yandilla
1976 Validation Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V02_E_1976_H_Yan.mxd
Date Saved: 17/03/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

● Town Centre
● Streamflow Gauge
☐ Cadastre

—— Road Centreline
—+— Rail Centreline

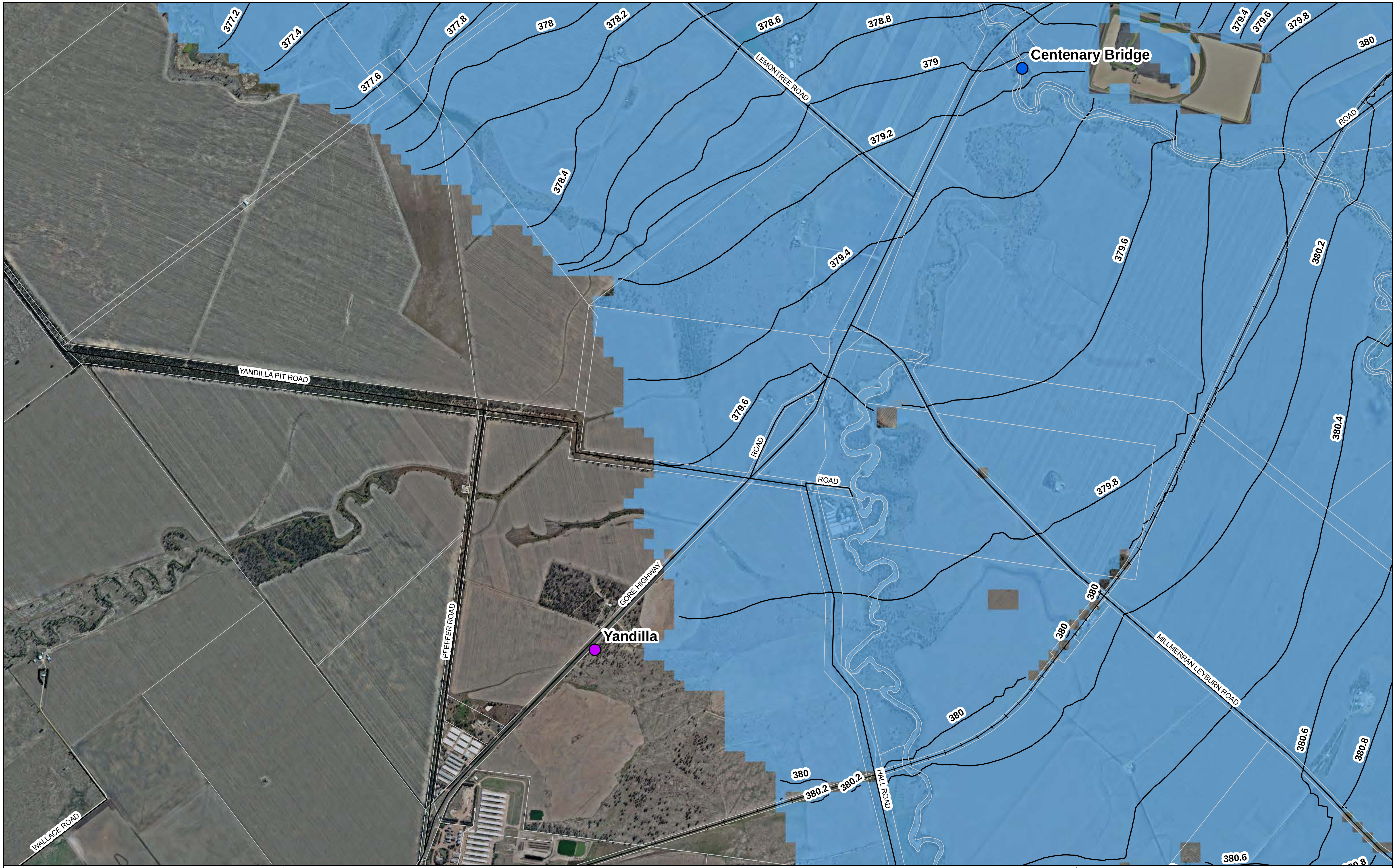
Peak Depth (m)

🟦 < 0.1	🟦 0.25 - 0.5	🟨 1.5 - 2.0	🟧 3.0 - 3.5	🟥 4.5 - 5.0
🟦 0.1- 0.25	🟩 0.5 - 1.0	🟨 2.0 - 2.5	🟧 3.5 - 4.0	🟥 > 5.0
	🟩 1.0 - 1.5	🟨 2.5 - 3.0	🟧 4.0 - 4.5	

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Yandilla
2011 Validation Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_2011_D_Yan.mxd
Date Saved: 17/03/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500

Metres

GDA 1994 MGA Zone 56

N

Legend

● Town Centre

● Streamflow Gauge

☐ Cadastre

— Road Centreline

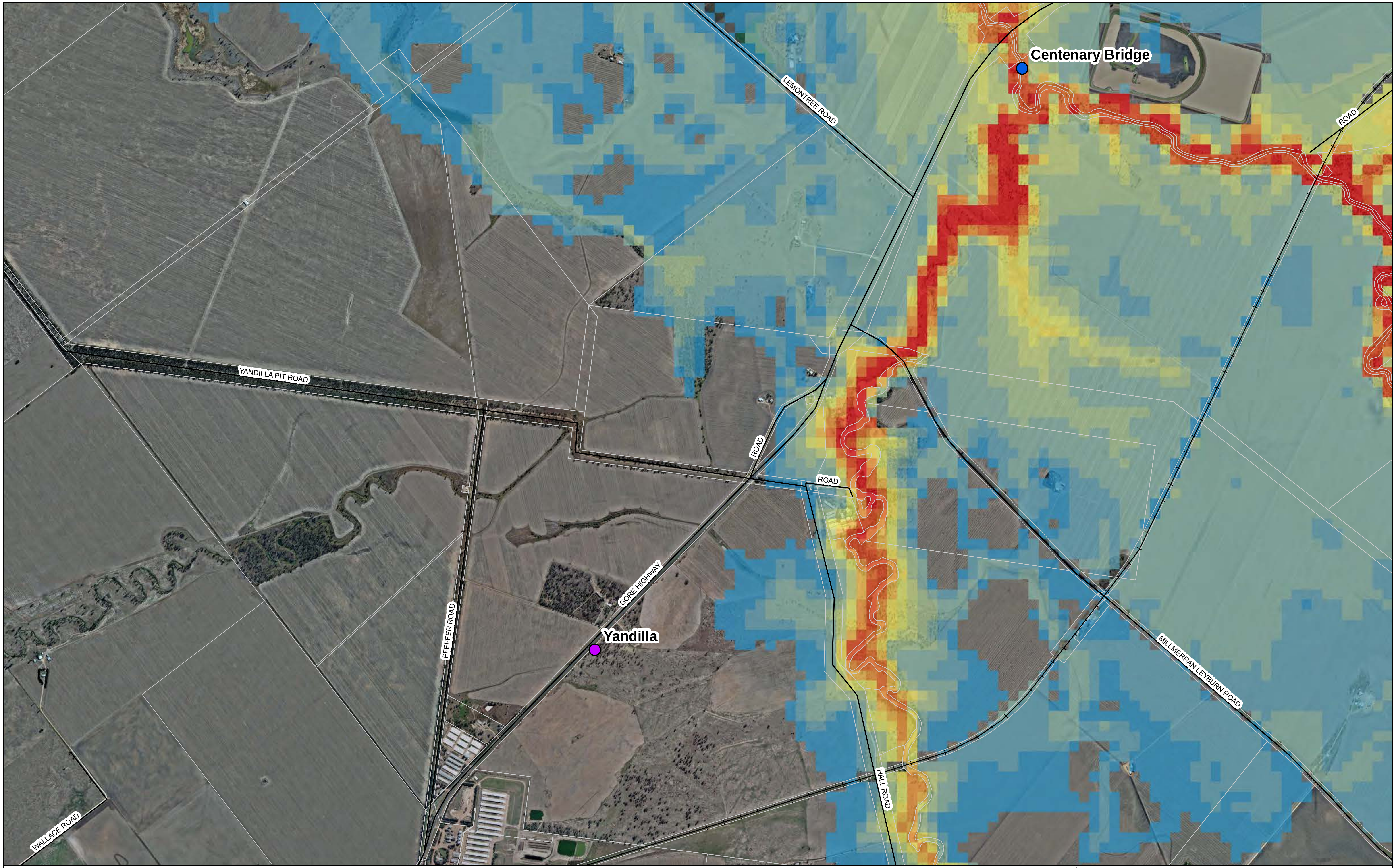
-+- Rail Centreline

— Water Level Contours (mAHD)

🟦 Inundation Extent

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Yandilla
2011 Validation Event Peak Water Level



TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

- ● Town Centre
- ● Streamflow Gauge
- ☐ Cadastre
- — Road Centreline
- ┼ Rail Centreline

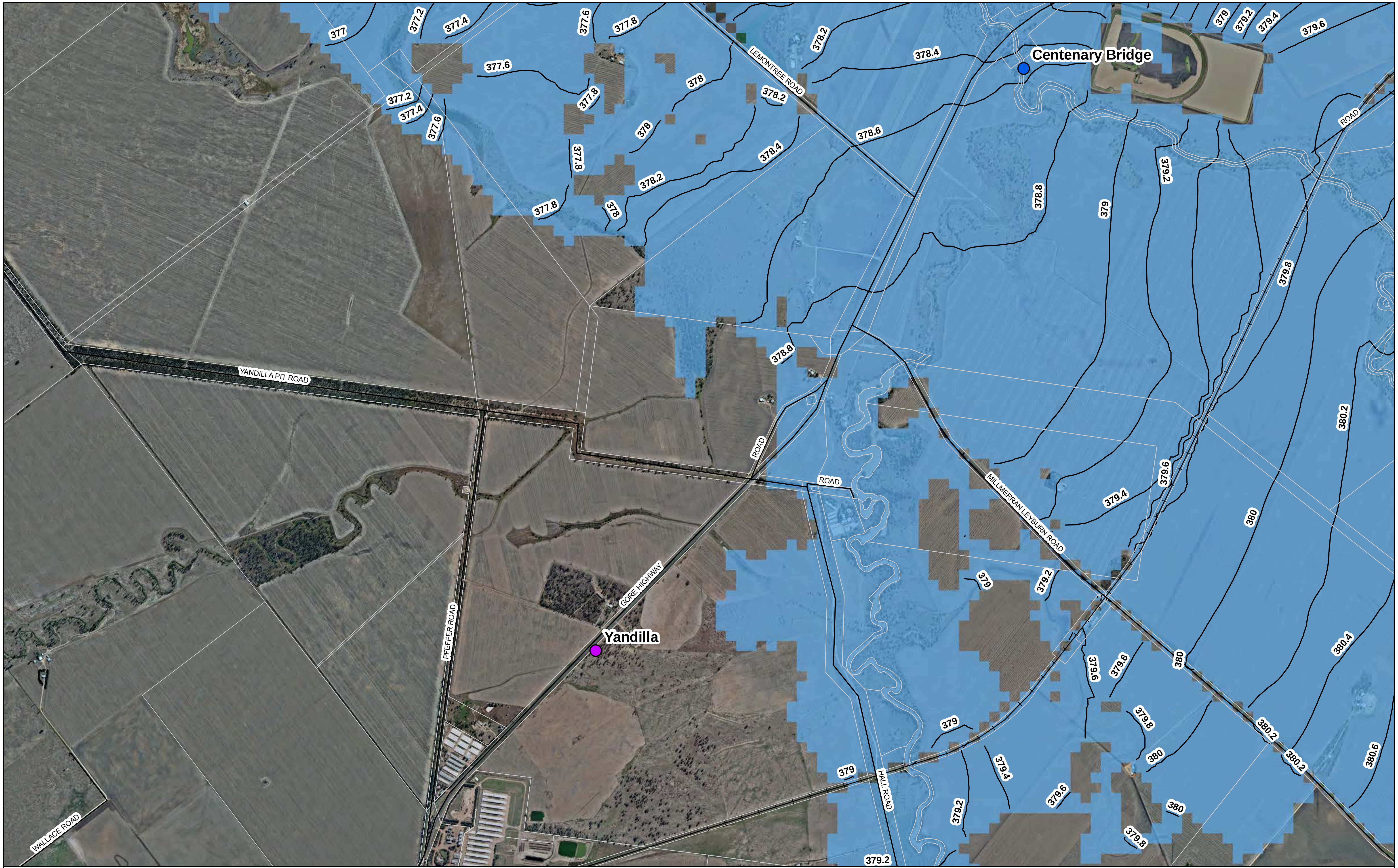
Peak Depth (m)

- ■ < 0.1
- ■ 0.1- 0.25
- ■ 0.25 - 0.5
- ■ 0.5 - 1.0
- ■ 1.0 - 1.5
- ■ 1.5 - 2.0
- ■ 2.0 - 2.5
- ■ 2.5 - 3.0
- ■ 3.0 - 3.5
- ■ 3.5 - 4.0
- ■ 4.0 - 4.5
- ■ 4.5 - 5.0
- ■ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Yandilla
10 Year ARI Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_10Y_D_Yan.mxd
Date Saved: 7/03/2014



Legend

● Town Centre
● Streamflow Gauge
☐ Cadastre
— Road Centreline
┼ Rail Centreline
— Water Level Contours (mAHD)
▨ Inundation Extent

TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

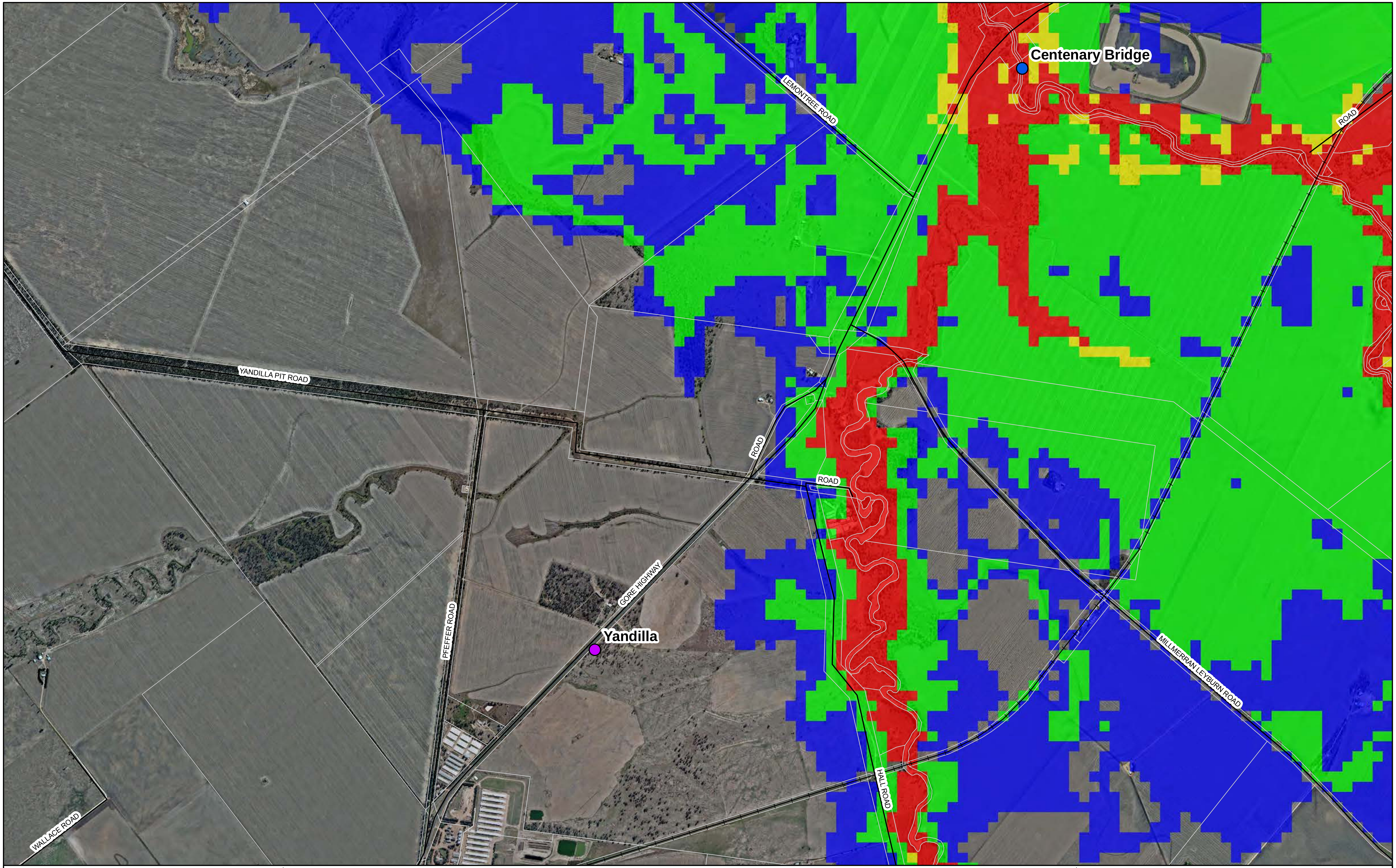
GDA 1994 MGA Zone 56

N

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Yandilla
10 Year ARI Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_10Y_H_Yan.mxd
Date Saved: 7/03/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

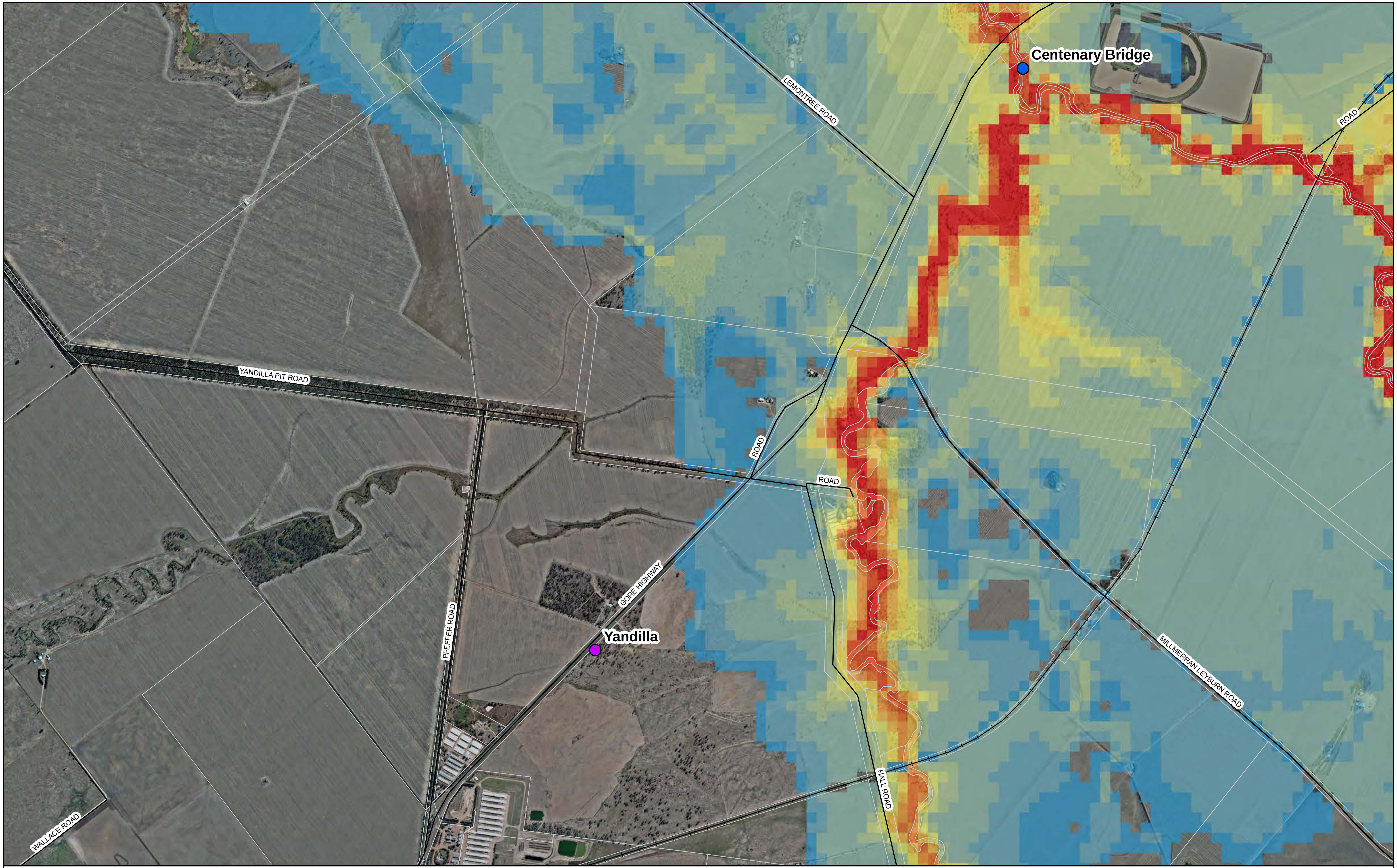
● Town Centre	Road Centreline
● Streamflow Gauge	Rail Centreline
☐ Cadastre	

Hazard Categories

🟦 Low	🟨 High
🟩 Significant	🟥 Extreme

SP 051 Flood Studies
Work Package 7 - Yandilla
10 Year ARI Event Peak Hazard

I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\CON_V08_E_10Y_Haz_Yan.mxd
Date Saved: 16/06/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

- ● Town Centre
- ● Streamflow Gauge
- ☐ Cadastre
- — Road Centreline
- ┼ Rail Centreline

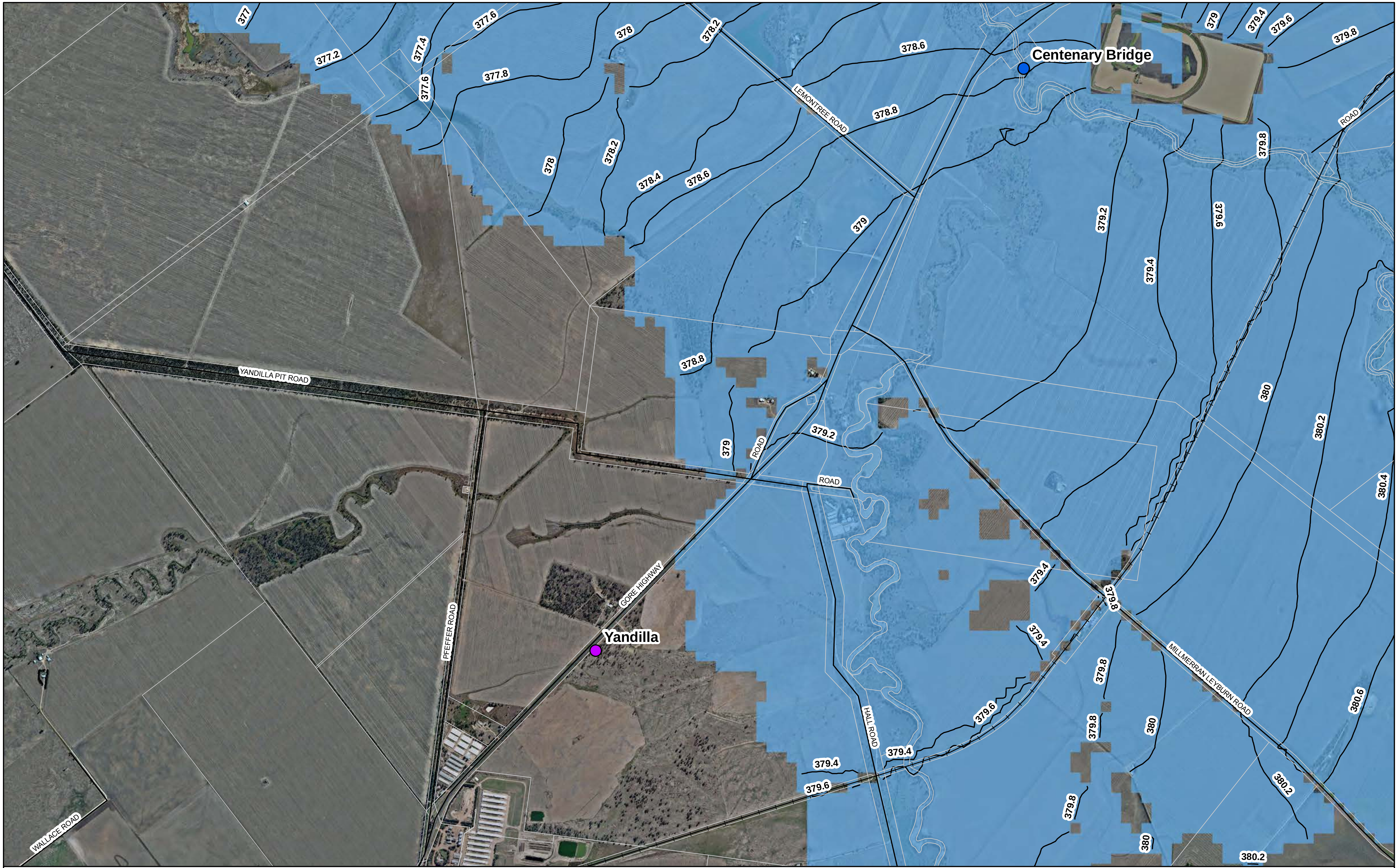
Peak Depth (m)

- ▨ < 0.1
- ▨ 0.1- 0.25
- ▨ 0.25 - 0.5
- ▨ 0.5 - 1.0
- ▨ 1.0 - 1.5
- ▨ 1.5 - 2.0
- ▨ 2.0 - 2.5
- ▨ 2.5 - 3.0
- ▨ 3.0 - 3.5
- ▨ 3.5 - 4.0
- ▨ 4.0 - 4.5
- ▨ 4.5 - 5.0
- ▨ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Yandilla
20 Year ARI Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_20Y_D_Yan.mxd
Date Saved: 7/03/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

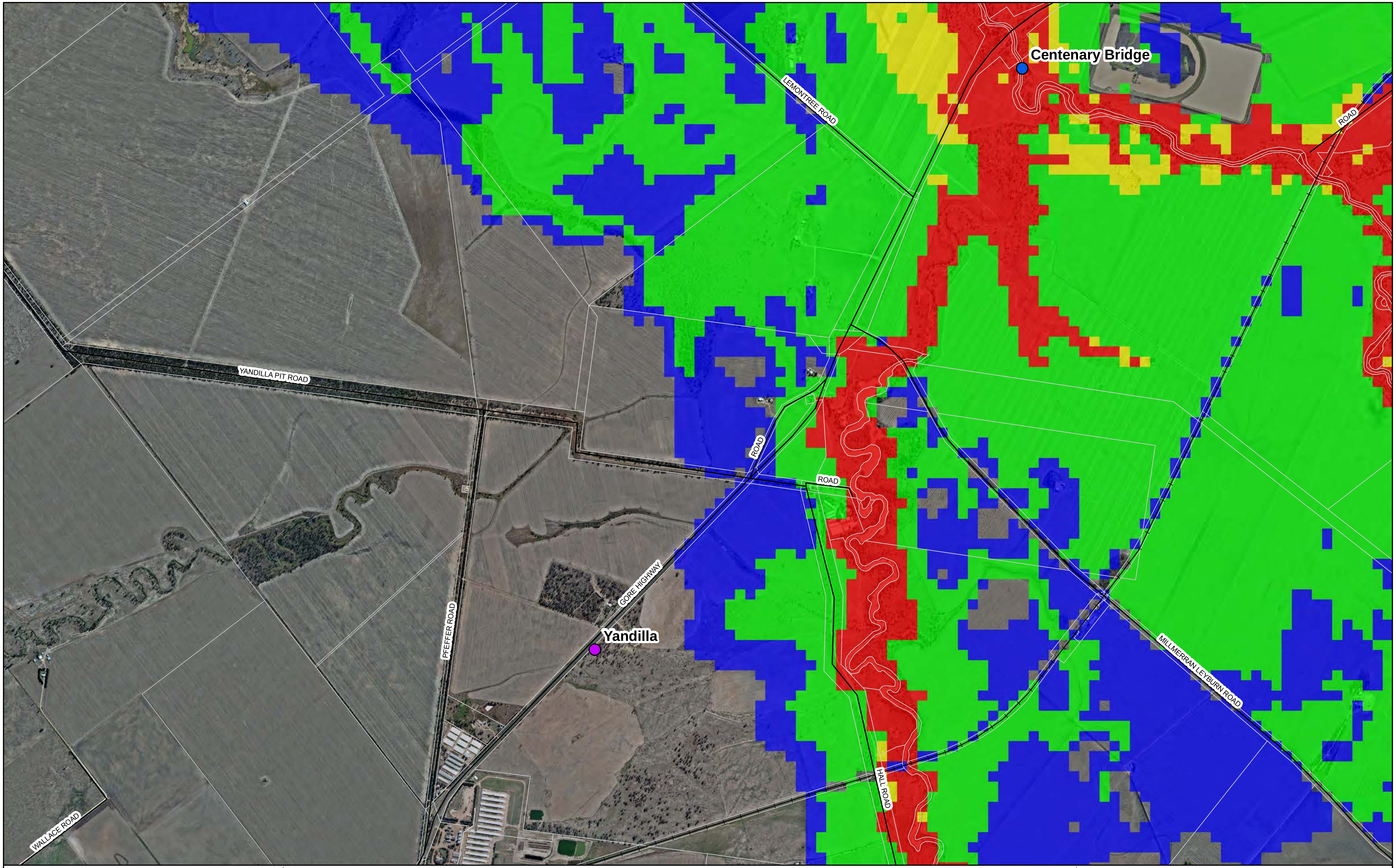
Legend

- ● Town Centre
- ● Streamflow Gauge
- ☐ Cadastre
- — Road Centreline
- ┼ Rail Centreline
- — Water Level Contours (mAHD)
- ▨ Inundation Extent

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Yandilla
20 Year ARI Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_20Y_H_Yan.mxd
Date Saved: 7/03/2014



TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

- ● Town Centre
- ● Streamflow Gauge
- ☐ Cadastre
- — Road Centreline
- ┼ Rail Centreline

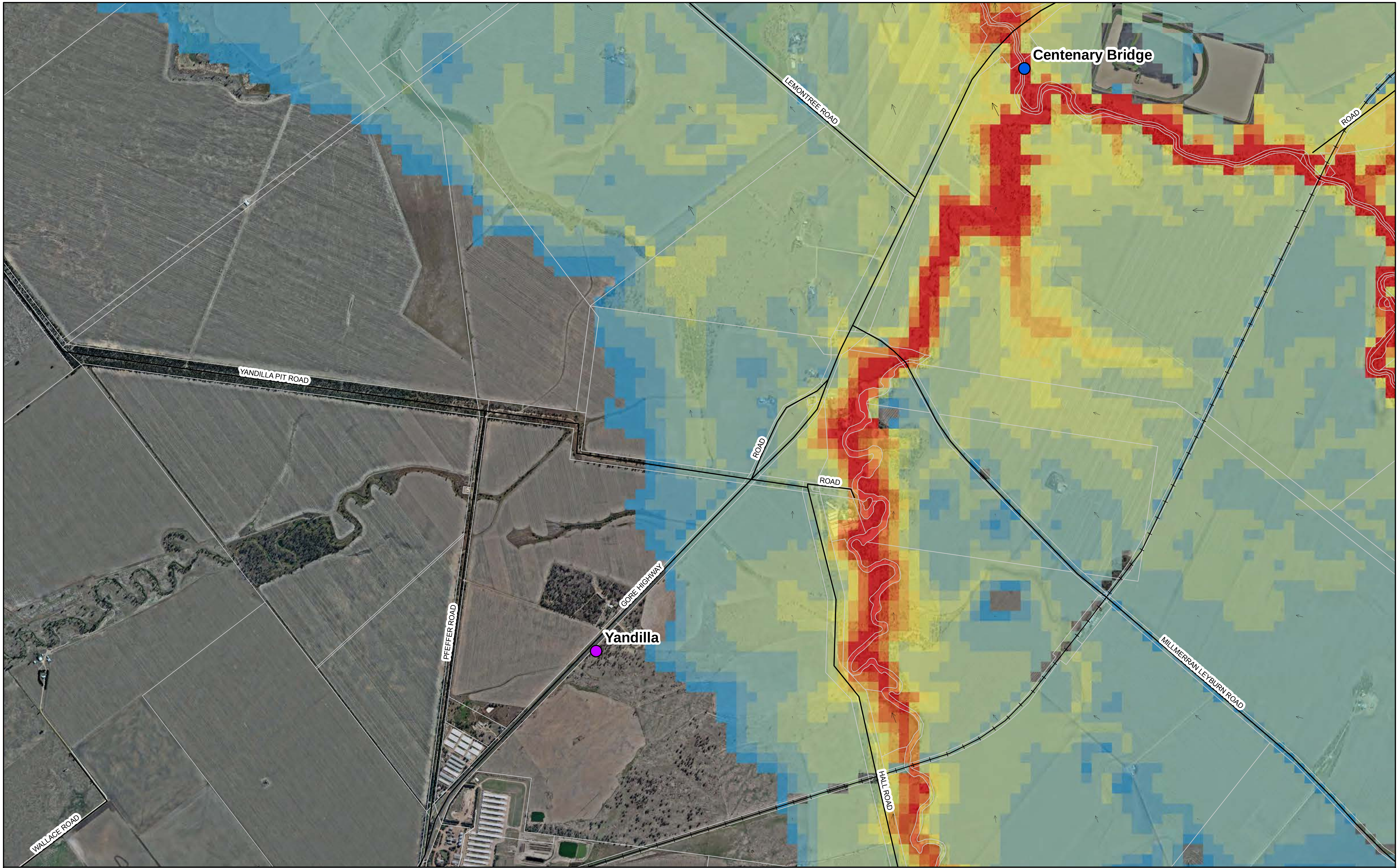
Hazard Categories

- 🟦 Low
- 🟩 Significant
- 🟨 High
- 🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Yandilla
20 Year ARI Event Peak Hazard

I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\CON_V08_E_20Y_Haz_Yan.mxd
Date Saved: 16/06/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500

Metres

GDA 1994 MGA Zone 56

N

Legend

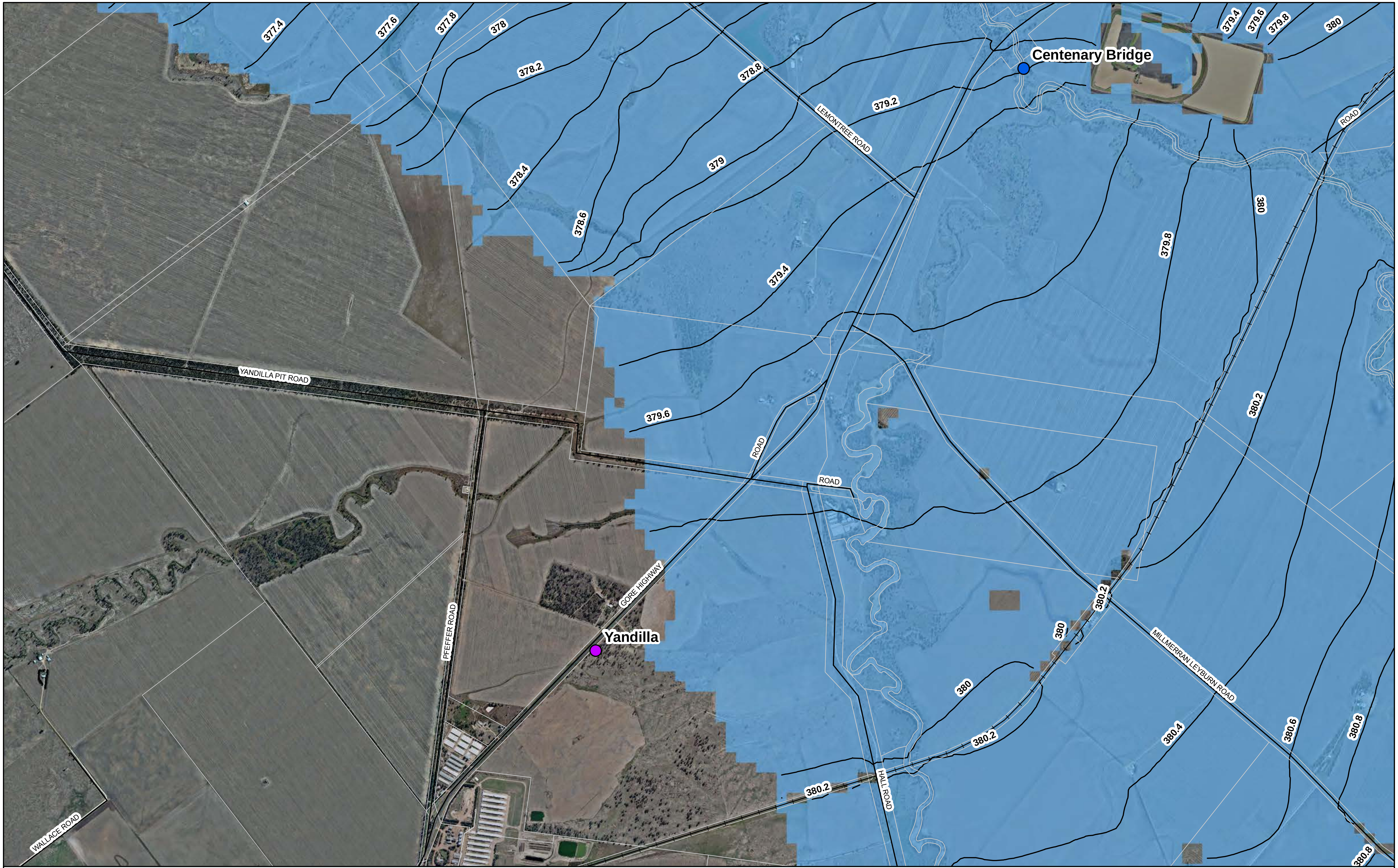
● Town Centre
● Streamflow Gauge
☐ Cadastre
— Road Centreline
┼ Rail Centreline
↑ Velocity Vectors

Peak Depth (m)

- 🟦 < 0.1
- 🟦 0.1- 0.25
- 🟦 0.25 - 0.5
- 🟩 0.5 - 1.0
- 🟩 1.0 - 1.5
- 🟩 1.5 - 2.0
- 🟨 2.0 - 2.5
- 🟨 2.5 - 3.0
- 🟧 3.0 - 3.5
- 🟧 3.5 - 4.0
- 🟧 4.0 - 4.5
- 🟥 4.5 - 5.0
- 🟥 > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Yandilla
100 Year ARI Event Peak Depth



1:20,000 (at A3)

0 125 250 500
Metres

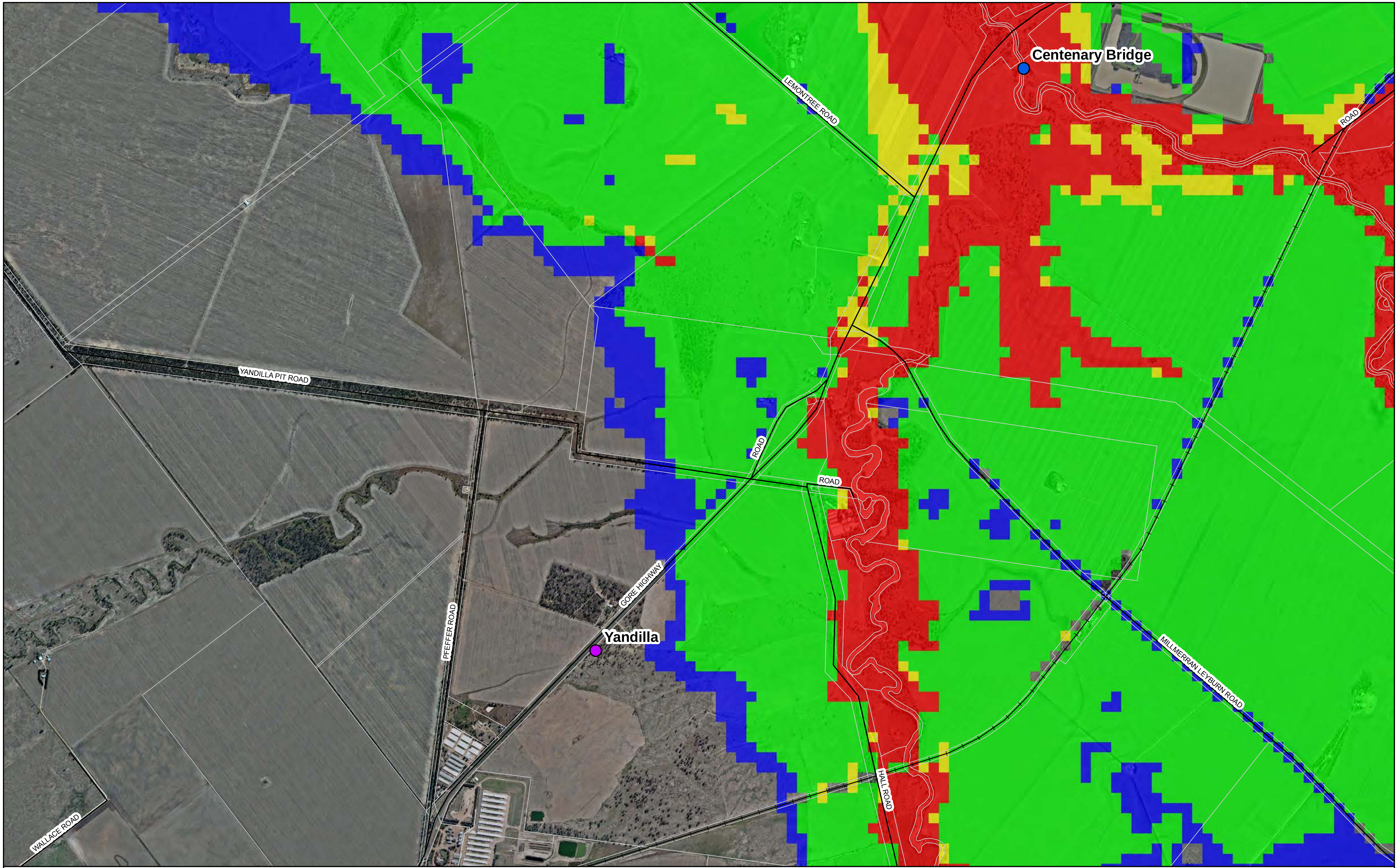
GDA 1994 MGA Zone 56

N

Legend

● Town Centre	— Road Centreline
● Streamflow Gauge	+ Rail Centreline
☐ Cadastre	— Water Level Contours (mAHD)
▨ Inundation Extent	

SP 051 Flood Studies
Work Package 7 - Yandilla
100 Year ARI Event Peak Water Level



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

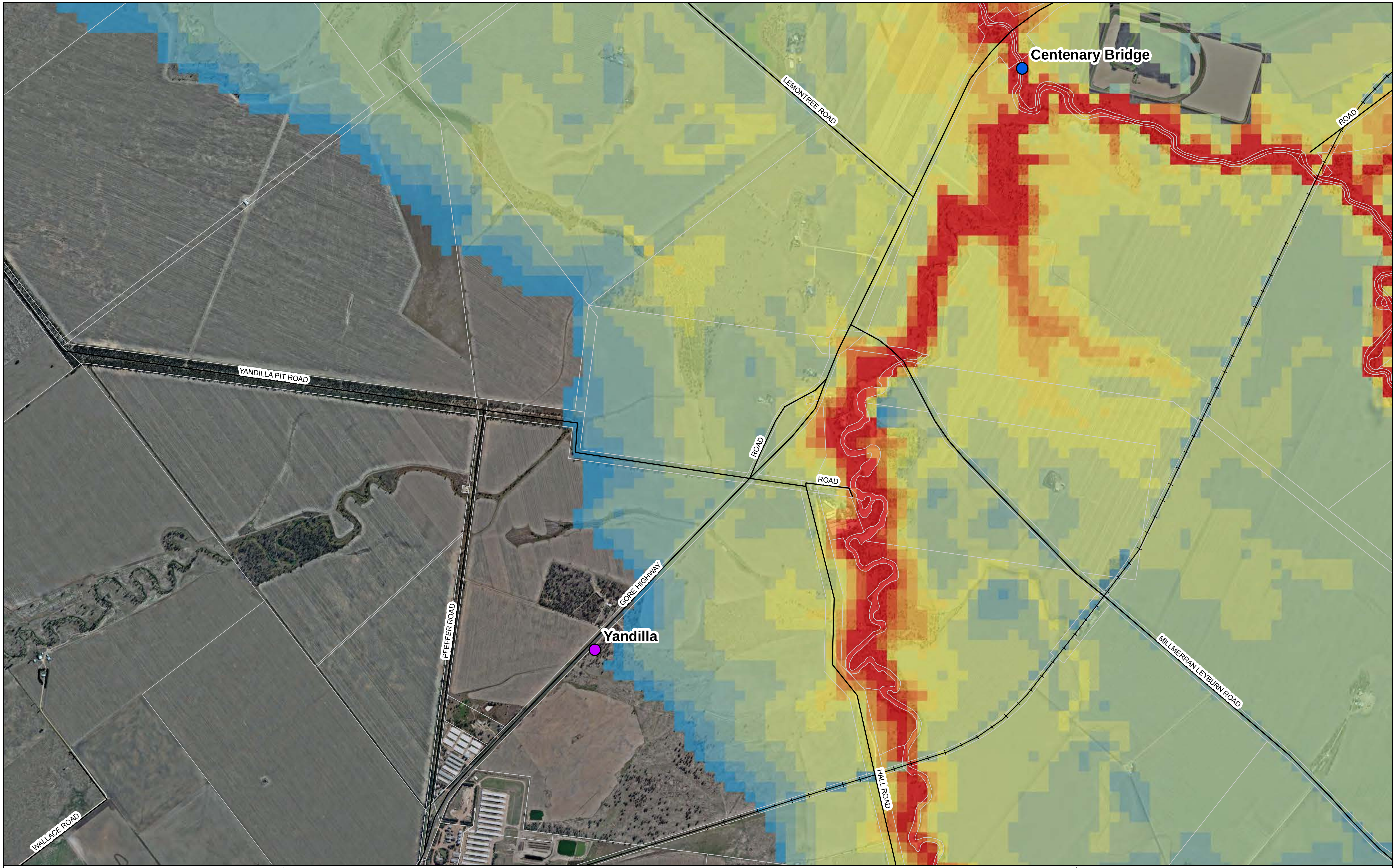
- ● Town Centre
- ● Streamflow Gauge
- ☐ Cadastre
- — Road Centreline
- ┼ Rail Centreline

Hazard Categories

- 🟦 Low
- 🟩 Significant
- 🟨 High
- 🟥 Extreme

SP 051 Flood Studies
Work Package 7 - Yandilla
100 Year ARI Event Peak Hazard

I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\CON_V08_E_100Y_Haz_Yan.mxd
Date Saved: 16/06/2014



TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

● Town Centre
● Streamflow Gauge
☐ Cadastre
— Road Centreline
—+— Rail Centreline

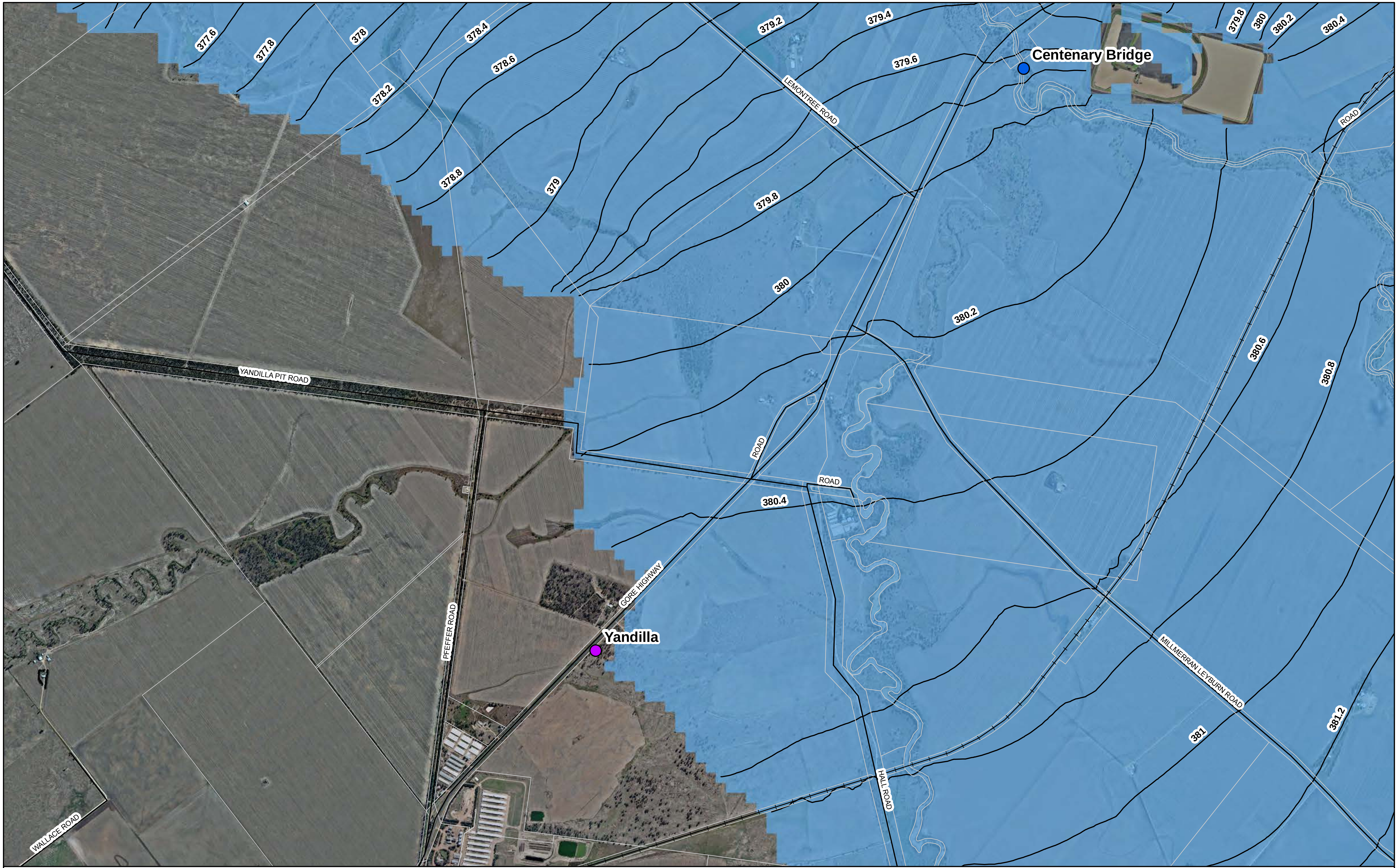
Peak Depth (m)

▨ < 0.1	▨ 0.25 - 0.5	▨ 1.5 - 2.0	▨ 3.0 - 3.5	▨ 4.5 - 5.0
▨ 0.1- 0.25	▨ 0.5 - 1.0	▨ 2.0 - 2.5	▨ 3.5 - 4.0	▨ > 5.0
	▨ 1.0 - 1.5	▨ 2.5 - 3.0	▨ 4.0 - 4.5	

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Yandilla
500 Year ARI Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_500Y_D_Yan.mxd
Date Saved: 7/03/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

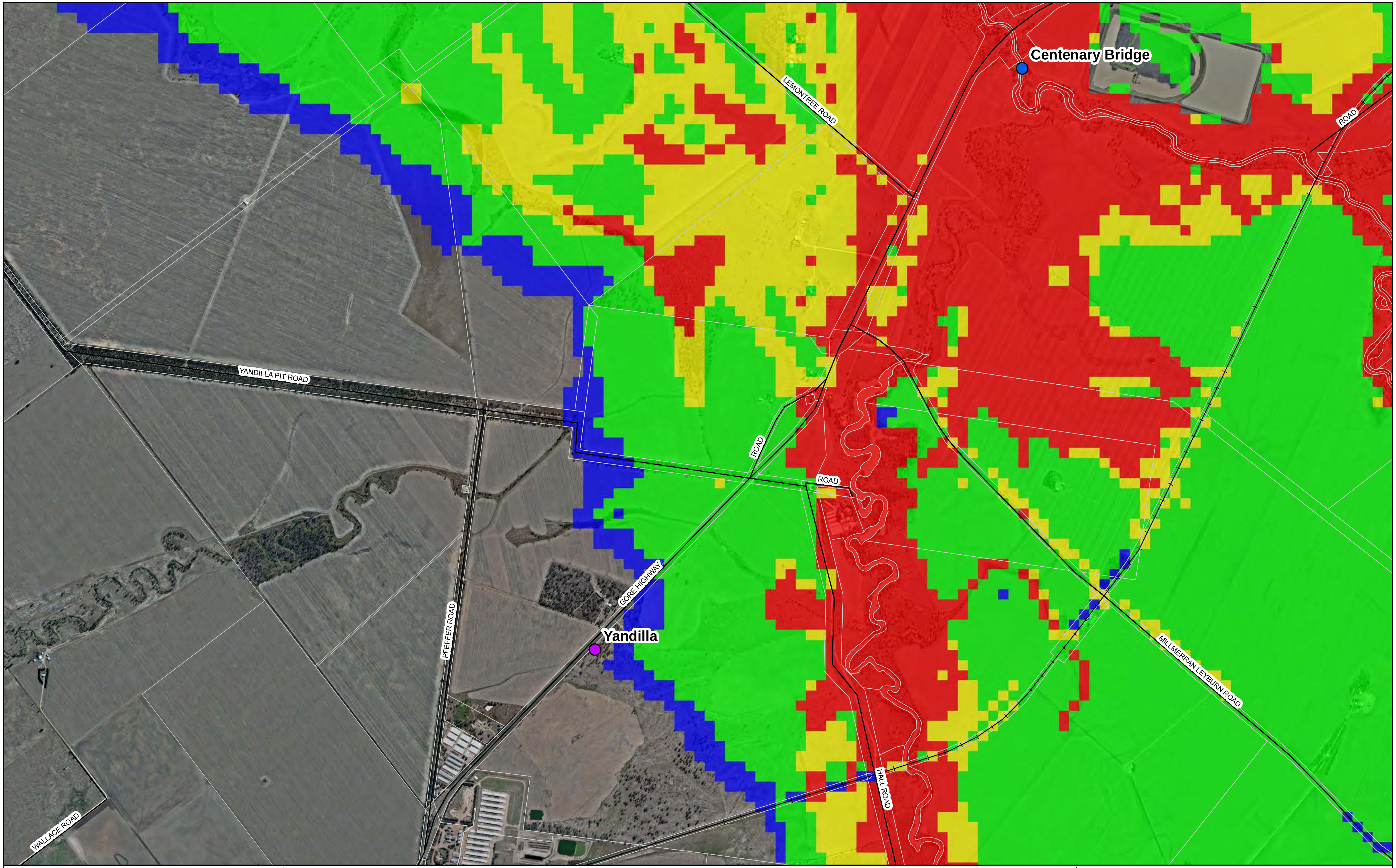
Legend

● Town Centre
● Streamflow Gauge
☐ Cadastre
— Road Centreline
-+- Rail Centreline
— Water Level Contours (mAHD)
▨ Inundation Extent

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Yandilla
500 Year ARI Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_500Y_H_Yan.mxd
Date Saved: 7/03/2014



TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

● Town Centre
● Streamflow Gauge
☐ Cadastre
— Road Centreline
┼ Rail Centreline

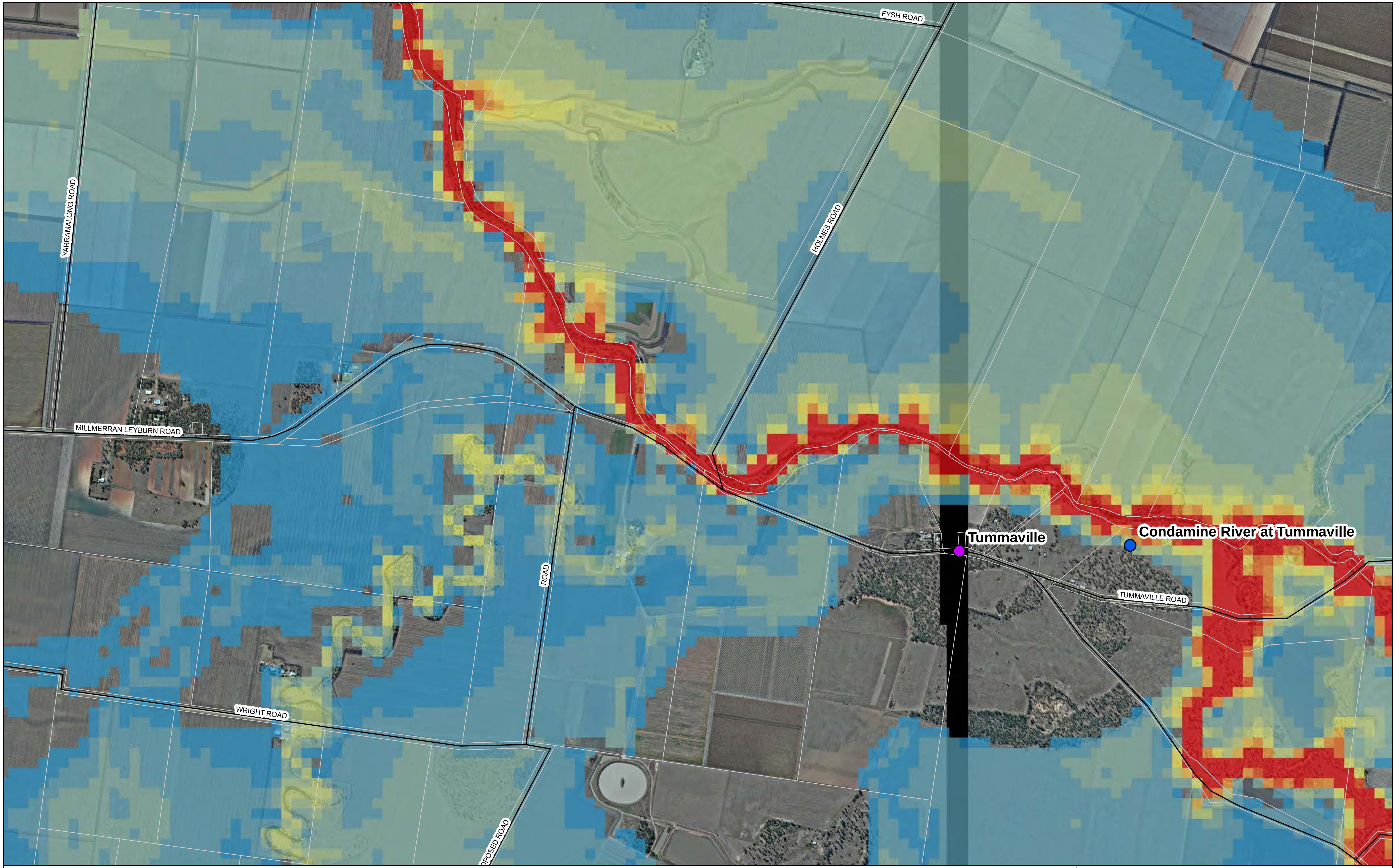
Hazard Categories

🟦 Low
🟩 Significant
🟨 High
🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Yandilla
500 Year ARI Event Peak Hazard

I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\CON_V08_E_500Y_Haz_Yan.mxd
Date Saved: 16/06/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

GDA 1994 MGA Zone 56

N

Legend

● Town Centre

● Streamflow Gauge

☐ Cadastre

— Road Centreline

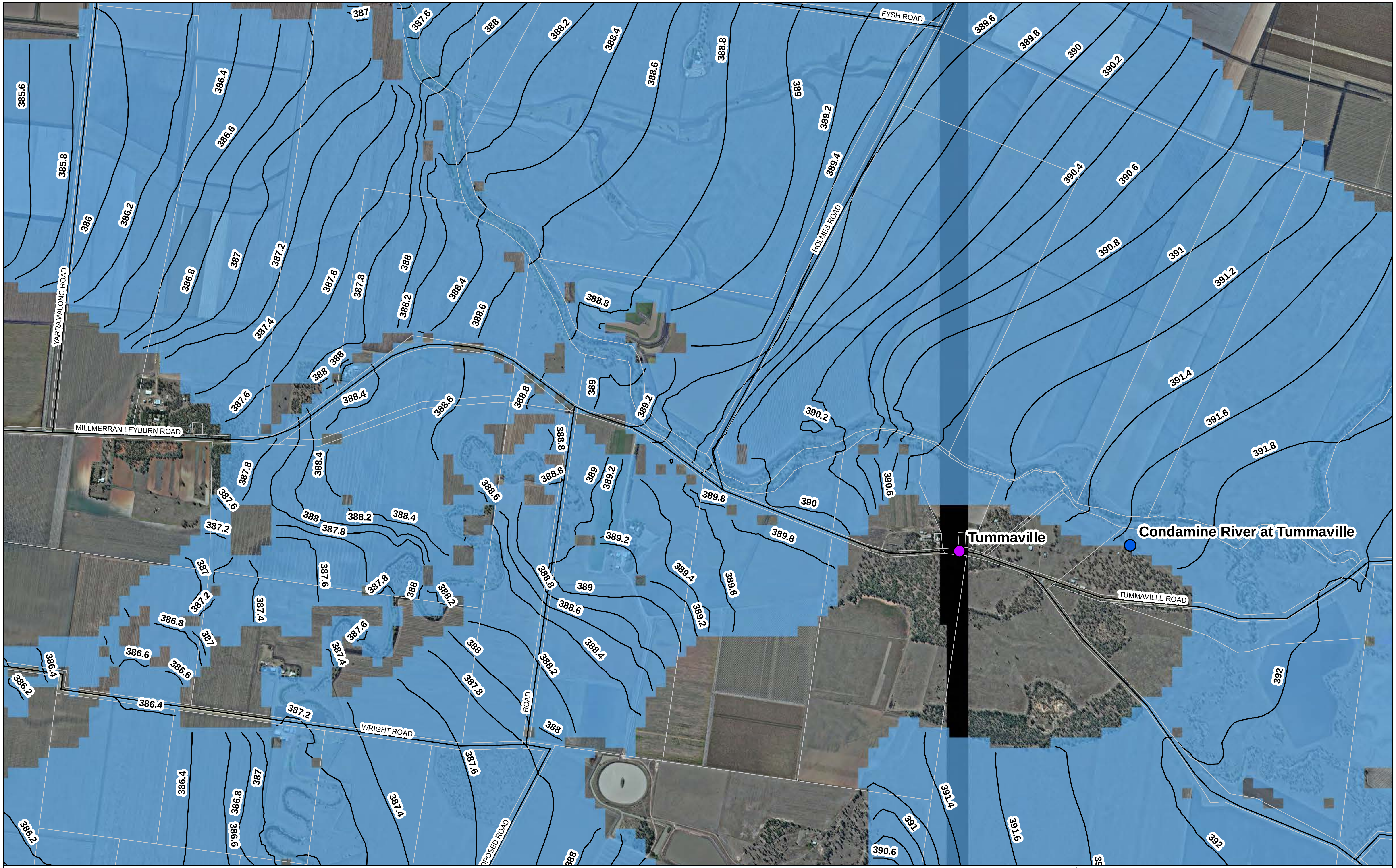
Peak Depth (m)

▨ < 0.1	▨ 0.1- 0.25	▨ 1.0 - 1.5	▨ 2.5 - 3.0	▨ 4.0 - 4.5
	▨ 0.25 - 0.5	▨ 1.5 - 2.0	▨ 3.0 - 3.5	▨ 4.5 - 5.0
	▨ 0.5 - 1.0	▨ 2.0 - 2.5	▨ 3.5 - 4.0	▨ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Tummaville
1976 Validation Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V02_E_1976_D_Tum.mxd
Date Saved: 11/04/2014



1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

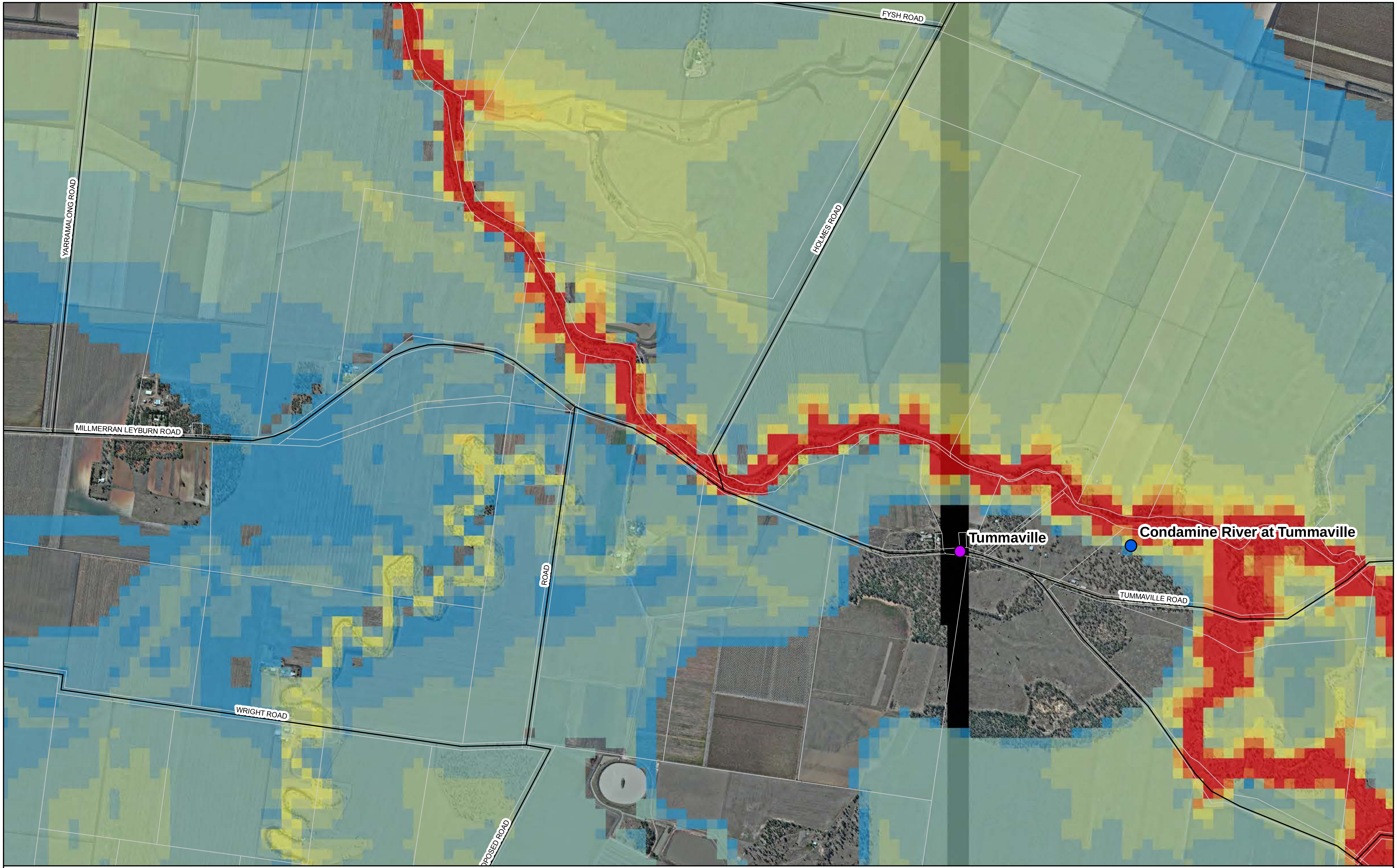
TOOWOOMBA
REGIONAL
COUNCIL

Legend

● Town Centre	Road Centreline
● Streamflow Gauge	Water Level Contours (mAHD)
☐ Cadastre	▨ Inundation Extent

SP 051 Flood Studies
Work Package 7 - Tummaville
1976 Validation Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V02_E_1976_H_Tum.mxd
Date Saved: 11/04/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

● Town Centre
● Streamflow Gauge
☐ Cadastre
— Road Centreline

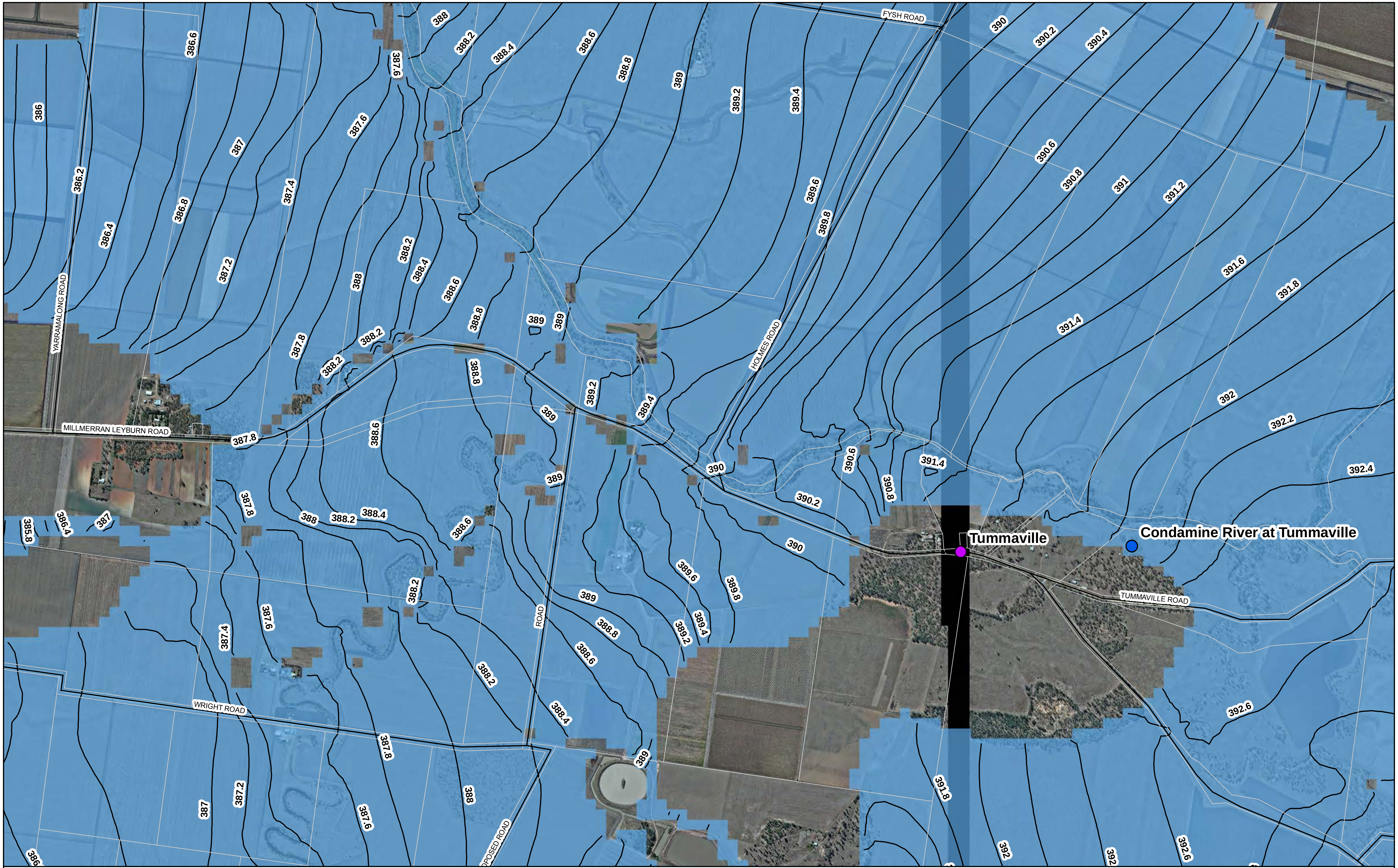
Peak Depth (m)

- ▨ < 0.1
- ▨ 0.1- 0.25
- ▨ 0.25 - 0.5
- ▨ 0.5 - 1.0
- ▨ 1.0 - 1.5
- ▨ 1.5 - 2.0
- ▨ 2.0 - 2.5
- ▨ 2.5 - 3.0
- ▨ 3.0 - 3.5
- ▨ 3.5 - 4.0
- ▨ 4.0 - 4.5
- ▨ 4.5 - 5.0
- ▨ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Tummaville
2011 Validation Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_2011_D_Tum.mxd
Date Saved: 11/04/2014



1:20,000 (at A3)

0 125 250 500

Metres

GDA 1994 MGA Zone 56

N

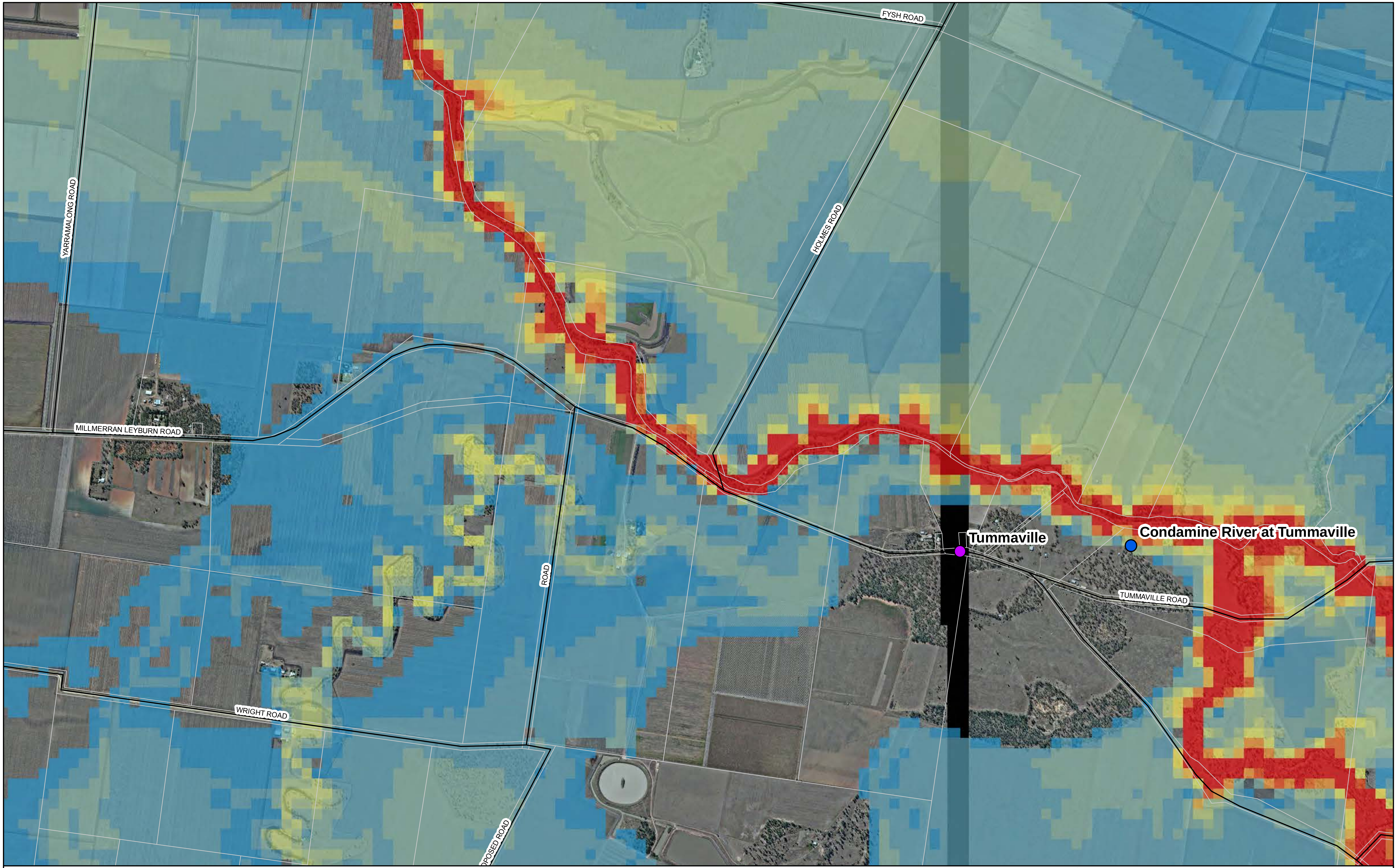
Legend

- ● Town Centre
- ● Streamflow Gauge
- ☐ Cadastre
- Road Centreline
- Water Level Contours (mAHD)
- ▨ Inundation Extent

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Tummaville
2011 Validation Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_2011_H_Tum.mxd
Date Saved: 11/04/2014



TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

- ● Town Centre
- ● Streamflow Gauge
- ☐ Cadastre
- — Road Centreline

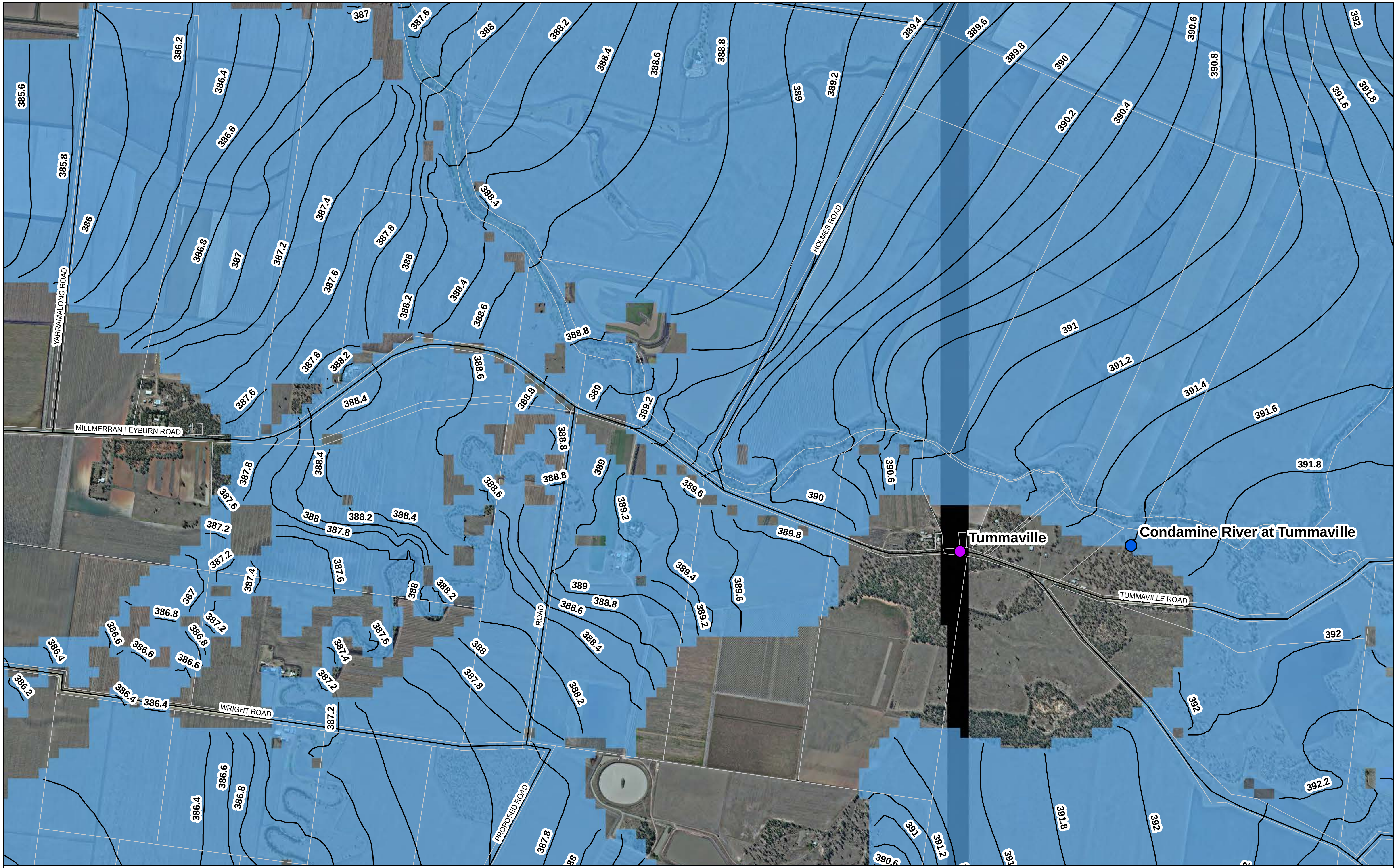
Peak Depth (m)

- ■ < 0.1
- ■ 0.1- 0.25
- ■ 0.25 - 0.5
- ■ 0.5 - 1.0
- ■ 1.0 - 1.5
- ■ 1.5 - 2.0
- ■ 2.0 - 2.5
- ■ 2.5 - 3.0
- ■ 3.0 - 3.5
- ■ 3.5 - 4.0
- ■ 4.0 - 4.5
- ■ 4.5 - 5.0
- ■ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Tummaville
10 Year ARI Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_10Y_D_Tum.mxd
Date Saved: 11/04/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

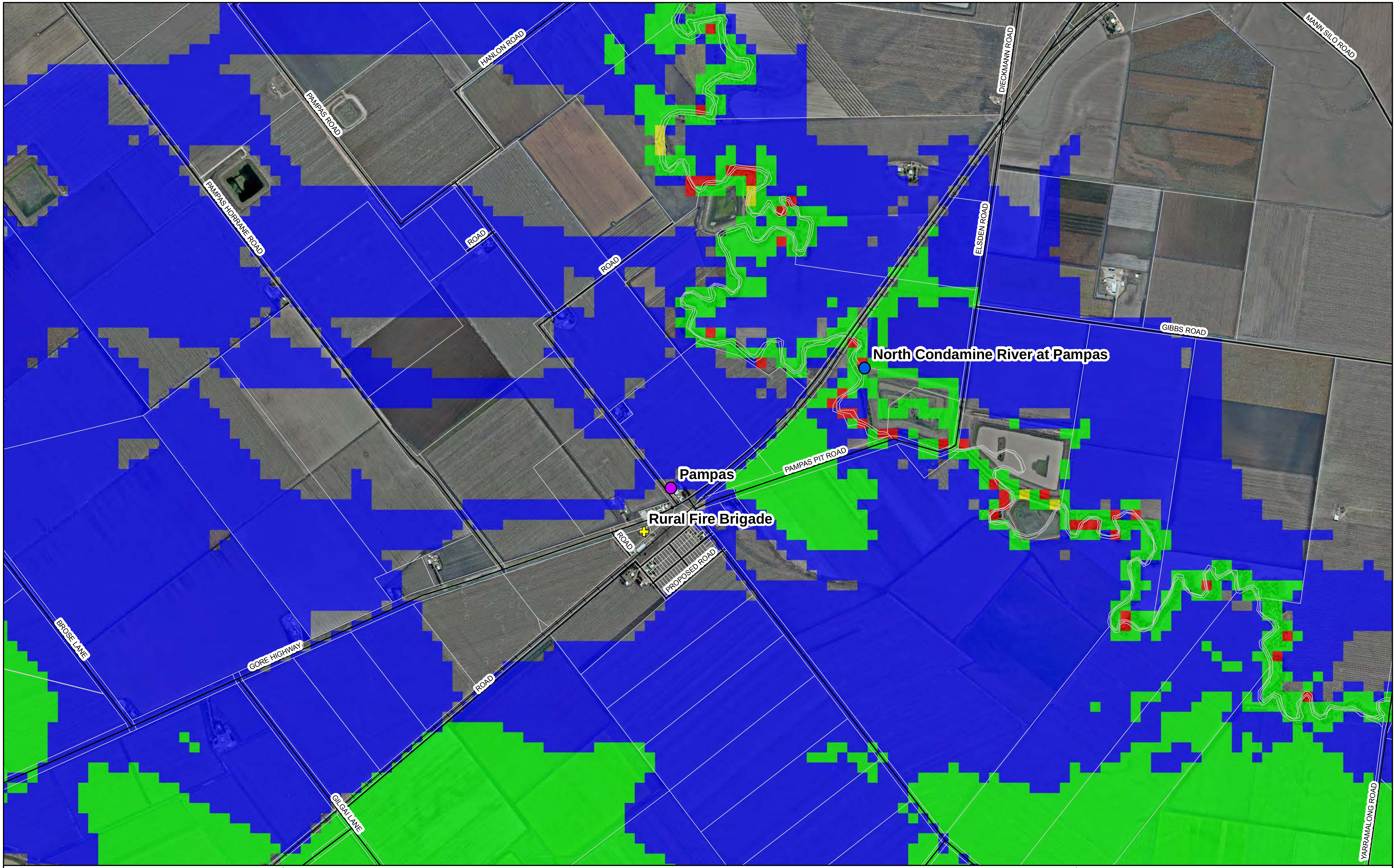
Legend

- ● Town Centre
- ● Streamflow Gauge
- ☐ Cadastre
- — Road Centreline
- — Water Level Contours (mAHD)
- ▨ Inundation Extent

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Tummaville
10 Year ARI Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_10Y_H_Tum.mxd
Date Saved: 11/04/2014



TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

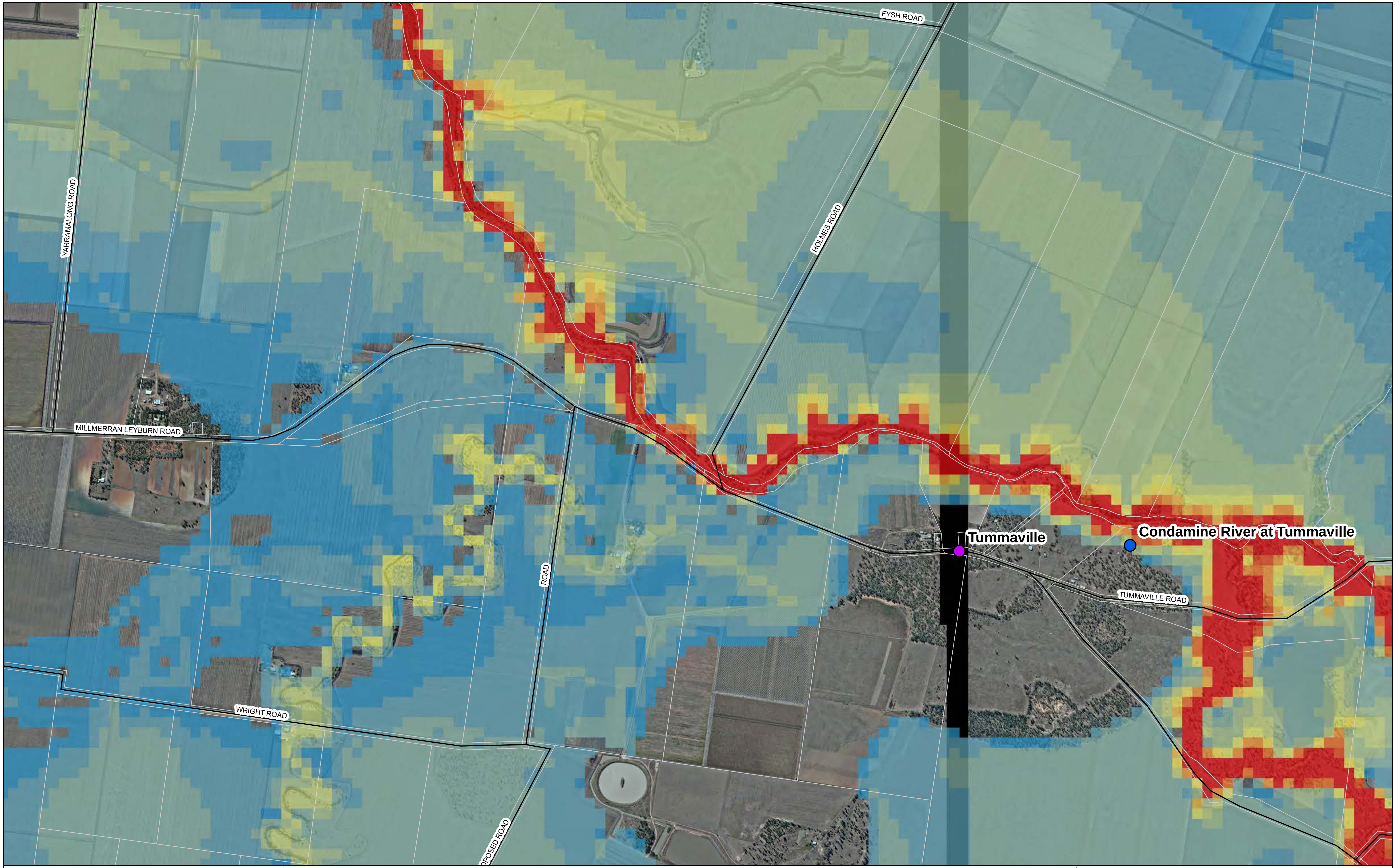
Legend

● Town Centre	Cadastre	**Hazard Categories**	🟨 High
● Streamflow Gauge	— Road Centreline	🟦 Low	🟥 Extreme
✚ Emergency Locations	┼ Rail Centreline	🟩 Significant	

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Pampas
10 Year ARI Event Peak Hazard

I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\CON_V08_E_10Y_Haz_Pam.mxd
Date Saved: 16/06/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500

Metres

GDA 1994 MGA Zone 56

N

Legend

- ● Town Centre
- ● Streamflow Gauge
- ☐ Cadastre
- — Road Centreline

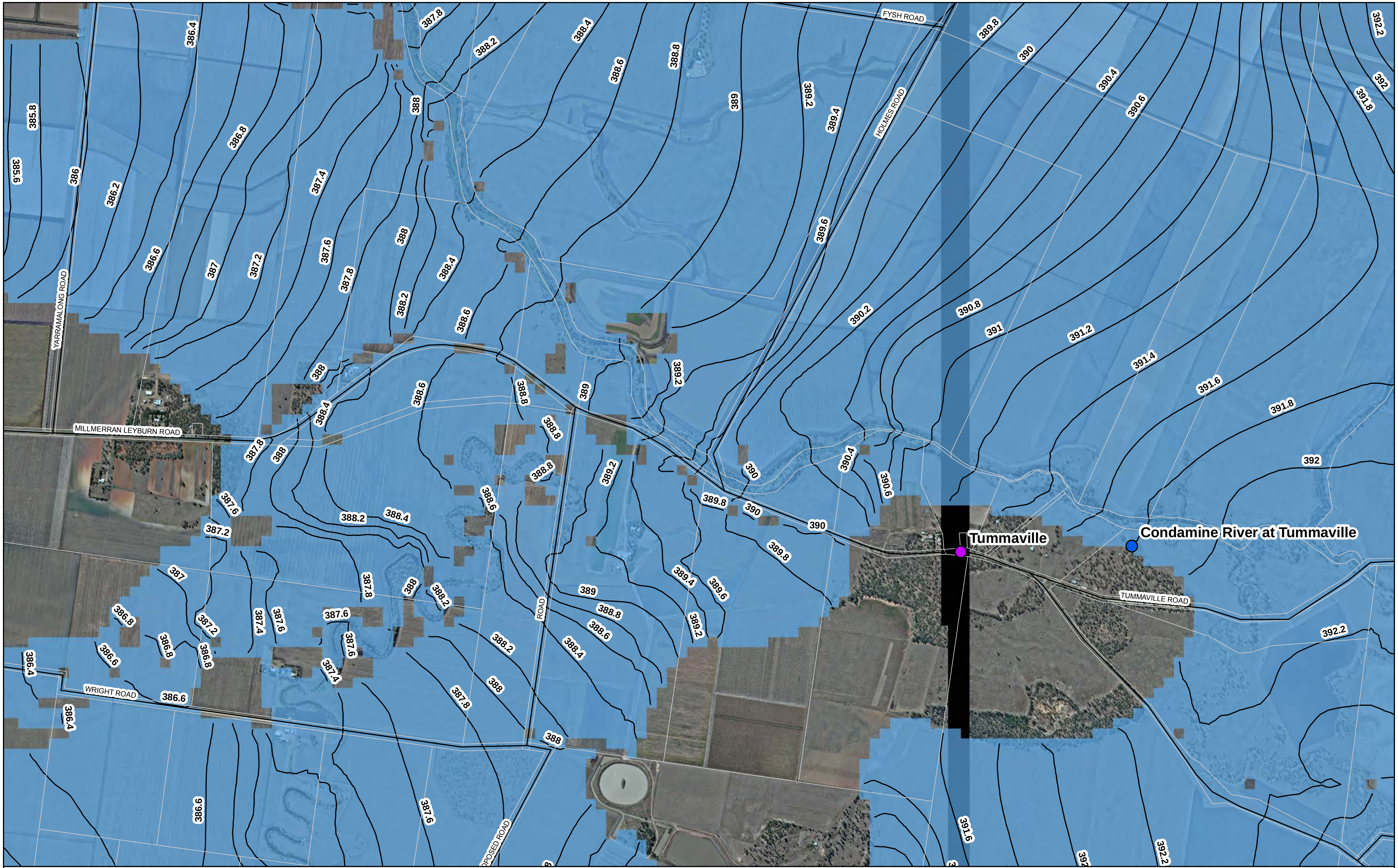
Peak Depth (m)

- ▨ < 0.1
- ▨ 0.1- 0.25
- ▨ 0.25 - 0.5
- ▨ 0.5 - 1.0
- ▨ 1.0 - 1.5
- ▨ 1.5 - 2.0
- ▨ 2.0 - 2.5
- ▨ 2.5 - 3.0
- ▨ 3.0 - 3.5
- ▨ 3.5 - 4.0
- ▨ 4.0 - 4.5
- ▨ 4.5 - 5.0
- ▨ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Tummaville
20 Year ARI Event Peak Depth

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_20Y_D_Tum.mxd
Date Saved: 11/04/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

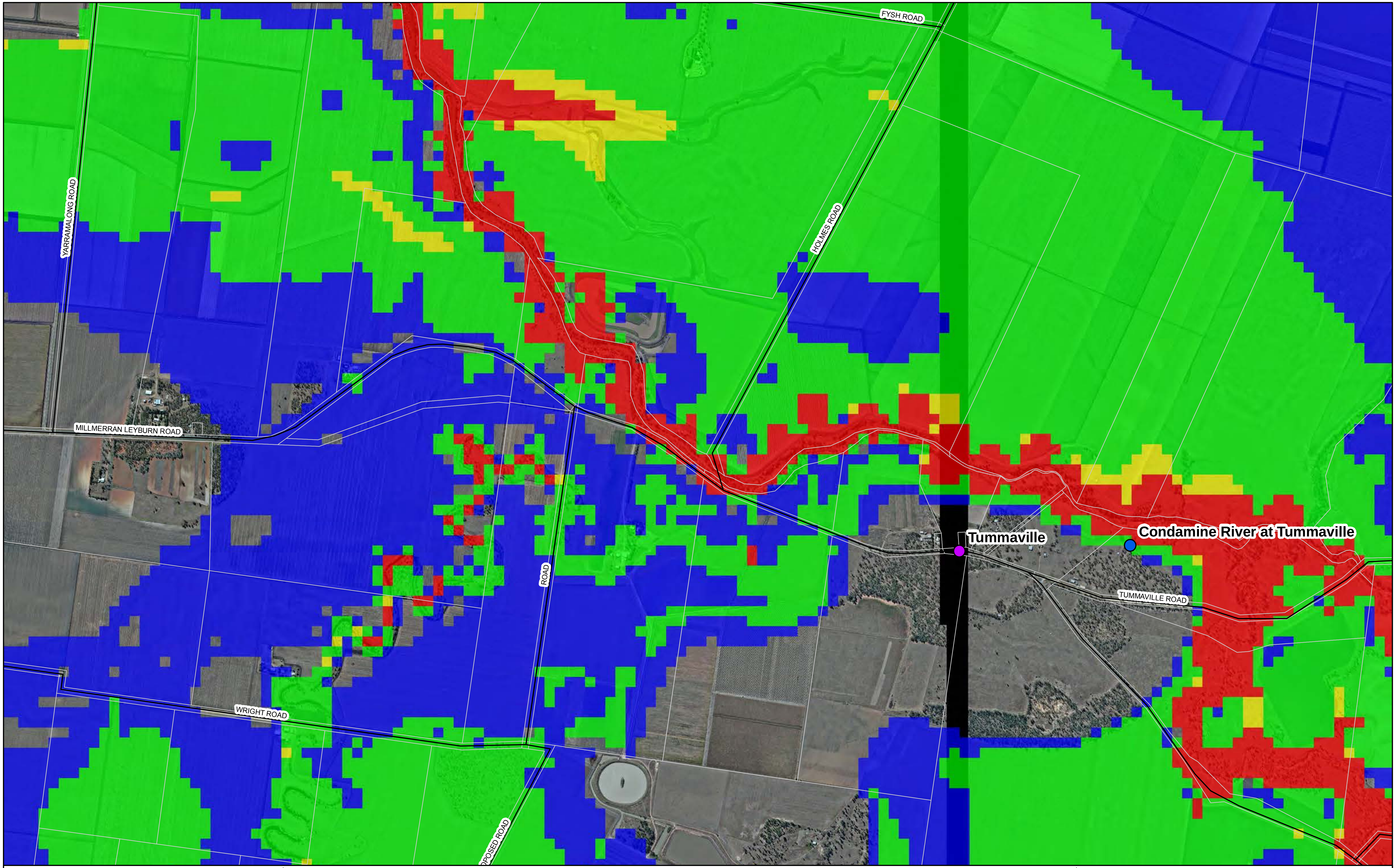
N

Legend

● Town Centre
● Streamflow Gauge
☐ Cadastre
— Road Centreline
— Water Level Contours (mAHD)
▨ Inundation Extent

SP 051 Flood Studies
Work Package 7 - Tummaville
20 Year ARI Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_20Y_H_Tum.mxd
Date Saved: 11/04/2014



TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

● Town Centre
● Streamflow Gauge
☐ Cadastre
— Road Centreline

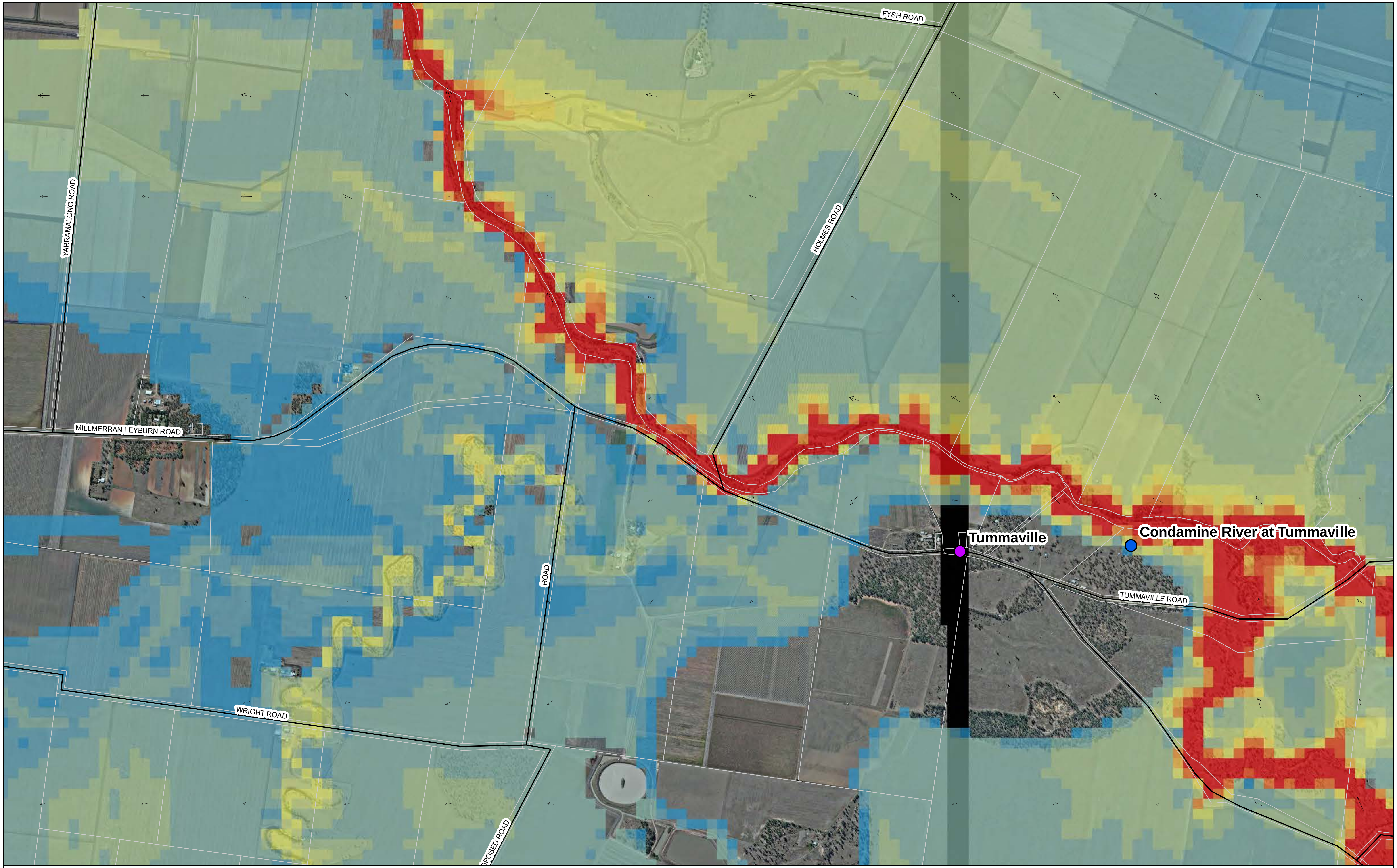
Hazard Categories

🟦 Low
🟩 Significant
🟨 High
🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Tummaville
20 Year ARI Event Peak Hazard

I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\CON_V08_E_20Y_Haz_Tum.mxd
Date Saved: 16/06/2014



TOOWOOMBA
REGIONAL
COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

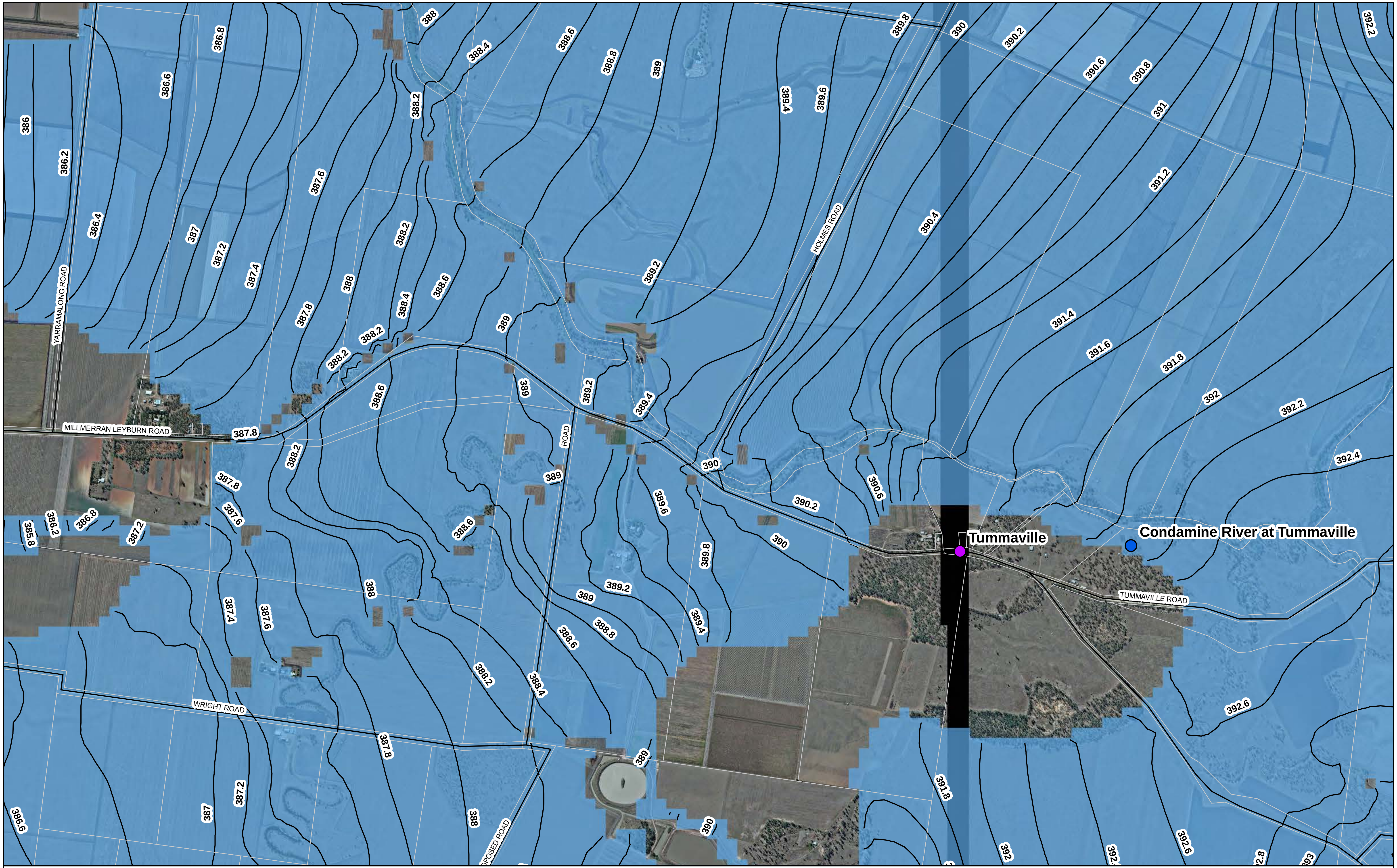
- ● Town Centre
- ● Streamflow Gauge
- ☐ Cadastre
- — Road Centreline
- ↑ Velocity Vectors

Peak Depth (m)

- ▨ < 0.1
- ▨ 0.1- 0.25
- ▨ 0.25 - 0.5
- ▨ 0.5 - 1.0
- ▨ 1.0 - 1.5
- ▨ 1.5 - 2.0
- ▨ 2.0 - 2.5
- ▨ 2.5 - 3.0
- ▨ 3.0 - 3.5
- ▨ 3.5 - 4.0
- ▨ 4.0 - 4.5
- ▨ 4.5 - 5.0
- ▨ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Tummaville
100 Year ARI Event Peak Depth



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

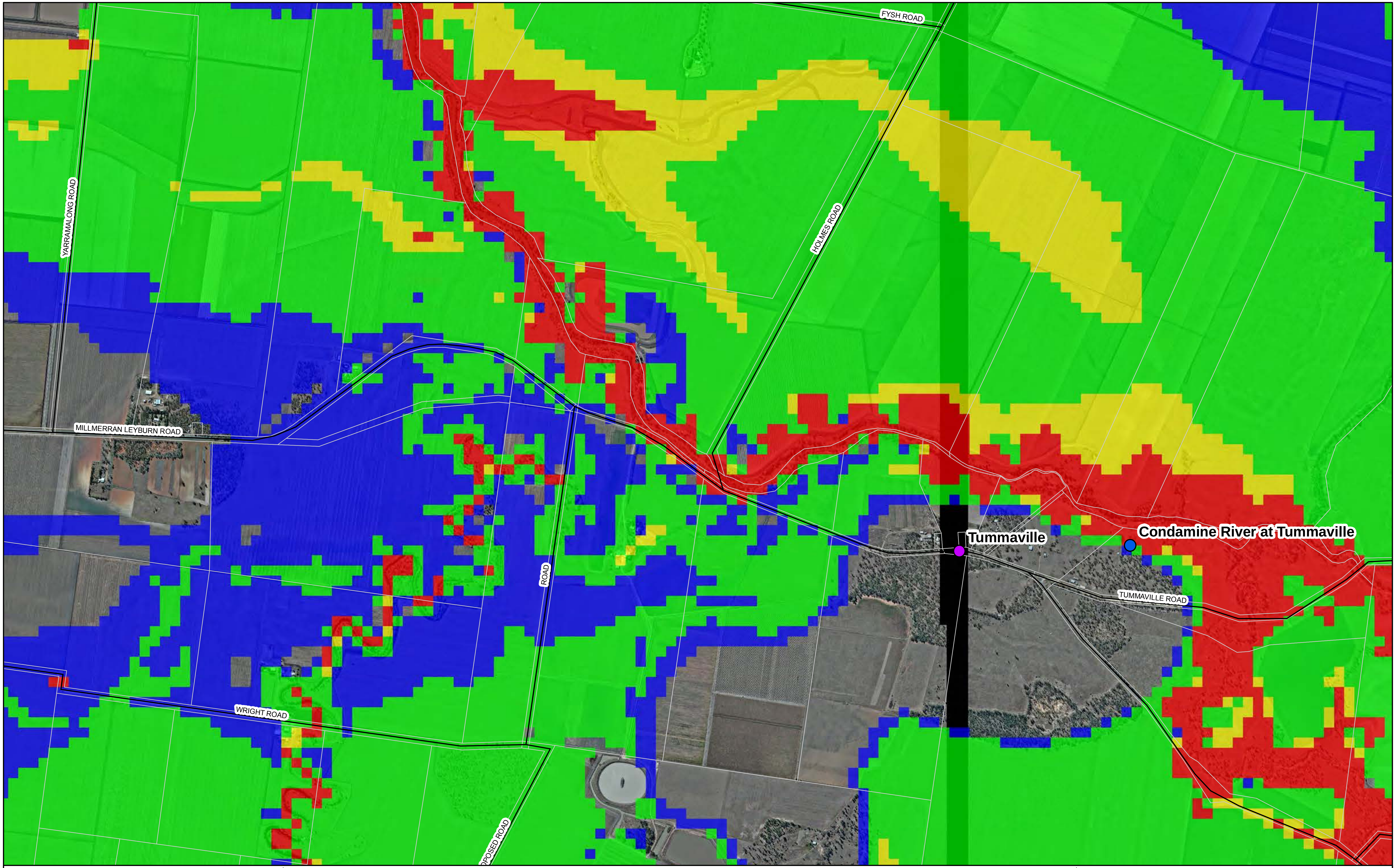
N

Legend

- ● Town Centre
- ● Streamflow Gauge
- ☐ Cadastre
- — Road Centreline
- — Water Level Contours (mAHD)
- ▨ Inundation Extent

SP 051 Flood Studies
Work Package 7 - Tummaville
100 Year ARI Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_100Y_H_Tum.mxd
Date Saved: 11/04/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

- ● Town Centre
- ● Streamflow Gauge
- ☐ Cadastre
- — Road Centreline

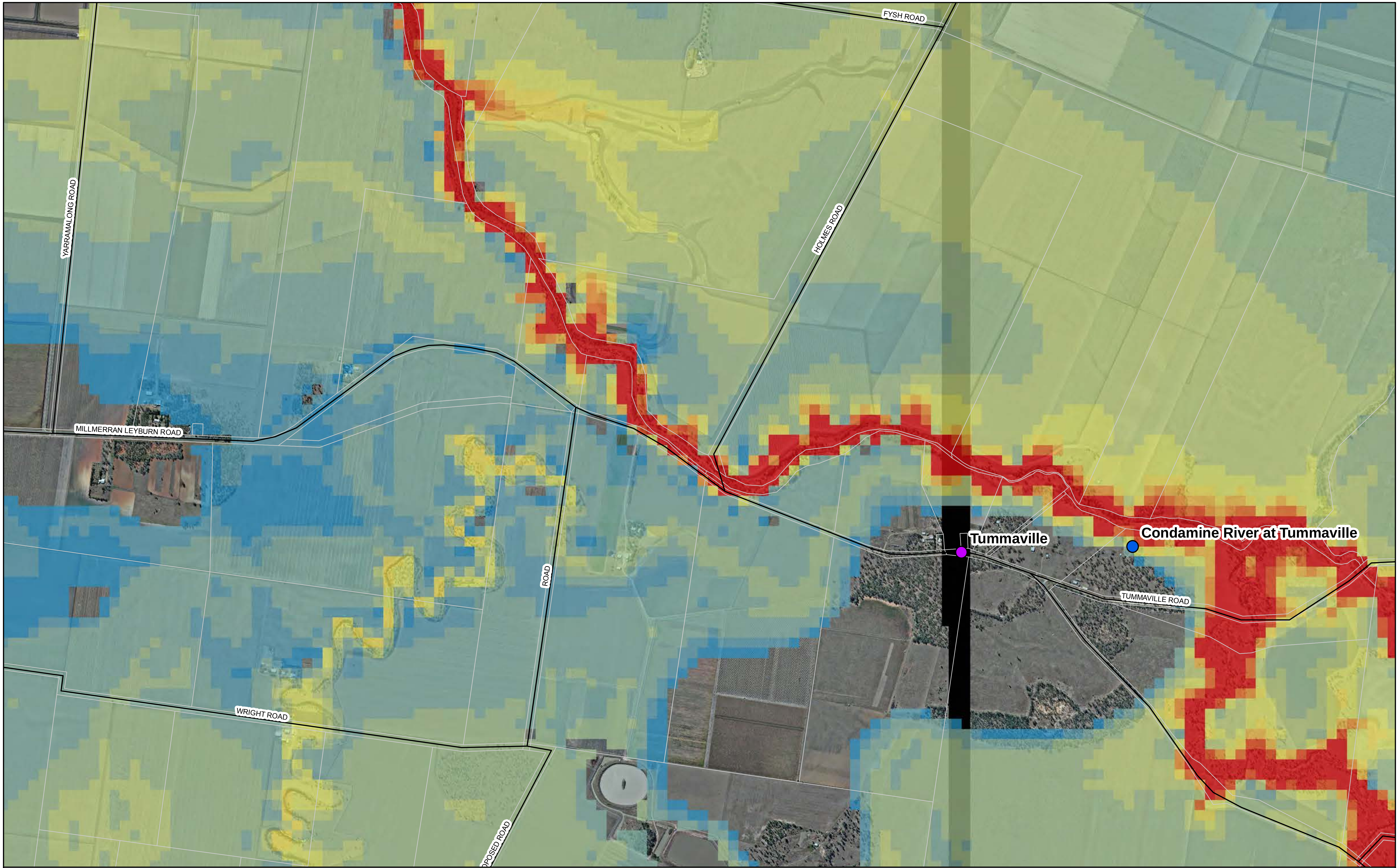
Hazard Categories

- 🟦 Low
- 🟩 Significant
- 🟨 High
- 🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Tummaville
100 Year ARI Event Peak Hazard

I:\QENV2\Projects\QE06787\Deliverables\Work Package 7\GIS\MXD\CON_V08_E_100Y_Haz_Tum.mxd
Date Saved: 16/06/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

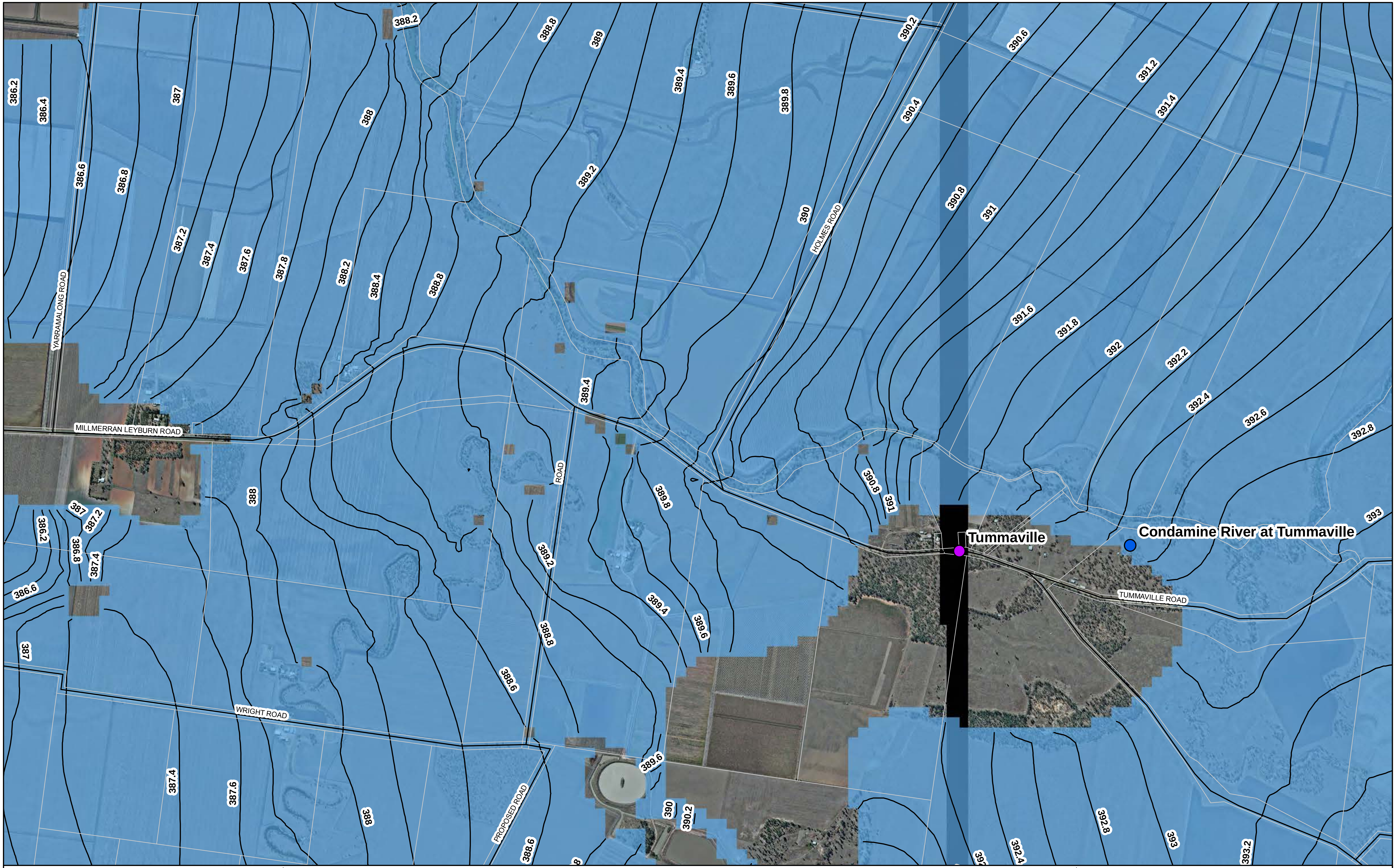
- ● Town Centre
- ● Streamflow Gauge
- ☐ Cadastre
- — Road Centreline

Peak Depth (m)

- ▨ < 0.1
- ▨ 0.1- 0.25
- ▨ 0.25 - 0.5
- ▨ 0.5 - 1.0
- ▨ 1.0 - 1.5
- ▨ 1.5 - 2.0
- ▨ 2.0 - 2.5
- ▨ 2.5 - 3.0
- ▨ 3.0 - 3.5
- ▨ 3.5 - 4.0
- ▨ 4.0 - 4.5
- ▨ 4.5 - 5.0
- ▨ > 5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Tummaville
500 Year ARI Event Peak Depth



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500

Metres

GDA 1994 MGA Zone 56

N

Legend

● Town Centre

● Streamflow Gauge

▭ Cadastre

— Road Centreline

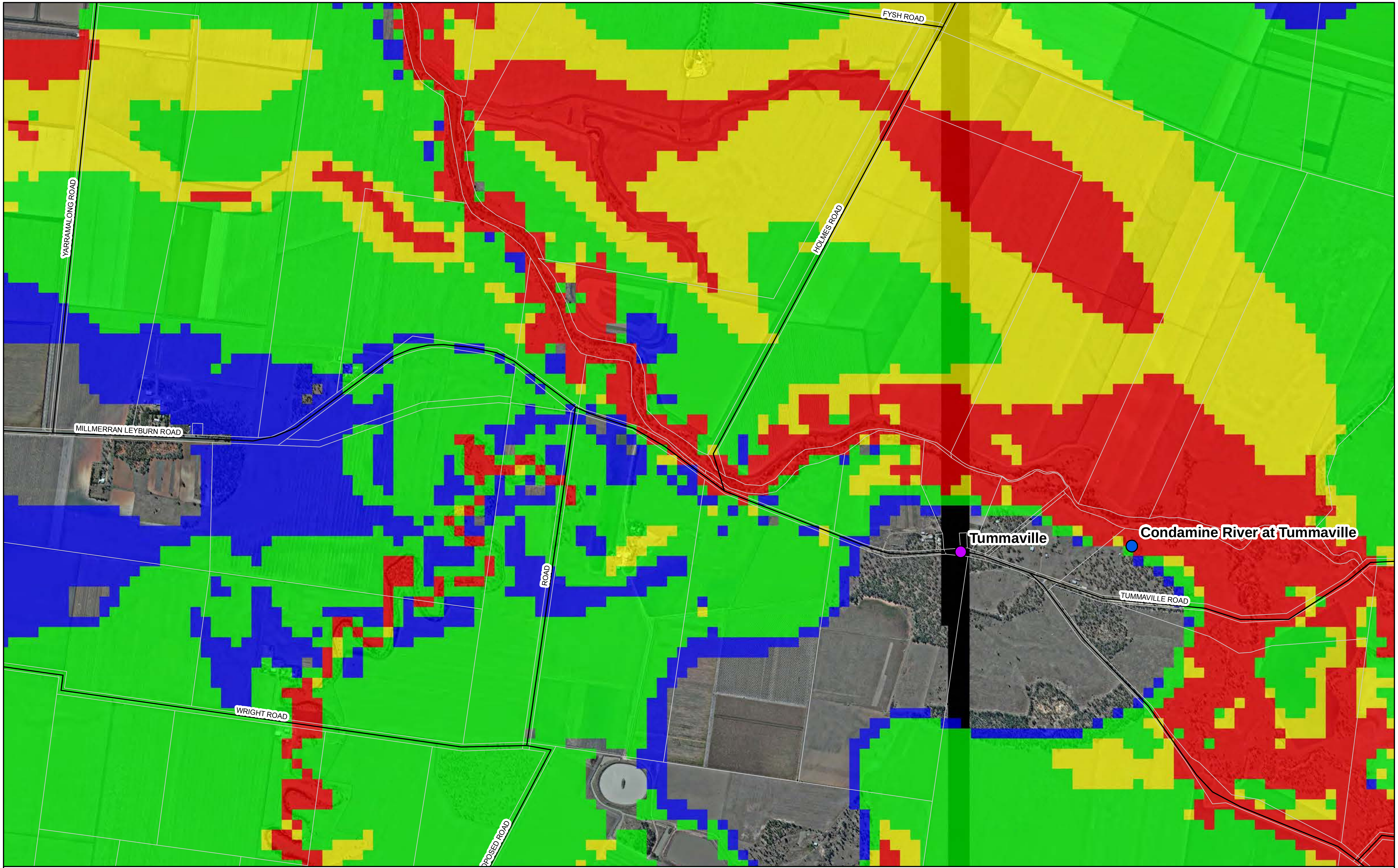
— Water Level Contours (mAHD)

▨ Inundation Extent

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Tummaville
500 Year ARI Event Peak Water Level

I:\QENV2\Projects\QE06787\Spatial\ArcGIS\Figures\Pk7\MXD\CON_V08_E_500Y_H_Tum.mxd
Date Saved: 11/04/2014



TOOWOOMBA REGIONAL COUNCIL

1:20,000 (at A3)

0 125 250 500
Metres

GDA 1994 MGA Zone 56

N

Legend

- ● Town Centre
- ● Streamflow Gauge
- ☐ Cadastre
- — Road Centreline

Hazard Categories

- 🟦 Low
- 🟩 Significant
- 🟨 High
- 🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP 051 Flood Studies
Work Package 7 - Tummaville
500 Year ARI Event Peak Hazard

Flood Studies

TOOWOOMBA REGION
Rich traditions. Bold ambitions.

Addendum 1 – Updated 2D Hydraulic Modelling to include LiDAR and Flexible Mesh GPU Approach

November 2015 • *Endorsed on 15 December 2015*

PROJECT DETAILS

Report Title	Addendum 1 Updated 2D Hydraulic Modelling to include LiDAR and Flexible Mesh GPU Approach
Client	Toowoomba Regional Council
WMS Project Manager	Blake Boulton
Job Number	10026
Document Name	10026-R03

DOCUMENT STATUS

Revision Number	Doc Type	Report Author	Reviewer	Distributed to	Report Date
01	Draft	DK/MB	BB	TRC	16/11/2015
02	Final	DK/MB	BB	TRC	24/11/2015
03	Revised Final	DK/MB	BB	TRC	2/12/2015

COPYRIGHT AND NON-DISCLOSURE NOTICE

The sole purpose of this report and the associated services performed by WMS is to provide the information required in accordance with the scope of services set out in the contract between WMS and the Client. That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of data and other relevant information.

In preparing this report, WMS has assumed that all data, reports and any other information provided to us by the Client, on behalf of the Client, or by third parties is complete and accurate, unless stated otherwise.

Executive Summary

Toowoomba Regional Council (TRC) has appointed Water Modelling Solutions Pty Ltd (WMS) to carry out hydraulic investigations of flooding in the Upper Condamine River catchment. The hydraulic modelling was undertaken using a coupled 1D/2D MIKE FLOOD Flexible Mesh model.

The majority of the data for the construction of the hydraulic model was derived from a 1 m LiDAR Digital Elevation Model (DEM) provided by TRC. A site visit was undertaken on June 28-29, 2015. The purpose of the site visit was to allow the project team to identify key features within the catchment, survey structures with potential significant hydraulic impact and gain a general feel for the floodplain.

The validation data consisted of recorded peak flood levels at several locations, hydrographs at two gauges on the Condamine River as well as locations of known flooding and observed flood extents during the December 2010/January 2011 flood event.

A coupled 1D/2D MIKE FLOOD FM hydraulic model has been successfully developed and validated for the Upper Condamine River catchment. The validation results were demonstrated graphically and locations of known flooding and the observed flood extents were reproduced by the hydraulic model. The fit between modelled and observed peak water levels at the two gauges was reasonable at one gauge and very good at the other gauge; however, a significant difference in the timing of the peaks has been observed with the model hydrographs peaking at least 10 hours too late. This difference is believed to be a result of lack of joint calibration of the hydrological and hydraulic models, which was not part of the scope of this study.

The model is believed to be appropriately validated to inform future Planning Scheme amendments; however, it is recommended to undertake a joint calibration of the hydrologic and hydraulic models for at least two historical flood events to improve the model accuracy.

The validated MIKE FLOOD FM model was used to estimate design peak flood surface elevations, peak water depths, hazard and hydraulic categories for the 10, 20, 100 and 500 year ARI design events.

Comprehensive mapping is included in Appendix C to Appendix F of this report. Digital mapping, GIS files and model setups and results were also delivered as part of the study.

Contents

Table Index

Figure Index

Appendices

1 Introduction

1.1 BACKGROUND

Toowoomba Regional Council (TRC) is a large local government area located in the Darling Downs part of Queensland, Australia. TRC comprises an area of nearly 13,000 km^2 with a population of approximately 172,000 people in 33 towns. In 2009 TRC commenced the Toowoomba Regional Planning Project (RPP) to develop one integrated planning scheme policy covering the entire Council area.

In 2012 the State Government approved Council adopting the Toowoomba Regional Planning Scheme with a set of conditions to be met to ensure the scheme was compliant with nominated State Planning Policies. To meet the conditions established by the State Government, a scoping study was completed by Council to identify the information required to meet the specified conditions. The study highlighted the need to investigate the flood behaviour and flood risk in several towns in the region.

In 2013, SKM (now Jacobs) was commissioned by TRC to undertake a 2D flood study for the Upper Condamine River catchment. The 2D flood study included historical and design event modelling and was based on an URBS hydrological model and a broad-scale flood model developed by SKM in 2003. The hydraulic model utilised a 60 m grid due to lack of LiDAR (light detection and ranging survey) information. As part of the 2013 Upper Condamine River flood study, SKM also developed a small model surrounding Cecil Plains. The Cecil Plains model was based on a 10 m grid resolution as LiDAR was available for the township.

Since the completion of the Upper Condamine River flood study by SKM in 2014, LiDAR data covering the majority of the modelled area has been acquired. A community consultation program was also held in several locations across the TRC region throughout March 2015. This consultation provided opportunities for the community to view flood maps and other materials and provide local flood knowledge to input into the models. As part of the community consultation, information on observed flood extents during the December 2010/January 2011 flood event was collected around the township of Ellangowan, which is located approximately 5 km upstream of the SKM model extent.

In July 2015, Water Modelling Solutions (WMS) was commissioned by TRC to build a new hydraulic model of the Upper Condamine River catchment using the recently acquired LiDAR data and extending the model domain to include the township of Ellangowan.

This report describes the methodology, available data and development of a hydraulic model for historical and design event simulations for the Upper Condamine River catchment. It should be noted that updating the hydrological URBS model or undertaking a joint calibration of the hydrologic and hydraulic models was not part of the scope of this study. This report is an addendum to the "*2D Flood Study for areas within the Upper Condamine River Floodplain. Broad-Scale Hydraulic Model Study Area including Cecil Plains*" report by SKM (2014). The report ends with concluding remarks and recommendations to further improve the model accuracy.

1.2 SCOPE OF PROJECT

The objective of this project was to build a 1D/2D coupled MIKE FLOOD Flexible Mesh model to define the nature and extent of flood behaviour in the Upper Condamine River catchment and enable TRC to:

- Target future studies/investigations; and

- Inform the risk assessment, subsequent investigation of policy options and future Planning Scheme amendments.

The project was divided into a number of phases. The scope of each phase is briefly outlined below.

Data Collation and Review

- Site visit; and
- Collection and review of available data.

Model Development, Validation and Design Event Modelling

- Development of a 1D/2D coupled MIKE FLOOD FM hydraulic model using available LiDAR data;
- Adjustment of parameters to ensure model stability;
- Running the model for the December 2010/January 2011 flood event; and
- Running the model for the 10 year, 20 year, 100 year and 500 year ARI design events.

Deliverables

- Report detailing methodology and results including A3 flood maps for the modelled events; and
- Handover of model setup, result and GIS files for all modelled events.

1.3 STUDY AREA

The study area is shown in Figure 1-1. The main waterways within the study area are the Condamine River and the Condamine River (North Branch). Land use within the study area is primarily rural, with small developed areas within townships.

The extents of the Upper Condamine River and Cecil Plains models developed by SKM in 2014 are shown in Figure 1-1 as pink and yellow polygons, respectively. These models will in the following be referred to as V01 models. The extent of the hydraulic model developed as part of this study is shown as a black polygon. This model will be referred to as the V02 model in the following.

The V02 model domain has been extended upstream of Ellangowan to enable the use of historical flood data in the vicinity of the township for model validation.

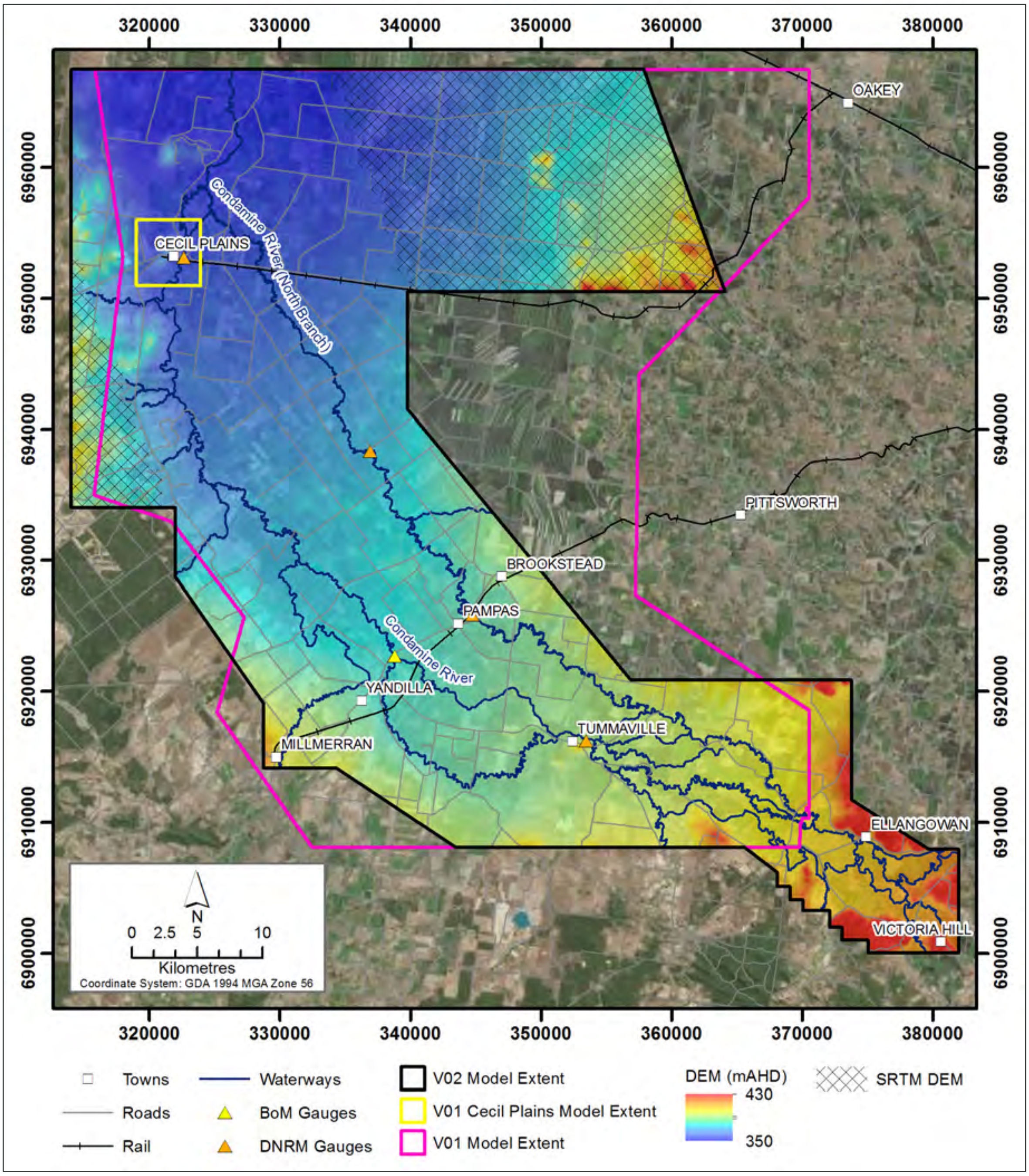


Figure 1-1 Study Area

2 Available Data

2.1 TOPOGRAPIC DATA

Tiles of 1 m LiDAR-derived gridded topographic data were provided by TRC. The 1 m tiles were merged and resampled to a 5 m Digital Elevation Model (DEM) of the study area. As LiDAR data did not cover the entire study area (see Figure 1-1), it was supplemented with a SRTM derived 1-second DEM dataset from Geoscience Australia.

2.2 GIS LAYERS

The available GIS layers provided by TRC included:

- Aerial photography;
- Cadastral data;
- Road and rail network;
- Land use data;
- Locations of emergency services; and
- Geodatabases containing all GIS information from the SKM study.

2.3 SITE VISIT

A site visit was undertaken on June 28th and 29th, 2015. The purpose of the site visit was to allow the project team to identify key hydraulic structures within the catchment and to gain a general feel for the floodplain. A total of 32 structures with potential significant hydraulic impact were identified. Their location and approximate structure dimensions were recorded for implementation within the model. A map of the structure locations and the structure details are presented in Appendix A.

2.4 HISTORICAL FLOOD INFORMATION

2.4.1 December 2010/January 2011 Flood Event

Available recorded historical flood information for the 2010/2011 event was supplied by TRC. The available historical flood information is listed in Table 2-1 and consisted of twenty spot flood levels, gauged levels at five gauges owned by the Department of Natural Resources and Mines (DNRM) and the Bureau of Meteorology (BoM), two water level hydrographs and one flow hydrograph at two DNRM gauges, three locations of known flooding and two flood lines showing the observed flood extent. The flood lines are based on sketches provided by residents as part of community consultation. The locations of known flooding are based on flood photographs also provided by the public during community consultation, see Appendix B. Out of the twenty spot flood levels provided, twelve were obtained during community consultation conducted after the original study by SKM. The community consultation process provided additional flood marks at Cecil Plains (1 flood mark), Pampas (7 flood marks) and Tummaville (4 flood marks). Model validation to the 2010/2011 event is presented and discussed in Section 4.

Table 2-1 Summary of Available Historical Data for December 2010 Event

Data Type	Source
Peak flood levels	TRC
Flood lines	TRC (Community Consultation)
Locations of known flooding	TRC (Community Consultation)
Peak levels at gauges	BoM and DNRM
Water level and discharge hydrographs at gauge 422316A at Cecil Weir	DNRM
Water level hydrograph at gauge 422323A at Tummaville	DNRM

2.4.2 February 1976 Flood Event

The V01 hydraulic model was also validated to the February 1976 flood event. However, the URBS model was maintained in its existing form (2003 version) for the validation of the model to the 1976 event, see the SKM flood study report (SKM, 2014) for more information. Due to the fact that some of the source point inflows changed as a result of the extension of the V02 model domain upstream of Ellangowan (see Section 3.2.5), the V02 model could not be validated to the 1976 flood event.

All available validation data is presented in Section 4. Please note that TRC has collected flood data for this study from a variety of sources including debris marks, flood marks visible and accessible at the time of survey after the 2010/2011 flood, eyewitness accounts, community consultation, etc. It is possible that some the flood data available to TRC may not be accurate or complete.

Information used is the best information available at this time for the purposes of this study. Marks observed and other anecdotal information obtained after flood events have been obtained from a range of sources and have varying degrees of uncertainty.

3 Hydrodynamic Model Development

3.1 OVERVIEW

The following section documents the development of the hydrodynamic model, selection of key model parameters and assumptions made. The hydrodynamic model was developed in MIKE FLOOD FM 2014 SP3, which was the most recent version available at the time of the project.

The use of a flexible mesh approach allows for optimal usage of mesh elements where relevant, e.g. fine elements can be used to represent narrower creeks and important features as roads and railway lines, while larger elements can be used to represent the floodplain. The flexible mesh approach also allows the user to take advantage of the latest technology advances in flood modelling involving the use of graphical processing units (GPUs) to significantly speed up simulations.

3.2 MIKE 21 FM MODEL

The 2D Condamine model domain is shown in Figure 1-1 and extends from approximately 10 km south of Ellangowan to approximately 14 km north of Cecil Plains. The majority of the model domain is limited by available LiDAR. The hatched areas in Figure 1-1 show areas where LiDAR information is unavailable and had to be supplemented with SRTM data. The V02 model domain has an area of approximately 2,230 km^2. The modelled reach of the Condamine River is approximately 170 km long.

3.2.1 Flexible Mesh Development

The flexible triangular mesh contains approximately 2.8 million elements. The mesh was refined around key features within the model domain. These features included:

- Waterway banks;
- Tributary centrelines;
- Roads and railway lines;
- Dam and ring tanks; and
- Bridge and culvert crossings.

The mesh refinement is illustrated in Figure 3-1. The mesh has also been refined around several townships. The maximum element size is 100 m^2 within the Cecil Plains area, which corresponds to the resolution of the V01 Cecil Plains 10 m grid model.

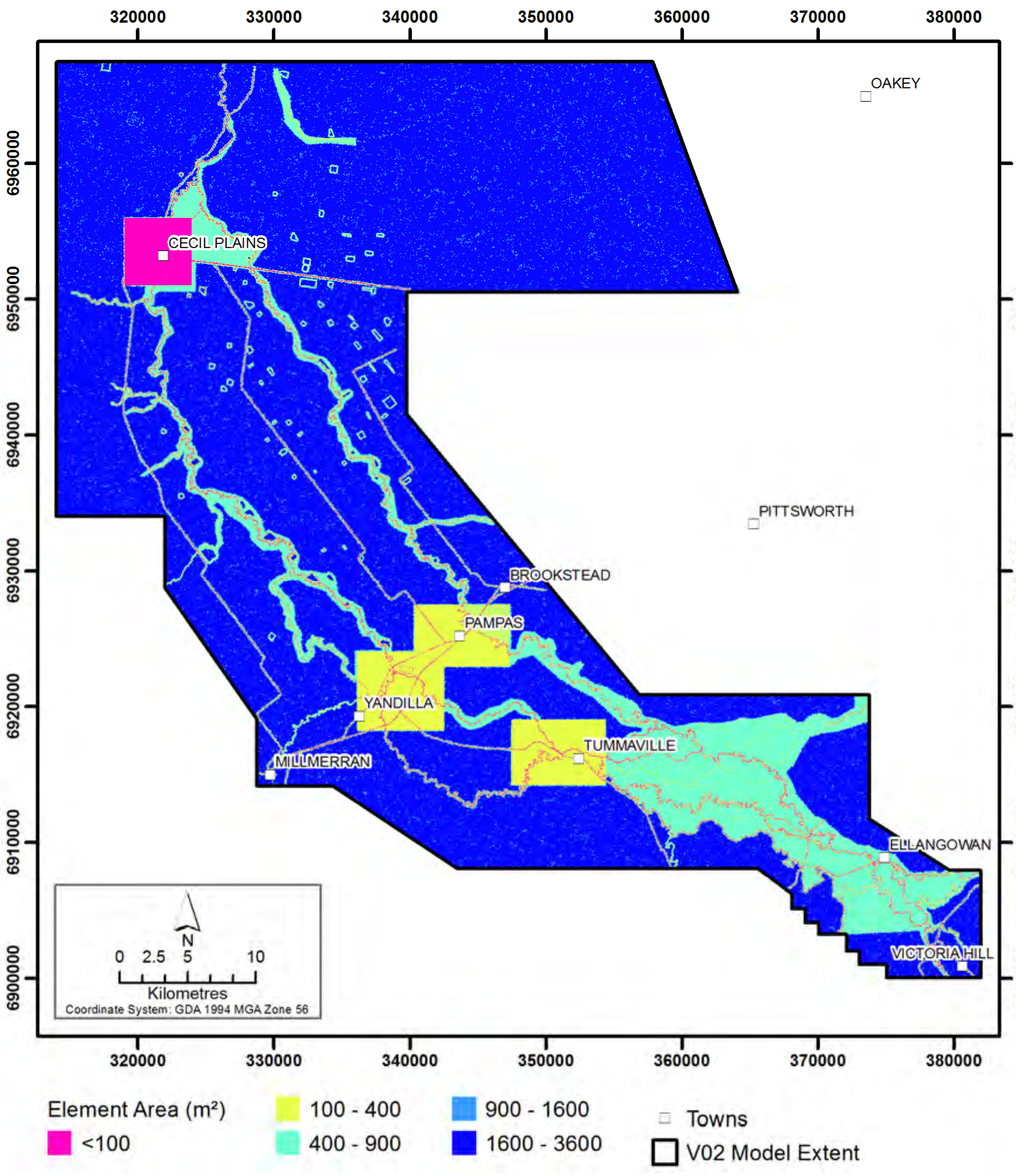


Figure 3-1 Model Mesh Resolution

A xyz scatter dataset was developed from the 5 m DEM and supplied with 30 m SRTM data where necessary. This dataset was cropped to the V02 model extent and interpolated onto the mesh. The mesh was subsequently saved as a bed level change file to enable running the MIKE FLOOD FM model with element-centred values.

A difference map between the V01 and V02 model bathymetries is shown in Appendix F. The map is based on both model bathymetries being interpolated onto a 10 m grid prior to calculating the difference.

3.2.2 Hydraulic Roughness

A spatially distributed roughness map for the model domain was created based on the road and river network as well as aerial imagery provided by TRC. The roughness map has a 10 m grid resolution. Six distinct land use classes were identified within the study area. The roughness values were selected by taking into account Australian Rainfall and Runoff (ARR) Revision Project's valid Manning's 'n' ranges for different land use types (Smith and Wasko, 2012). It should be noted that the adopted Manning's 'n' value for 'Developed Areas' is slightly lower than the ARR recommended range of roughness values for this land use type. This is due to the coarse delineation of 'Developed Areas' based on land use classes, resulting in a Manning's 'n' value of 0.083 being applied to buildings as well as some open pervious areas. The final adopted hydraulic roughness values for each class are shown in Table 3-1, with the spatial distribution of roughness presented in Figure 3-2.

Table 3-1 Adopted Land Use Classes and Roughness Values

Land Use Type	Manning's 'M'	Manning's 'n'	Range of Manning's 'n' Values[a]
Dams	50	0.020	0.02 – 0.04
Roads	40	0.025	0.02 – 0.03
Waterways	33	0.030	0.02 – 0.04
Floodplains	25	0.040	0.03 – 0.05
Dense Vegetation	14	0.071	0.07 – 0.12
Developed Areas	12	0.083	0.10 – 0.20

Notes: [a] Smith and Wasko (2012)

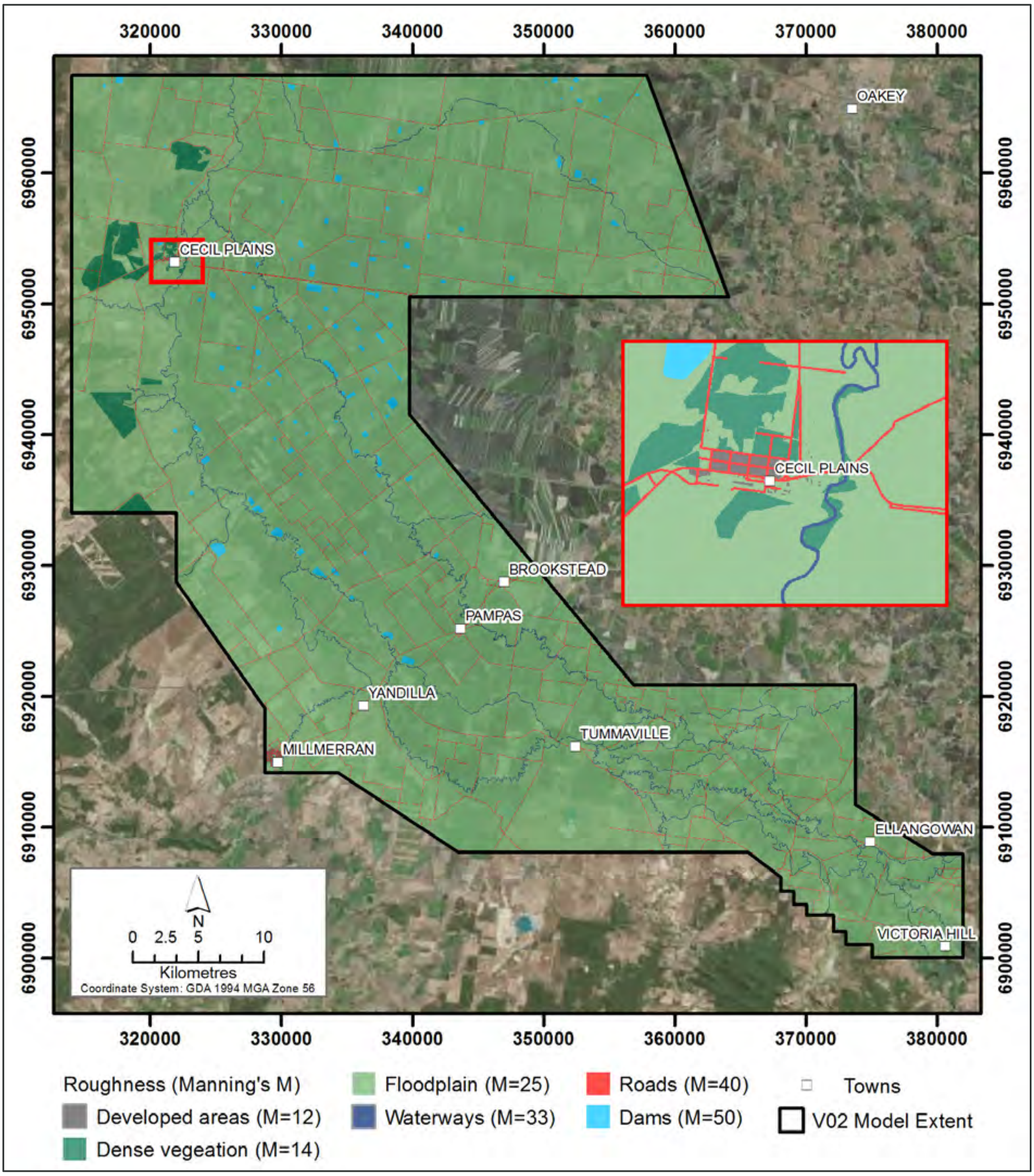


Figure 3-2 Spatial Distribution of Roughness

3.2.3 Flooding and Drying Depths

Continuity is fully preserved during the flooding and drying process, as the water depths at the points which are dried out are saved and then reused when the point becomes flooded again. A flooding depth of 0.05 m and a drying depth of 0.02 m were adopted in this study.

3.2.4 Eddy Viscosity

A constant Smagorinsky eddy viscosity of 0.5 m^2/s was adopted in this study.

3.2.5 Model Boundaries

Catchment flows from SKM's hydrological URBS model were applied to the MIKE 21FM model at one inflow boundary (Thane Creek) and nine internal boundaries (source points), see Figure 3-3. All source points were split across 10 mesh elements to avoid high velocities or 'jetting'. Due to the extension of the Condamine study area upstream of Ellangowan, flows at additional locations had to be extracted from the URBS model. As part of this study, Jacobs (previously SKM) reran the URBS model and provided flows at the additional locations. Jacobs provided time series of flows for the 2010/2011event and the 10 year, 20 year, 100 year and 500 year ARI events for the 'Kings Creek', 'Condamine River' and 'S2' source points as well as the 'Thane Creek' boundary. It was necessary to adjust the flow at 'S2' due to inflows applied upstream of this location. Flows at the remaining source points ('S1' and 'S3'-'S7') were adopted from the V01 model.

A constant water level of 338 mAHD was used at the downstream boundary. The model bathymetry along the downstream boundary was artificially lowered to avoid backwater effects on areas of interest to the study from assumptions made at the boundary location.

3.2.6 Initial Conditions

An initial water level map was used to ensure all model boundaries were wet at the commencement of the simulation.

3.2.7 Time Step and Save Step

MIKE 21 Flexible Mesh models run on an adaptive time step. The maximum time step was set to 10 seconds. The model ran using the higher order scheme, with a critical Courant-Friedrich-Lévy (CFL) number of 0.8. The 2D results were saved every 30 minutes.

3.3 MIKE 11 MODEL

3.3.1 Network and Structures

All 32 structures (15 culverts and 17 bridges) identified during the site visit (see Section 2.3) have been represented in the 1D model and linked to the 2D domain using approximate dimensions recorded during the site visit. Invert levels of structures and their waterway length were estimated from the 1 m DEM and aerial photography, respectively. Bridge or culvert headwall railing has not been considered in the structure definition, i.e. it was assumed no blockage of rails occurred during the validation flood event. The structure locations and photographs of the structures taken during the site visit are included in Appendix A.

3.3.2 Cross-Sections

The cross-sections defined at the upstream and downstream ends of each MIKE 11 branch were extracted from the 1 m DEM. Cross-sections upstream and downstream of structures were enlarged if they were smaller than the structure dimensions. This is necessary to ensure a realistic head loss across the structure.

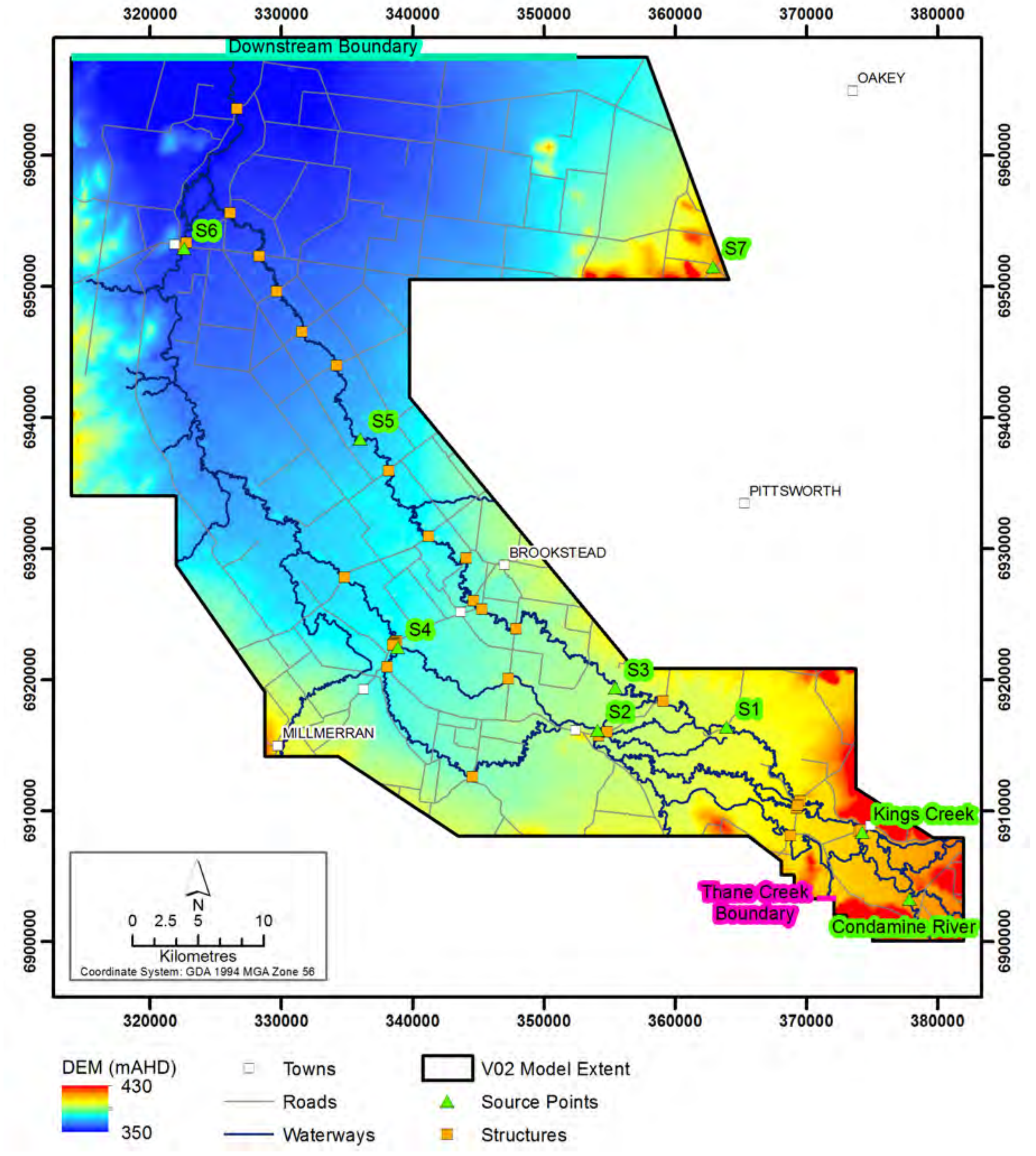


Figure 3-3 MIKE FLOOD Model Setup

3.4 MIKE FLOOD MODEL

3.4.1 Standard Link Options

A total of 64 coupling points were implemented in the MIKE FLOOD model. All structures were modelled using the 'standard' link type. In a standard link structure submergence and overtopping is modelled in MIKE 11 and MIKE 21, respectively.

The standard link parameters adopted in the MIKE FLOOD model are summarised in Table 3-2. The momentum factor was set to 1 at all links. Exponential smoothing factors of 0.1 and 0.2 were adopted.

Table 3-2 Adopted Standard Link Parameters

Parameter	Value/Option
Momentum factor	1
Depth Adjustment	Yes
Exponential Smoothing Factor	0.1 - 0.2

4 Assessment of Model Performance

The developed MIKE FLOOD FM model was validated to the December 2010/January 2011 flood event. Validation mapping is provided in Appendix C.

It should be noted that all maps included in Appendices C to E are based on 2D modelling results interpolated onto a 10 m grid with the same extent as the roughness map shown in Figure 3-2. The interpolation significantly reduces the time it takes to map the modelling results. If the results were not converted to raster format, each mesh element would be mapped as a triangular polygon in a polygon shapefile.

The interpolation means that there will be minor differences between the mapped results and the actual modelled results. However, due to the small grid cell size used for the interpolation (most elements are significantly larger than 100m^2) the difference is very small. The actual modelled and interpolated levels were compared at several locations and the difference was found to be less than 10 mm.

Modelled peak water levels and water level and discharge hydrographs presented in the following were extracted from the actual 2D modelling outputs and not the interpolated gridded results.

4.1 WATER LEVEL AND FLOW COMPARISON

A comparison of observed and modelled peak water levels is shown in Table 4-1. The locations of all validation points are shown on the maps presented in Appendix C. Appendix C contains a regional scale map of the entire study area as well as detailed flood maps for the townships of Cecil Plains, Pampas, Tummaville and Yandilla.

Where available, the difference between observed and modelled levels from the SKM V01 model are also shown in Table 4-1 for reference. It should be noted that the reported differences in Cecil Plains are based on the small Cecil Plains V01 model where URBS-generated hydrographs were applied directly as inflows into the model. Even considering the differences in flows applied, the V01 and V02 models result in similar peak water levels at Cecil Plains. The V02 modelled levels are generally lower than the V01 modelled levels, which is a result of the cumulative inflow hydrographs being approximately 15% smaller in the V02 model compared to the V01 model.

The model underestimates the observed peak water levels at the BoM and DNRM gauges by up to 1.83 m at the Lone Pine gauge. The poor match is most likely a result of the absence of inflow hydrographs on the North Condamine River reach at source points ‘S3’ and ‘S5’ (see Figure 3-3 for their location) for the 2010/2011 validation event. In all modelled design events, the hydrographs at ‘S3’ and ‘S5’ contribute a significant rate of flow. As an example, the peak flow rates at ‘S5’ are 439 m^3/s and 788 m^3/s for the 10 year and 100 year ARI events, respectively. This also explains why the flood extent along the North Condamine River is narrower for the validation event compared to the design flood events. While validation is less reliable along the North Condamine River, the result is not considered significant as there are no urban localities in the vicinity of S3 or S5. In addition, for the urban areas of Cecil Plains, Pampas, Tummaville and Yandilla a better validation is achieved. The design event contribution of source points ‘S3’ and ‘S5’ is approximately 10% of the total event and therefore has negligible influence for the Condamine River reach.

Table 4-1 Comparison of Observed, Gauged and Modelled Results

Location	Observed Level (mAHD)	Modelled Level (mAHD)	Difference (m)	Difference in SKM Study (m)
ID 192, Cecil Plains	354.09	353.69	-0.40	-0.29
ID 193, Cecil Plains	353.84	353.69	-0.15	-0.05
ID 194, Cecil Plains	355.97[a]	357.31	1.34	1.52
ID 195, Cecil Plains	356.68	356.71	0.03	0.10
ID 196, Cecil Plains	356.13[b]	357.03	0.90	0.75
ID 197, Cecil Plains	356.86	356.59	-0.27	-0.13
ID 198, Cecil Plains	356.30	356.45	0.15	0.18
ID 199, Cecil Plains	356.59	356.51	-0.08	-0.06
422316A – Condamine River at Cecil Weir (DNRM Gauge)	356.74	356.66	-0.08	-0.05
Horrane	357.61	357.75	0.14	NA[d]
422345A – North Condamine River at Lone Pine (DNRM Gauge)	371.46	369.63	-1.83	-1.96
Pampas	381.78	382.15	0.37	NA[d]
Pampas	382.44	382.15	-0.29	NA[d]
Pampas	382.21	382.33	0.12	NA[d]
Pampas	383.07	382.32	-0.75	NA[d]
Pampas	382.50	382.10	-0.40	NA[d]
Pampas	382.30	382.12	-0.18	NA[d]
Pampas	382.63	382.13	-0.50	NA[d]
422347B – North Condamine River at Pampas (DNRM Gauge)	382.59	382.35	-0.24	-0.41
422323A – Condamine River at Tummaville (DNRM Gauge)	392.07	391.64	-0.43	0.06
Tummaville	393.02	393.15	0.13	NA[d]
041472 – Centenary Bridge (BoM Gauge)	379.59	379.04	-0.55	-0.44
Toowoomba Karara Rd	405.53[c]	406.87	1.34	NA[d]
Toowoomba Karara Rd	406.86[c]	406.87	0.01	NA[d]
Toowoomba Karara Rd	406.09	406.63	0.54	NA[d]

[a] Ground level is 356.38 mAHD according to digital terrain model - observed level may be unreliable

[b] Ground level is 356.25 mAHD according to digital terrain model - observed level may be unreliable

[c] The two flood levels are located very close to each other - one or both levels may be unreliable

[d] 'NA' indicates the additional flood marks from the community consultation conducted after the original 2014 study by SKM

A comparison of the recorded and modelled water level hydrographs at gauge 422323A at Tummaville is shown in Figure 4-1. The V01 modelled hydrograph is also shown. The V02 model peak water level is lower than the observed peak water level and occurs 10 hours late.

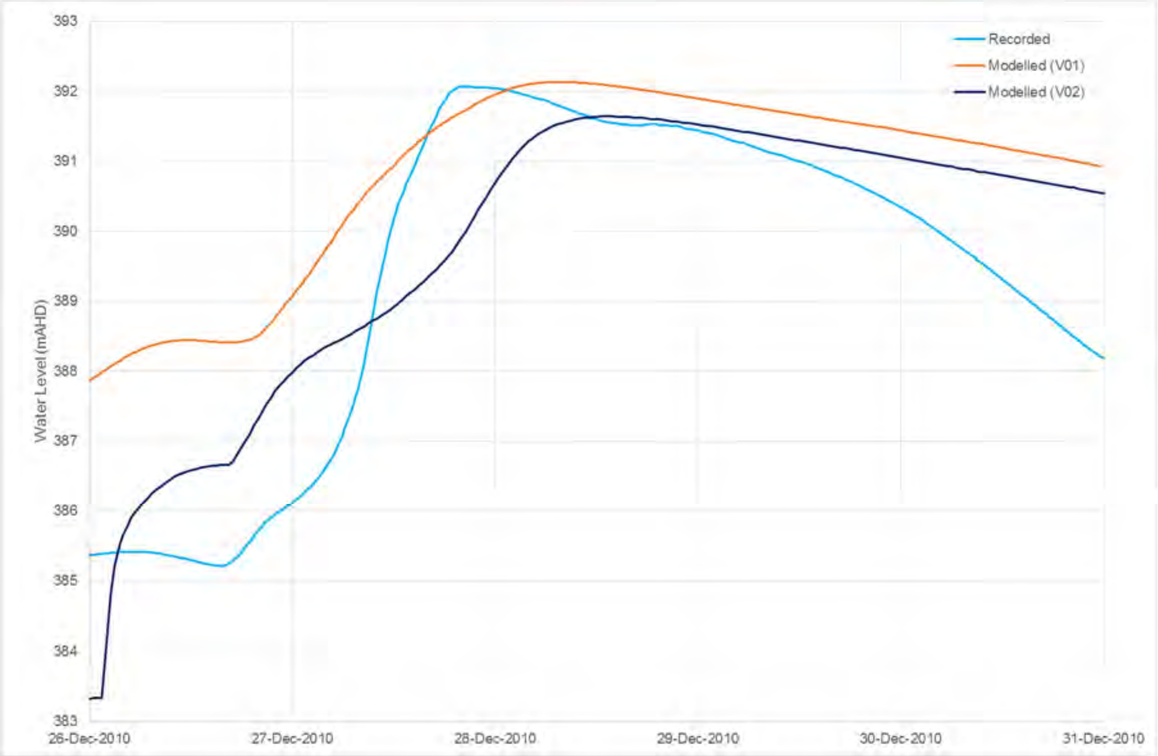


Figure 4-1 2010/2011 Flood Level Validation at Gauge 422323A at Tummaville

A comparison of the recorded and modelled water level and discharge hydrographs at gauge 422316A at Cecil Weir is shown in Figure 4-2 and Figure 4-3, respectively. The V02 model peak water level is only 0.08 m lower than the observed peak water level. The shape of the water level hydrograph is very similar to the observed hydrograph; but is shifted by approximately 15 hours at the peak. The match between modelled and observed peak discharges at the Cecil Weir is good, with the modelled peak flow being 11% higher and 6% lower than the observed peak flow of 2,047 m^3/s when extracting the modelled flows upstream and downstream of the weir, respectively.

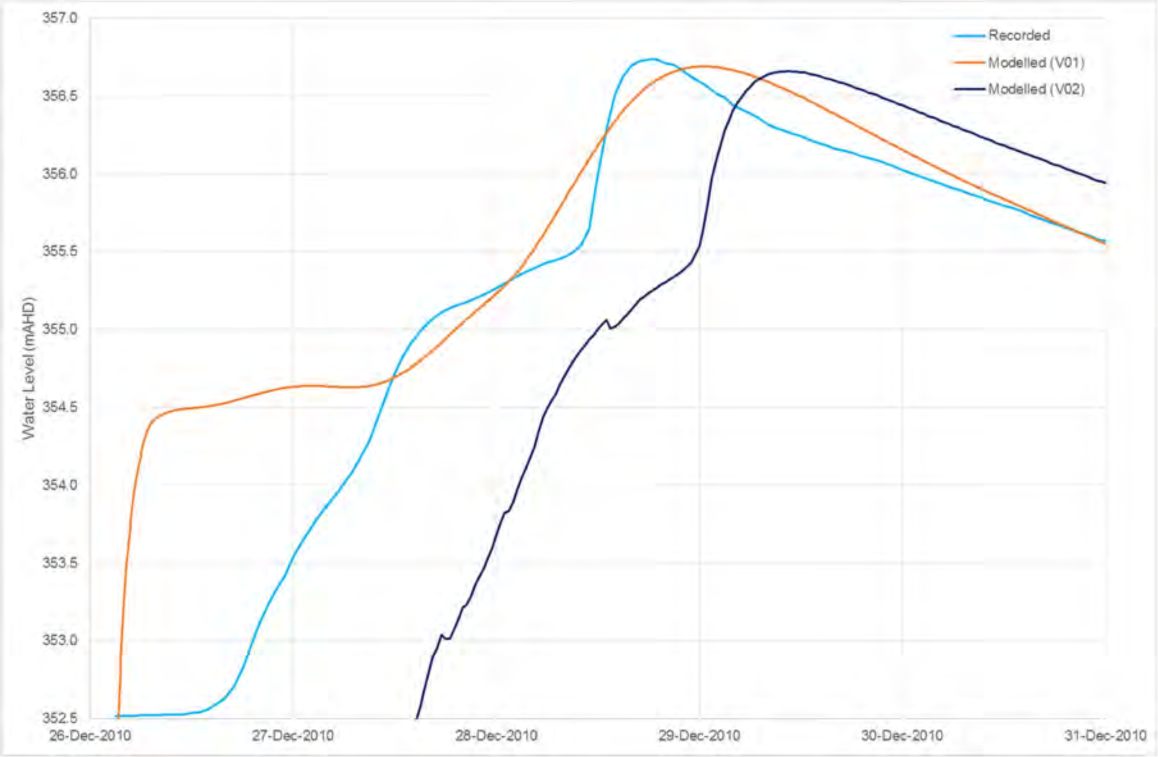


Figure 4-2 2010/2011 Flood Level Validation at Gauge 422316A at Cecil Weir

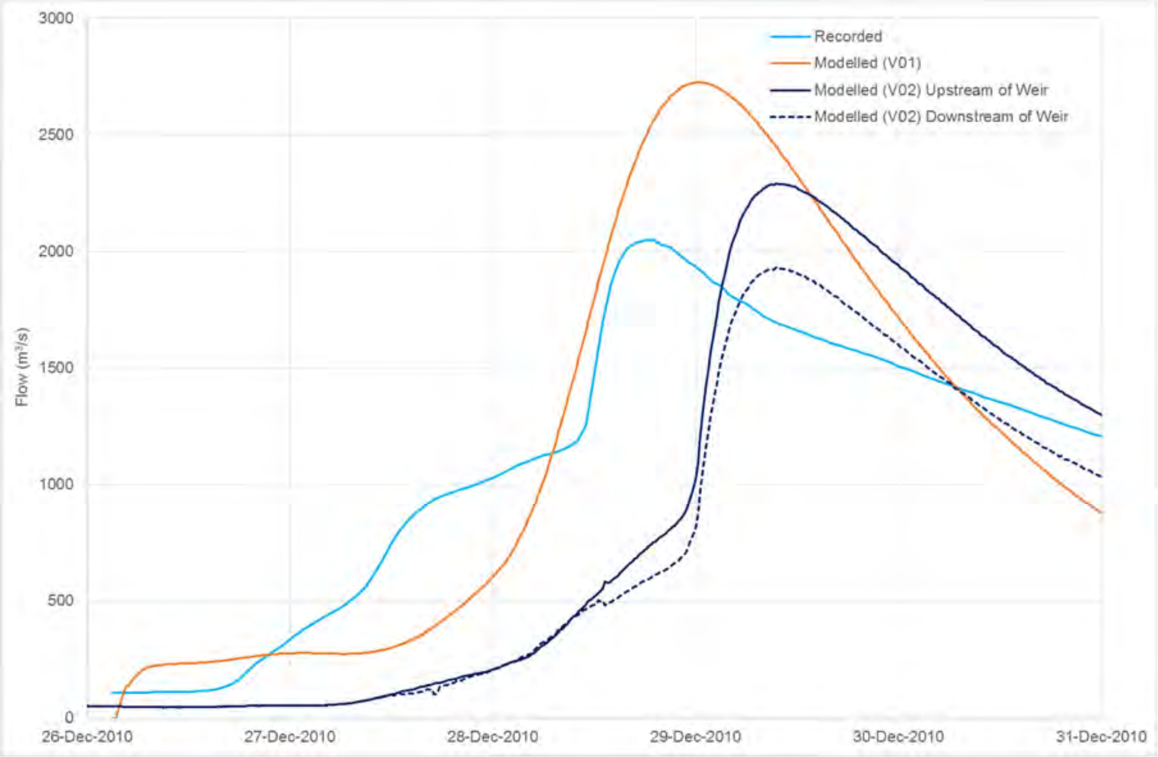


Figure 4-3 2010/2011 Flood Flow Validation at Gauge 422316A at Cecil Weir

The fact that the model is generally underestimating the peak water levels and that the modelled hydrographs peak 10 or more hours too late indicates that a joint calibration of the hydrologic and hydraulic models is required to achieve a good fit between modelled and observed hydrographs. Reducing the hydraulic roughness which is the main hydraulic model calibration parameter would shorten the peak travel time, however not by 10 hours. It would also further decrease the modelled water levels.

4.2 FLOOD EXTENT COMPARISON

The fit between modelled flood extents and locations of known flooding is summarised in Table 4-2. The locations and photographs taken at these locations during the 2010/2011 flood event are presented in Appendix B. Location A is not inundated in the model; however it is within 2 m of the model extent, see Figure 4-4. Locations B and C known to have been inundated during the 2010/ 2011 flood have been reproduced by the model. Location B is plotted against the modelled flood extent in Figure 4-4. Location C can be seen on the Cecil Plains validation map in Appendix C.

Table 4-2 Observed and Modelled Flooding

ID	Observed	Modelled
A – Upstream of Toowoomba Karara Road	Flooded	Not Flooded
B – Downstream of the Gore Highway	Flooded	Flooded
C – Cecil Plains	Flooded	Flooded

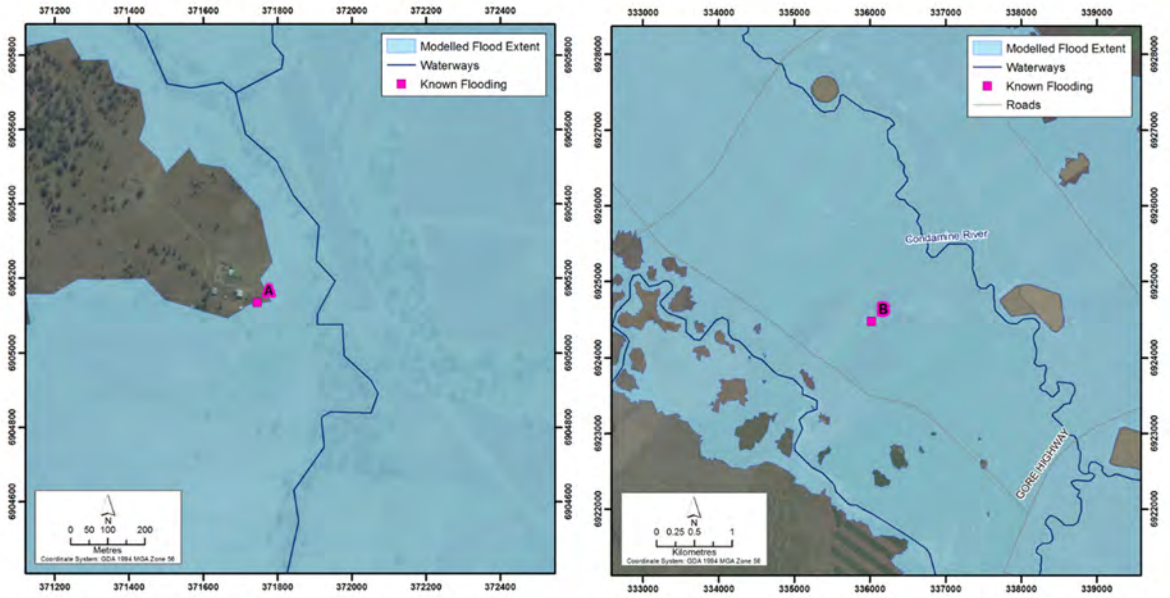


Figure 4-4 Observed Locations of Flooding and Modelled Flood Extent

In addition to the three locations of known flooding, two flood lines showing the 2010/2011 flood extent in the vicinity of Ellangowan have also been provided by TRC. The flood lines were based on hand drawn flood extents provided by members of the community during community consultation. A comparison of the modelled and observed flood extents at Ellangowan is shown in Figure 4-5. The model reproduces the observed flood extent very well at both locations.

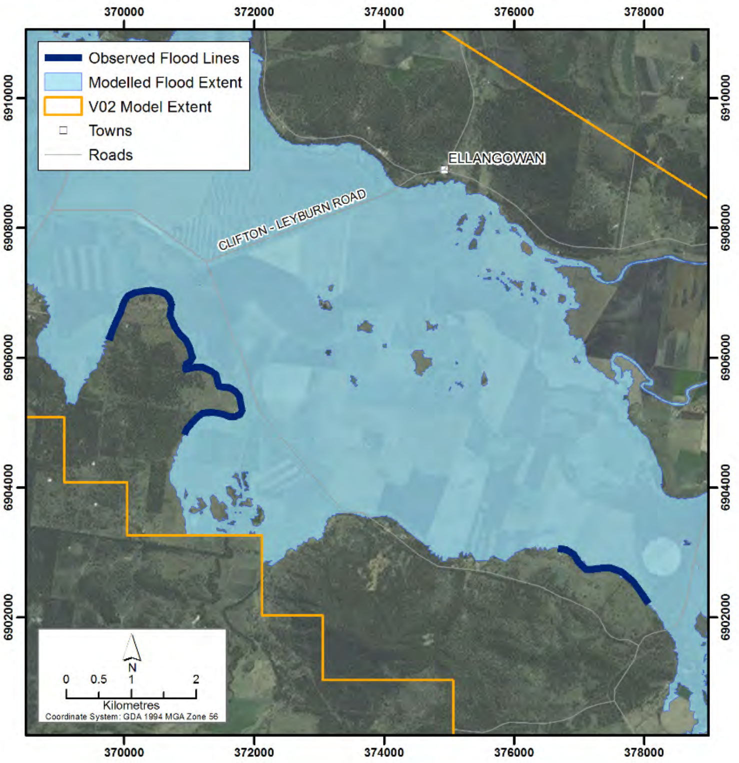


Figure 4-5 Observed Flood Lines and Modelled Flood Extent at Ellangowan

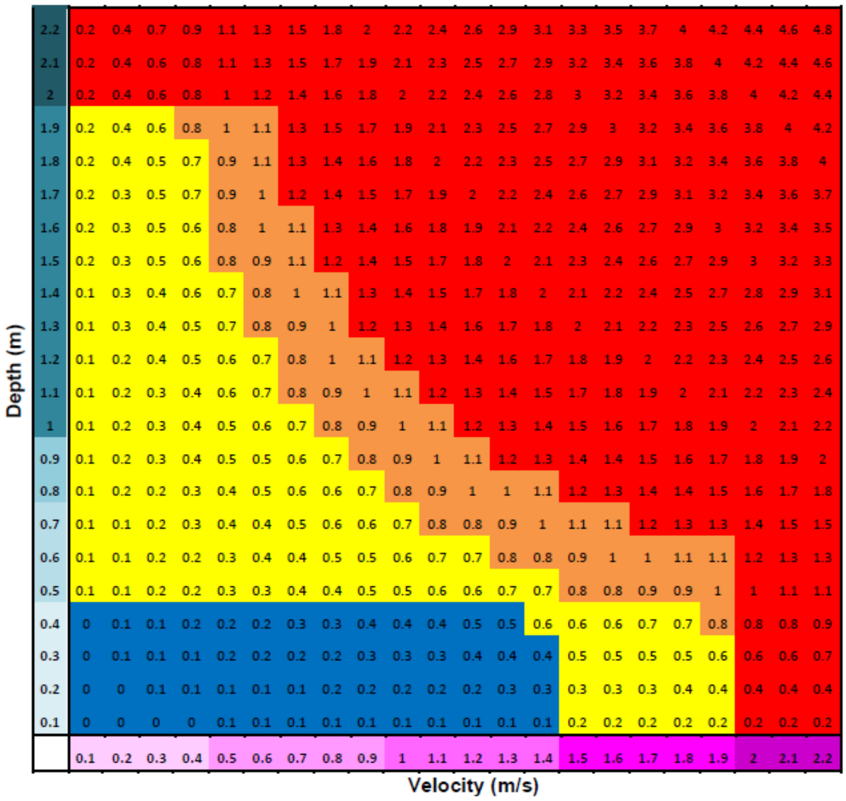
A comparison of V01 and V02 modelled flood extents for the validation event is shown in Appendix F. The flood extents are generally similar; however, there is a decrease in the V02 flood extent in some areas. One example is the area to the west of Cecil Plains. This is considered to be a result of the more accurate topographic data used in the V02 model where LiDAR data in this area is higher in elevation than the SRTM bathymetry used in the V01 model (see also difference map between V01 and V02 model bathymetries in Appendix F).

5 Design Flood Estimation

The developed MIKE FLOOD FM model was run for the 10 year, 20 year, 100 year and 500 year ARI events for the 72 hour storm duration, which was identified as the critical duration in the SKM study. The results were used to produce peak surface elevation, depth, flood hazard and hydraulic category maps for Condamine. Design event mapping is provided in Appendix D. A comparison of V01 and V02 modelled flood extents for the design events is shown in Appendix F.

5.1 FLOOD HAZARD MAPPING

Flood hazard mapping is presented in Appendix E. The flood hazard criteria used in the flood hazard maps are based on Schedule 4 on page 45 in QLDRA's *"Planning for stronger, more resilient floodplains"* document (QLDRA, 2012). The flood hazard criteria *'have been prepared for use in preparing flood investigations (level 2), and planning evaluations based on latest available engineering guidance. In absence of other more appropriate flood hazard definitions, the criteria below may be used'*. The references used to develop the criteria are given in the guidelines.



Depth (m)

2.2	0.2	0.4	0.7	0.9	1.1	1.3	1.5	1.8	2	2.2	2.4	2.6	2.9	3.1	3.3	3.5	3.7	4	4.2	4.4	4.6	4.8
2.1	0.2	0.4	0.6	0.8	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.2	3.4	3.6	3.8	4	4.2	4.4	4.6
2	0.2	0.4	0.6	0.8	1	1.2	1.4	1.6	1.8	2	2.2	2.4	2.6	2.8	3	3.2	3.4	3.6	3.8	4	4.2	4.4
1.9	0.2	0.4	0.6	0.8	1	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3	3.2	3.4	3.6	3.8	4	4.2
1.8	0.2	0.4	0.5	0.7	0.9	1.1	1.3	1.4	1.6	1.8	2	2.2	2.3	2.5	2.7	2.9	3.1	3.2	3.4	3.6	3.8	4
1.7	0.2	0.3	0.5	0.7	0.9	1	1.2	1.4	1.5	1.7	1.9	2	2.2	2.4	2.6	2.7	2.9	3.1	3.2	3.4	3.6	3.7
1.6	0.2	0.3	0.5	0.6	0.8	1	1.1	1.3	1.4	1.6	1.8	1.9	2.1	2.2	2.4	2.6	2.7	2.9	3	3.2	3.4	3.5
1.5	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.4	1.5	1.7	1.8	2	2.1	2.3	2.4	2.6	2.7	2.9	3	3.2	3.3
1.4	0.1	0.3	0.4	0.6	0.7	0.8	1	1.1	1.3	1.4	1.5	1.7	1.8	2	2.1	2.2	2.4	2.5	2.7	2.8	2.9	3.1
1.3	0.1	0.3	0.4	0.5	0.7	0.8	0.9	1	1.2	1.3	1.4	1.6	1.7	1.8	2	2.1	2.2	2.3	2.5	2.6	2.7	2.9
1.2	0.1	0.2	0.4	0.5	0.6	0.7	0.8	1	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2	2.2	2.3	2.4	2.5	2.6
1.1	0.1	0.2	0.3	0.4	0.6	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.7	1.8	1.9	2	2.1	2.2	2.3	2.4
1	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2	2.1	2.2
0.9	0.1	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.7	1.8	1.9	2
0.8	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.6	0.7	0.8	0.9	1	1	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.7	1.8
0.7	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.8	0.8	0.9	1	1.1	1.1	1.2	1.3	1.3	1.4	1.5	1.5
0.6	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.8	0.9	1	1	1.1	1.1	1.2	1.3	1.3
0.5	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.9	0.9	1	1	1.1	1.1
0.4	0	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.8	0.9
0.3	0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.7
0.2	0	0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4
0.1	0	0	0	0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2	2.1	2.2

Velocity (m/s)

	Low	Significant	High	Extreme
Depth	<0.5	<2	<2	2+
Velocity	<1.5	<2	<2	2+
DxV Product	<0.6	0.6 to <0.8	0.8 to <1.2	1.2 +

Figure 5-1 Adopted Flood Hazard Classification

5.2 HYDRAULIC CATEGORY MAPPING

Hydraulic category mapping was undertaken based on the classification below and is presented in Appendix E.

- Floodway
  - Velocity-depth product ≥ 0.5 m^2/s or
  - Velocity ≥ 1 m/s
- Flood storage
  - Velocity-depth product < 0.5 m^2/s and
  - Depth ≥ 0.5 m
- Flood fringe
  - Velocity-depth product < 0.5 m^2/s and
  - Depth < 0.5 m

6 Uncertainty

The following limitations are applicable to the data used as input to the investigation and the hydraulic modelling results and mapping deliverables. The modelling results should therefore be viewed in light of these limitations.

- The spatial distribution of Manning's 'n' roughness values is based on TRC's land use map and inspection of aerial photography.
- Where LiDAR intersects with standing water, creek and river bed levels are not accurately represented. It is assumed that LiDAR was flown at a dry time, therefore exposing most of the ground surface. The Condamine River profile has been estimated using the supplied 1 m DEM due to lack of bathymetric or cross-section survey data.
- The validation data used is the best information available at the time of the study and has varying degrees of certainty.
- The fit between modelled and recorded peak water levels is reasonable or good at most locations; however, the modelled hydrographs peak at least 10 hours later than the observed hydrographs.

7 Summary and Conclusions

The primary objective of this flood study project was to build a 1D/2D coupled MIKE FLOOD Flexible Mesh model to define the nature and extent of flood behaviour in the Upper Condamine River catchment and enable TRC to target future studies/investigations and inform the risk assessment, subsequent investigation of policy options and future Planning Scheme amendments.

A coupled 1D/2D MIKE FLOOD FM hydraulic model has been successfully developed and validated for the Upper Condamine River catchment. The hydraulic model was validated for the December 2010/January 2011 flood event. The validation results were demonstrated graphically and locations of known flooding and the observed flood extents were reproduced by the hydraulic model. Modelled and observed hydrographs were compared at two gauges within the study area. Whilst the fit between modelled and observed peak water levels at the two gauges was reasonable at one gauge and very good at the other, a significant difference in the timing of the peaks has been observed with the model hydrographs peaking at least 10 hours too late. This difference is believed to be a result of lack of joint calibration of the hydrological and hydraulic models, which was not part of the scope of this study.

The model is believed to be appropriately validated to inform future Planning Scheme amendments; however, it is recommended to undertake a joint calibration of the hydrologic and hydraulic models for at least two historical flood events to improve the model accuracy.

The validated MIKE FLOOD FM model was used to estimate design peak flood surface elevations, peak water depths, hazard and hydraulic categories for the 10, 20, 100 and 500 year ARI design events.

Comprehensive mapping is included in Appendix C to Appendix F of this report. Digital mapping, GIS files and model setups and results were also delivered as part of the study.

8 References

QLDRA (2012). *Planning for stronger, more resilient floodplains. Part 2 – Measures to support floodplain management in future planning schemes.* Queensland Reconstruction Authority. [Online]: November 9, 2015 at http://www.qldreconstruction.org.au/u/lib/cms2/resilient-floodplains-part2-full.pdf

Smith, G. and Wasko, C. (2012). *Australian Rainfall and Runoff, Revision Project 15: Two Dimensional Simulations in Urban Areas - Representation of Buildings in 2D Numerical Flood Models.* Engineers Australia, Barton, ACT, February 2012.

SKM (2014). *Toowoomba Regional Council SP051 Flood Studies. Work Package 7. 2D Flood Study for areas within the Upper Condamine River Floodplain. Broad-Scale Hydraulic Model Study Area including Cecil Plains.* Final Report QE06787, June 2014.

9 Disclaimer

Information used is the best information available at this time for the purposes of this study. Marks observed and other anecdotal information obtained after flood events have been obtained from a range of sources and have varying degrees of uncertainty.

While every care is taken by the Toowoomba Regional Council (TRC) to ensure the accuracy of the data used in the study and published in the report, Toowoomba Regional Council makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of data being inaccurate or incomplete.

APPENDIX A

Structure Information

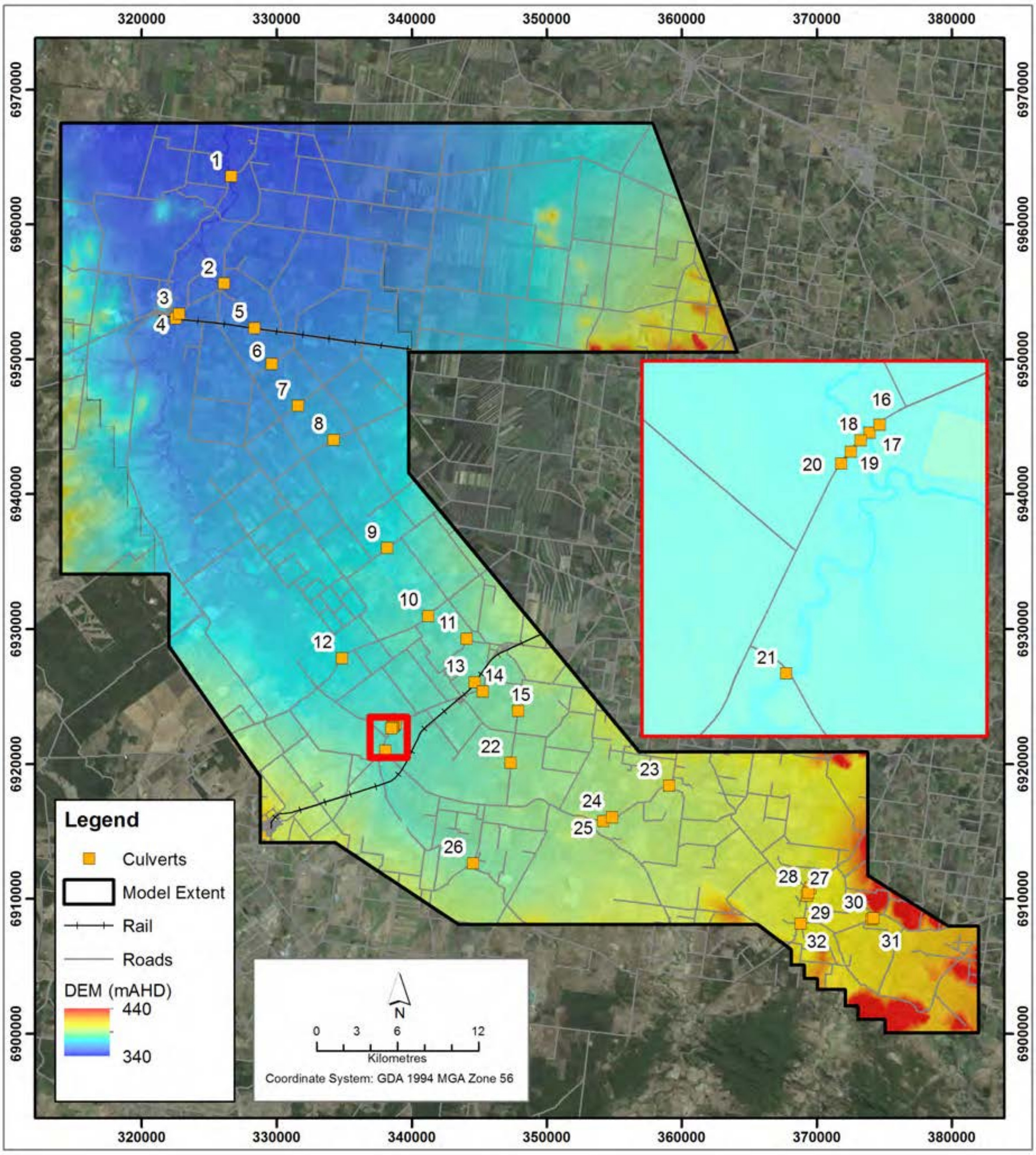


Figure A-1 Structure Locations

1: DALBY-CECIL PLAINS ROAD

Bridge

Location: -27.532, 151.2055

Number of Piers: 4 rows of 2

Pier Geometry: Square

Pier Width: 500 mm

Deck to Obvert: 1100 mm

Deck to Rail: 500 mm

2: TIPTON HORRANE ROAD

8 Culverts

Location: -27.512, 151.2395

Width: 2100 mm

Height: 1800 mm

Cover: 500 mm

3: TOOWOOMBA-CECIL PLAINS ROAD 1

Bridge

Location: -27.532, 151.2055

Number of Piers: 10 rows of 4

Pier Geometry: Circular

Pier Width: 450 mm

Deck to Obvert: 700 mm

Deck to Rail: 700 mm

4: RAIL BRIDGE

Bridge

Location: -27.535, 151.2031

Number of Piers: 8 rows of 4

Pier Geometry: Circular

Pier Width: 430 mm

Deck to Obvert: 700 mm

5: TOOWOOMBA-CECIL PLAINS ROAD 2

Bridge

Location: -27.5421, 151.2618

Number of Piers: 2 rows of 6

Pier Geometry: Square

Pier Width: 400 mm

Deck to Obvert: 1000 mm

Deck to Rail: 850 mm

6: HEARN ROAD

2 Culverts

Location: -27.5664, 151.2746

Width: 2100 mm

Height: 1200 mm

Cover: 500 mm

7: ROWLAND ROAD

2 Culverts

Location: -27.5945, 151.2937

Width: 2100 mm

Height: 1200 mm

Cover: 500 mm

8: BRANCHVIEW ROAD

Bridge

Location: -27.6178, 151.3201

Number of Piers: 2 rows of 4

Pier Geometry: Circular

Pier Width: 450 mm

Deck to Obvert: 780 mm

9: MELROSE ROAD

Bridge

Location: -27.6908, 151.3592

Number of Piers: 2 rows of 4

Pier Geometry: Circular

Pier Width: 450mm

Deck to Obvert: 780mm

10: LEMON TREE ROAD

3 Culverts

Location: -27.7362, 151.3893

Width: 2200 mm

Height: 1200 mm

Cover: 500 mm

11: PUMP ROAD

2 Culverts

Location: -27.7518, 151.4182

Width: 2100 mm

Height: 1200 mm

Cover: 450 mm

12: LEMONTREE BOSTOCKS ROAD

Bridge

Location: -27.7637, 151.3241

Number of Piers: 2 rows of 4

Pier Geometry: Circular

Pier Width: 450 mm

Deck to Obvert: 750 mm

13: GORE HIGHWAY 2

8 Culverts

Location: -27.781, 151.4237

Width: 2400 mm

Height: 1200 mm

Cover: 500 mm

14: PAMPAS PIT ROAD

2 Culverts

Location: -27.7871, 151.4297

Width: 2100 mm

Height: 500 mm

Cover: 500 mm

15: HAYDOCK ROAD

2 Culverts

Location: -27.8006, 151.4562

Width: 2100 mm

Height: 1200 mm

Cover: 500 mm

16: GORE HIGHWAY 3

8 Culverts

Location: -27.8081, 151.3638

Width: 2400 mm

Height: 1200 mm

Cover: 500 mm

17: GORE HIGHWAY 1

Bridge

Location: -27.8087, 151.363

Number of Piers: 4 rows of 6

Pier Geometry: Square

Pier Width: 400 mm

Deck to Obvert: 900 mm

Deck to Rail: 600 mm

18: GORE HIGHWAY 4

2 Culverts

Location: -27.8092, 151.3622

Width: 2400 mm

Height: 1200 mm

Cover: 510 mm

19: GORE HIGHWAY 5

8 Culverts

Location: -27.8101, 151.3614

Width: 2400 mm

Height: 1200 mm

Cover: 510 mm

20: GORE HIGHWAY 6

3 Culverts

Location: -27.8109, 151.3606

Width: 2400 mm

Height: 600 mm

Cover:

21: MILLMERAN LEYBURN ROAD

Bridge

Location: -27.826, 151.3559

Number of Piers: 3 rows of 5

Pier Geometry: Octagonal

Pier Width: Undetermined

Deck to Obvert: Undetermined

Deck to Rail: Undetermined

22: YARRAMALONG ROAD

3 Culverts

Location: -27.8352, 151.4497

Width: 2800 mm

Height: 900 mm

Cover: 500 mm

23: PITTSWORTH-TUMMAVILLE ROAD 3

Bridge

Location: -27.8518, 151.569

Number of Piers: 4 rows of 4

Pier Geometry: Circular

Pier Width: 520 mm

Deck to Obvert: 700 mm

24: PITTSWORTH-TUMMAVILLE ROAD 2

Bridge

Location: -27.8725, 151.5255

Number of Piers: 1 row of 7

Pier Geometry: Square

Pier Width: Undetermined

Deck to Obvert: 700 mm

25: PITTSWORTH-TUMMAVILLE ROAD 1

Bridge

Location: -27.8751, 151.5188

Number of Piers: 1 row of 4

Pier Geometry: Octagonal

Pier Width: Undetermined

Deck to Obvert: Undetermined

26: GRASSTREE ROAD

7 Culverts

Location: -27.9022, 151.4207

Width: 2100 mm

Height: 1700 mm

Cover: 1000 mm

27: TOOWOOMBA KARARA ROAD 1

Bridge

Location: -27.9216, 151.6742

Number of Piers: 1 row of 5

Pier Geometry: Circular

Pier Width: 450 mm

Deck to Obvert: 750 mm

Deck to Rail: 530 mm

28: TOOWOOMBA KARARA ROAD 3

3 Culverts

Location: -27.9247, 151.6725

Width: 2400 mm

Height: 1800 mm

Cover: 560 mm

29: TOOWOOMBA KARARA ROAD 2

Bridge

Location: -27.9265, 151.6717

Number of Piers: 4

Pier Geometry: Rectangular

Pier Width: 275 mm

Deck to Obvert: 670 mm

Deck to Rail: 980 mm

30: CLIFTON LEYBURN ROAD 2

Bridge

Location: -27.9421, 151.7214

Number of Piers: 3 rows of 4

Pier Geometry: Circular

Pier Width: 300 mm

Deck to Obvert: 700 mm

31: CLIFTON LEYBURN ROAD 1

Bridge

Location: -27.9428, 151.7201

Number of Piers: 3 rows of 4

Pier Geometry: Circular

Pier Width: 300 mm

Deck to Obvert: 700 mm

32: TOOWOOMBA KARARA ROAD 4

Bridge

Location: -27.9452, 151.6665

Number of Piers: 2

Pier Geometry: Rectangular

Pier Width: Undetermined

Deck to Obvert: 670 mm

Deck to Rail: 530 mm

APPENDIX B

Community Consultation Data

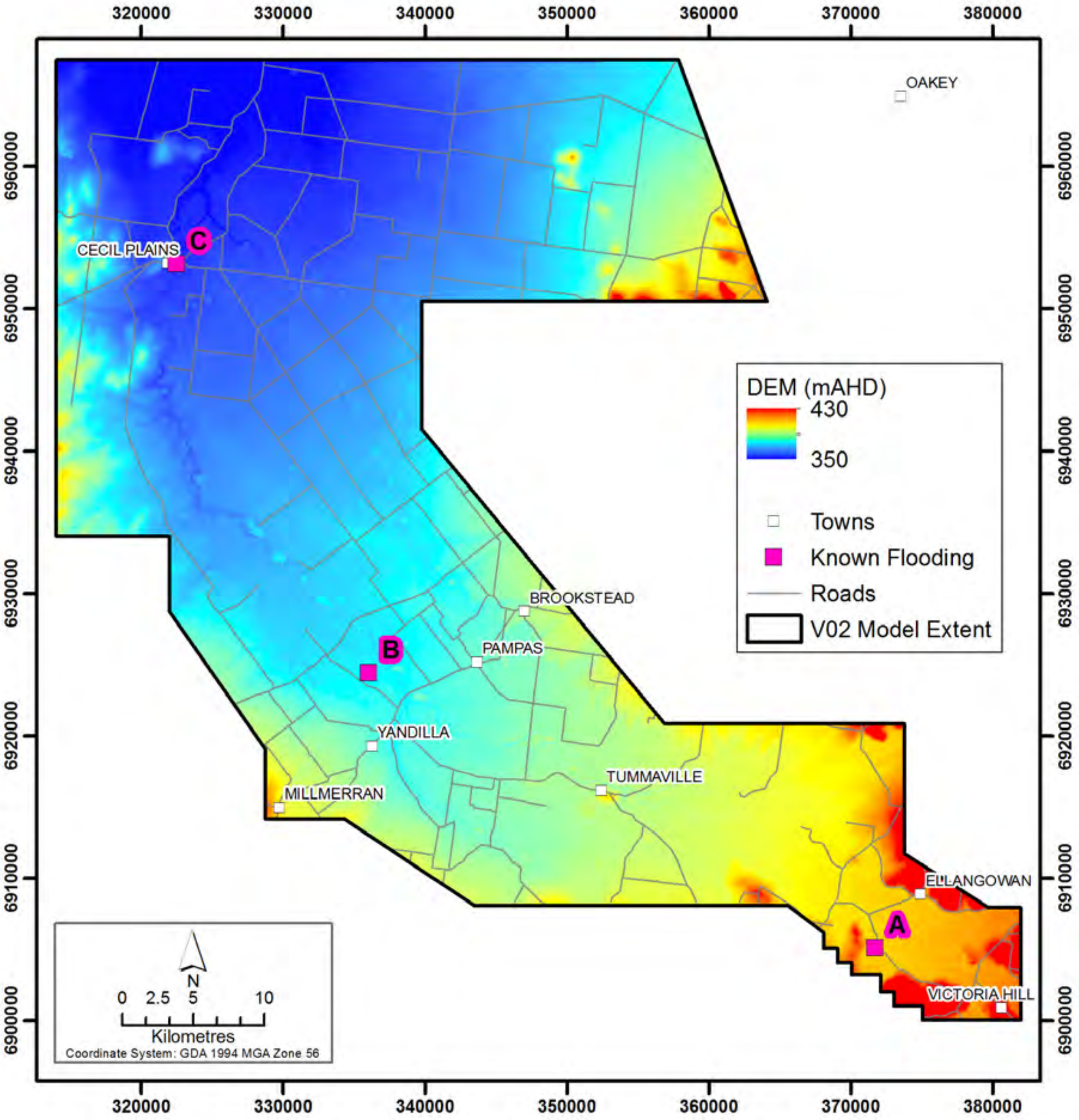


Figure B-1 Locations of Known Flooding - December 2010 Event

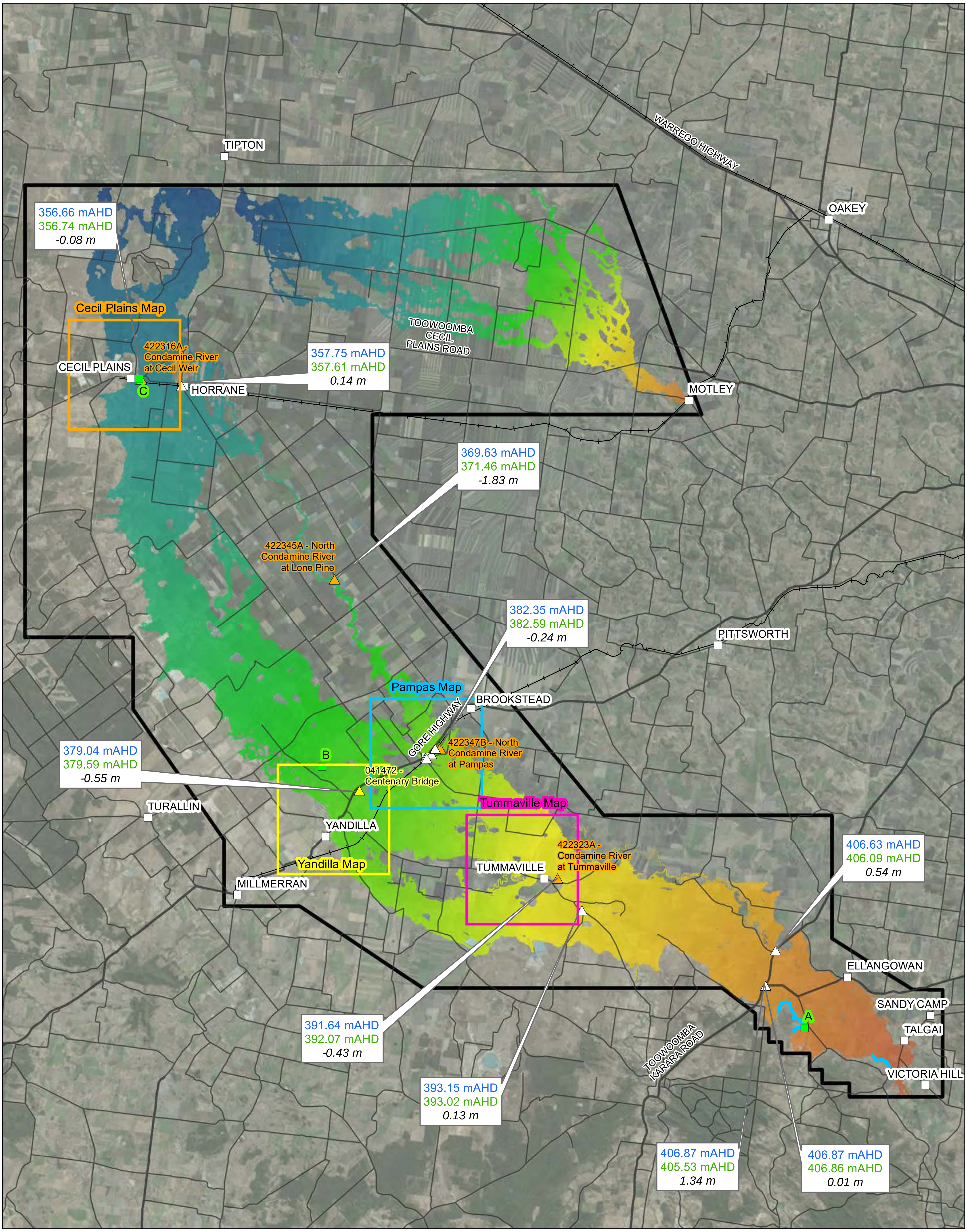
Location A

Location B

Location C

APPENDIX C

Model Validation Mapping



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

N

Legend

Surface Elevation [mAHD]

420

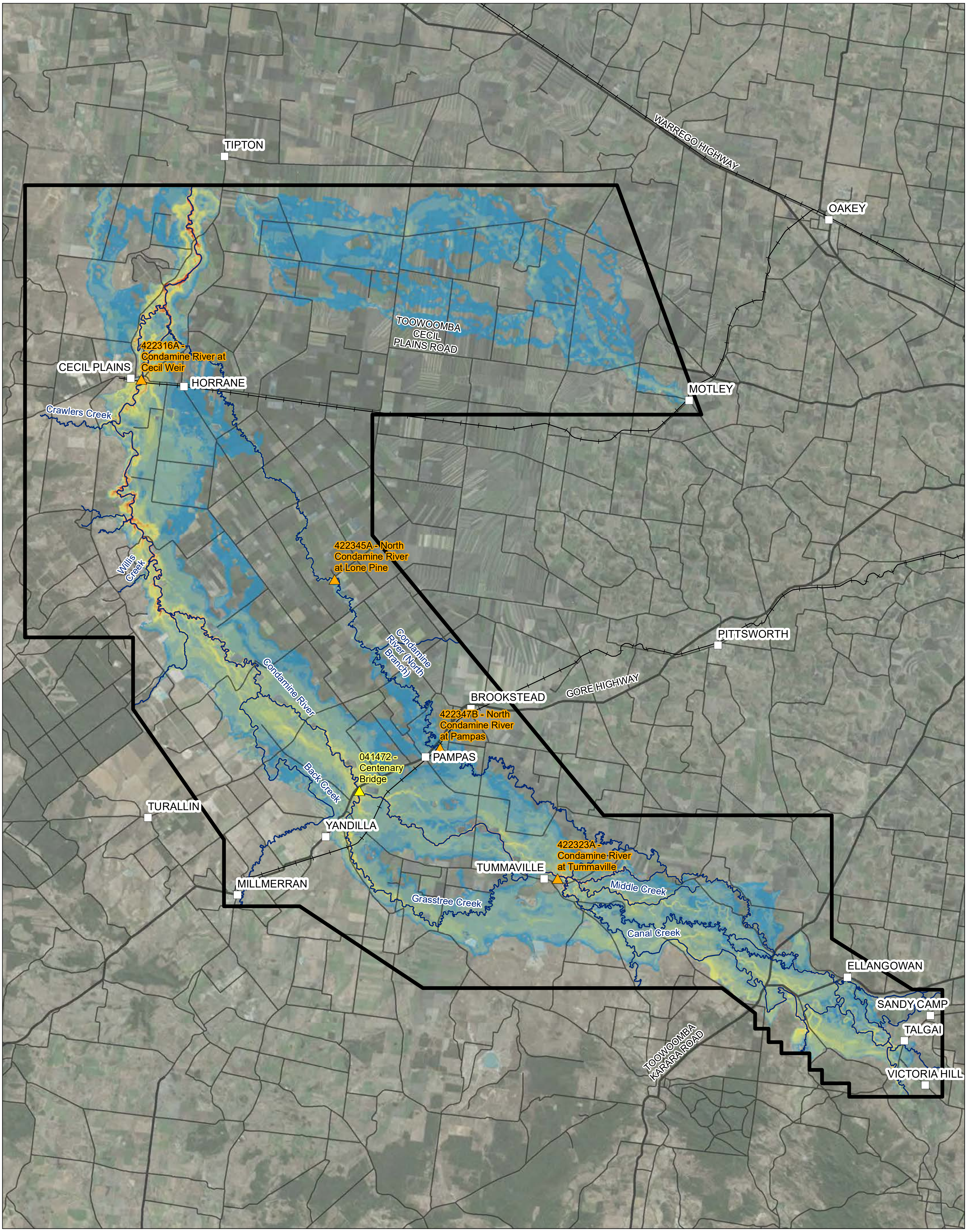
345

Modelled
Observed
Difference

- ▲ BoM Gauges
- ▲ DNRM Gauges
- △ Flood Levels
- 🟩 Known Flooding
- ━ Flood Lines
- □ Towns
- ▭ Model Extent
- ┼ Rail
- ─ Minor Roads
- ━ Major Roads

SP051 Flood Studies
Work Package 7 - Addendum 1
Dec 2010 / Jan 2011 Event
Peak Water Level

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

N

Legend

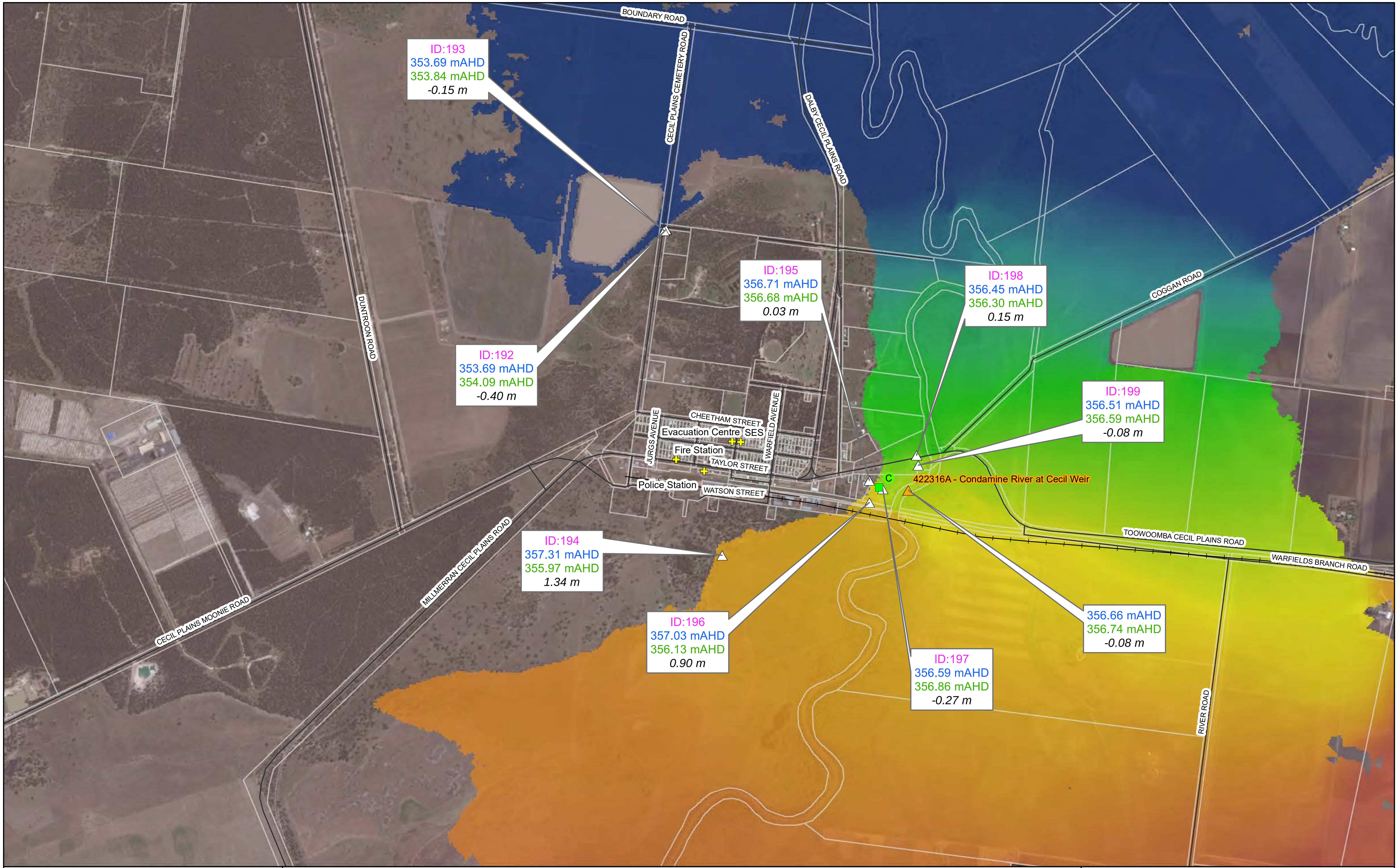
Peak Depth [m]

- 🟦 0 - 0.25
- 🟦 0.25 - 0.50
- 🟩 0.5 - 1.0
- 🟩 1.0 - 1.5
- 🟩 1.5 - 2.0
- 🟨 2.0 - 2.5
- 🟨 2.5 - 3.0
- 🟧 3.0 - 3.5
- 🟧 3.5 - 4.0
- 🟧 4.0 - 4.5
- 🟥 4.5 - 5.0
- 🟥 >5.0
- Rail
- Minor Roads
- Major Roads
- Waterways
- Model Extent
- ☐ Towns
- ▲ BoM Gauges
- ▲ DNRM Gauges

SP051 Flood Studies
Work Package 7 - Addendum 1
Dec 2010 / Jan 2011 Event
Peak Flood Depth

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

Disclaimer: Whilst all due care has been taken in the preparation of the plan and all information (the Plan and all information is referred to as "Plan information"), the accuracy of the Plan Information cannot be guaranteed. The Plan Information is provided as a guide and should not be relied upon in anyway whatsoever. Toowoomba Regional Council takes no responsibility for inaccuracies in the Plan Information and is not liable under any circumstances for any loss or damage whatsoever or howsoever caused arising directly or indirectly in connection with its use. The recipient must verify the Plan Information on site. Please refer any discrepancies to Toowoomba Regional Council - Information, Communications & Technology. No part of the Plan Information should be reproduced without the permission of the Coordinator GIS - ICT Branch, or other delegated representative of Council (131872).



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

Legend

Surface Elevation (mAHD)
358
355

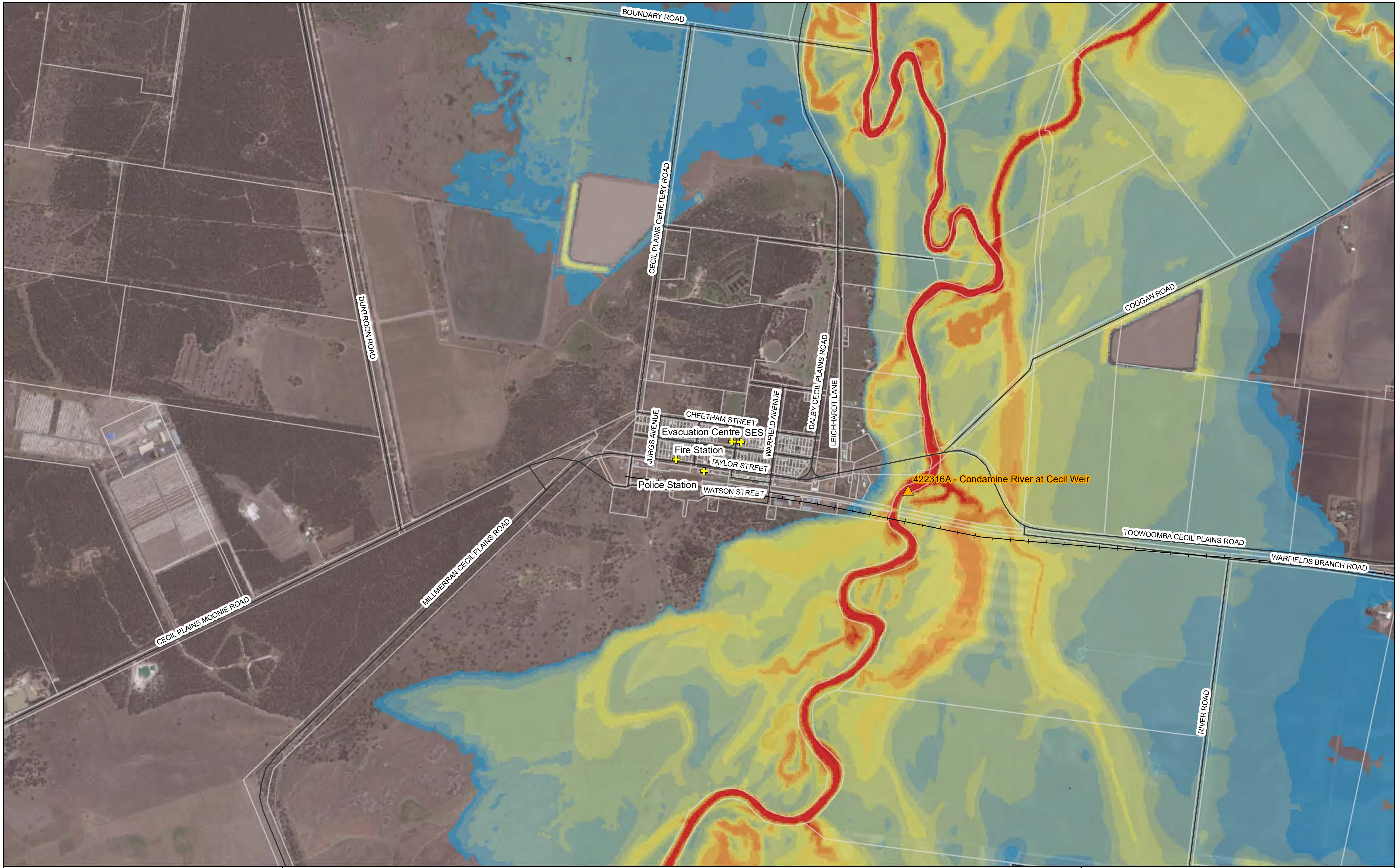
- Rail
- Cadastre
- Roads
- △ BoM Gauges
- △ DNRM Gauges
- ✚ Emergency Locations
- △ Flood Levels
- 🟩 Known Flooding

ID
Modelled
Observed
Difference

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
Dec 2010 / Jan 2011 Event
Peak Water Level

\\wms-stor\Public\PROJECTS\10026-CondamineHydraulicModelBuild\GIS\Mapping\Validation\CEC_Map01_SurfaceElevation_2011.mxd
Date Saved: 27/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

Legend

✚ Emergency Locations

—+— Rail

▭ Cadastre

— Roads

△ BoM Gauges

▲ DNRM Gauges

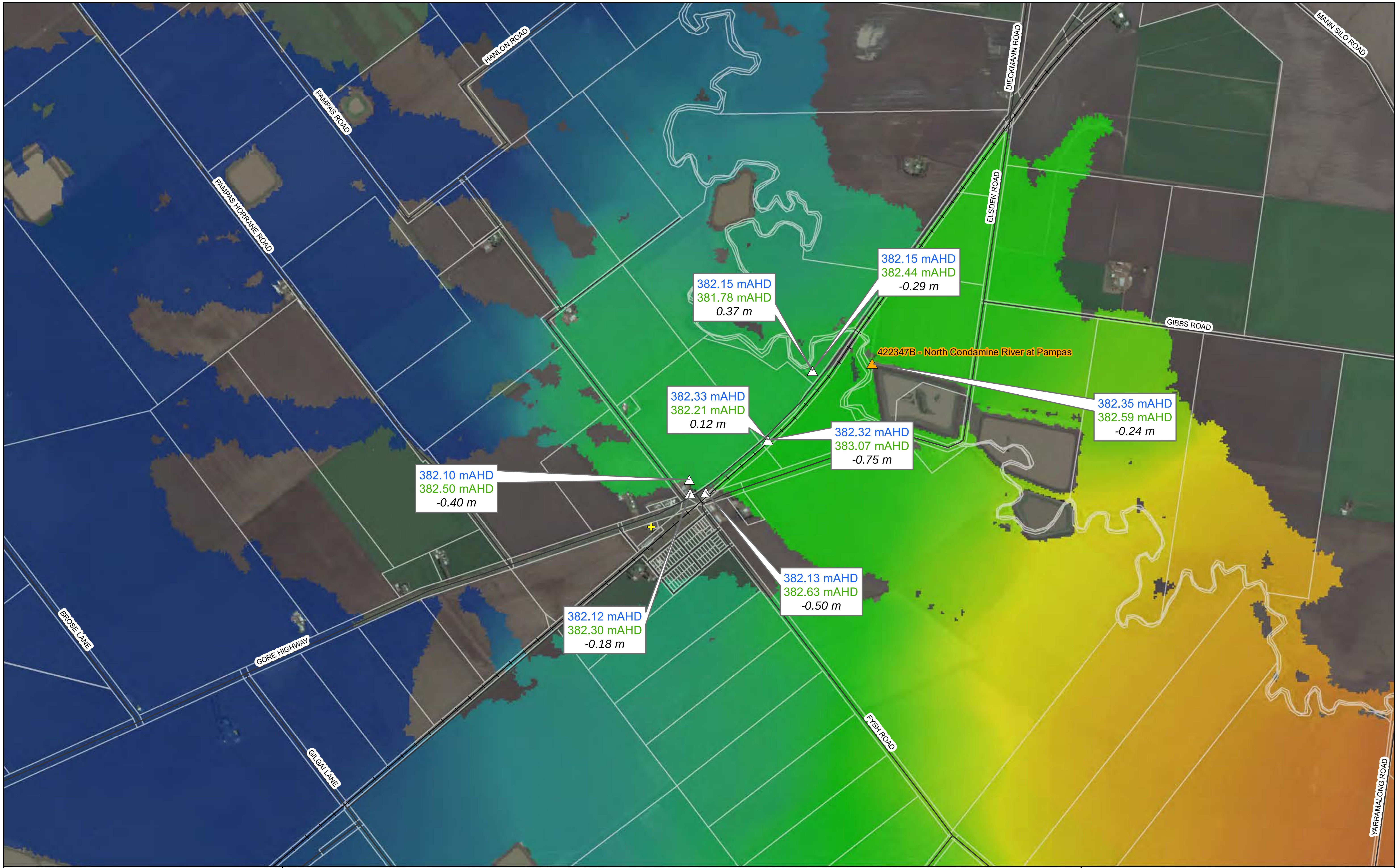
Peak Depth [m]

■ 0 - 0.25	■ 0.5 - 1.0	■ 2.0 - 2.5	■ 3.5 - 4.0
■ 0.25 - 0.50	■ 1.0 - 1.5	■ 2.5 - 3.0	■ 4.0 - 4.5
	■ 1.5 - 2.0	■ 3.0 - 3.5	■ 4.5 - 5.0
			■ >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
Dec 2010 / Jan 2011 Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Validation\CEC_Map02_FloodDepth_2011.mxd
Date Saved: 14/11/2015



TOOWOOMBA
REGION

1:20,000 (at A3)
0 100 200 400
Metres
GDA 1994 MGA Zone 56
N

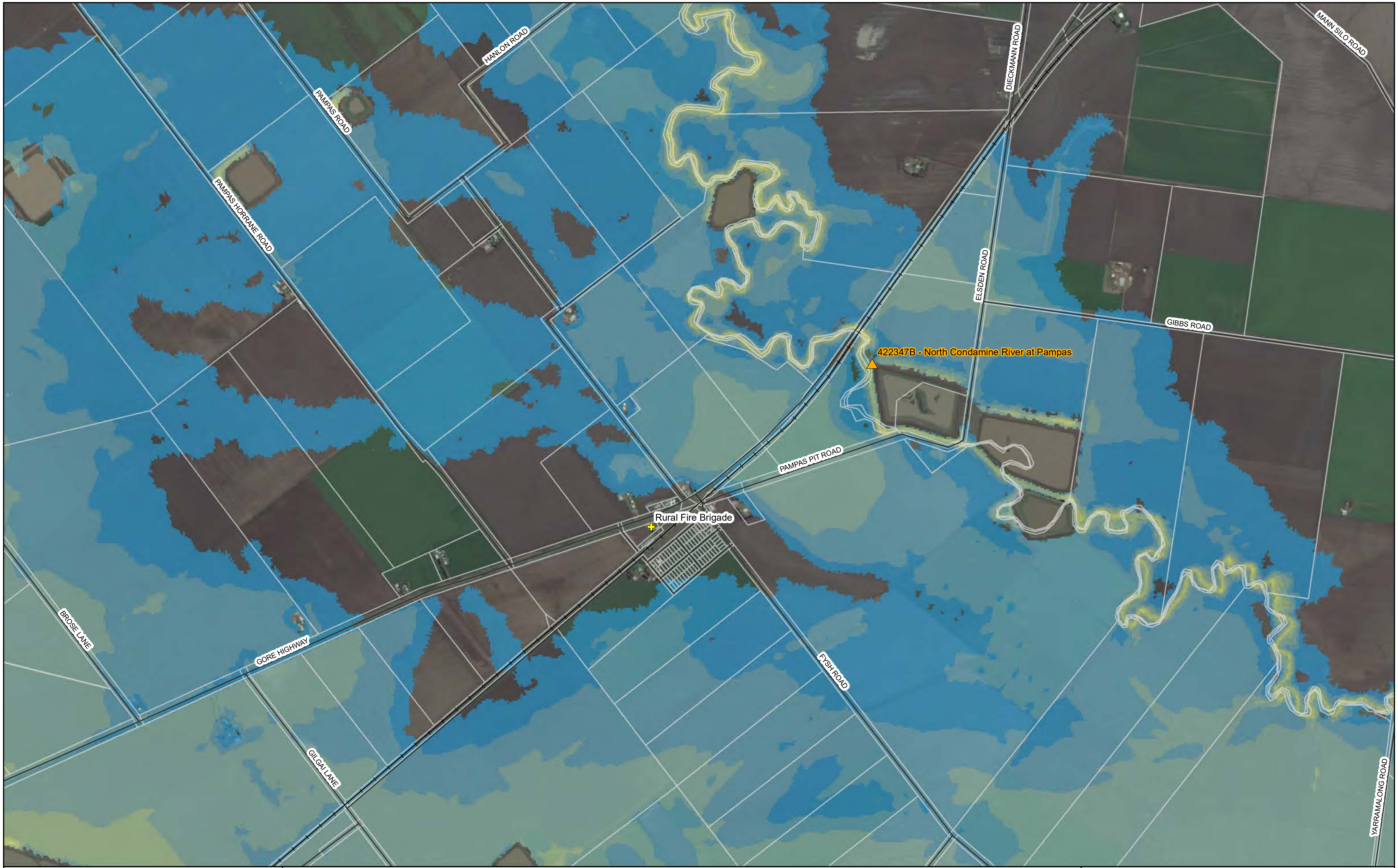
Legend

Surface Elevation (mAHD)
386
380

Rail	△ BoM Gauges
Cadastre	▲ DNRM Gauges
Roads	✚ Emergency Locations
△ Flood Levels	Modelled Observed *Difference*

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
Dec 2010 / Jan 2011 Event
Peak Water Level



TOOWOOMBA REGION

1:20,000 (at A3)
0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

Legend

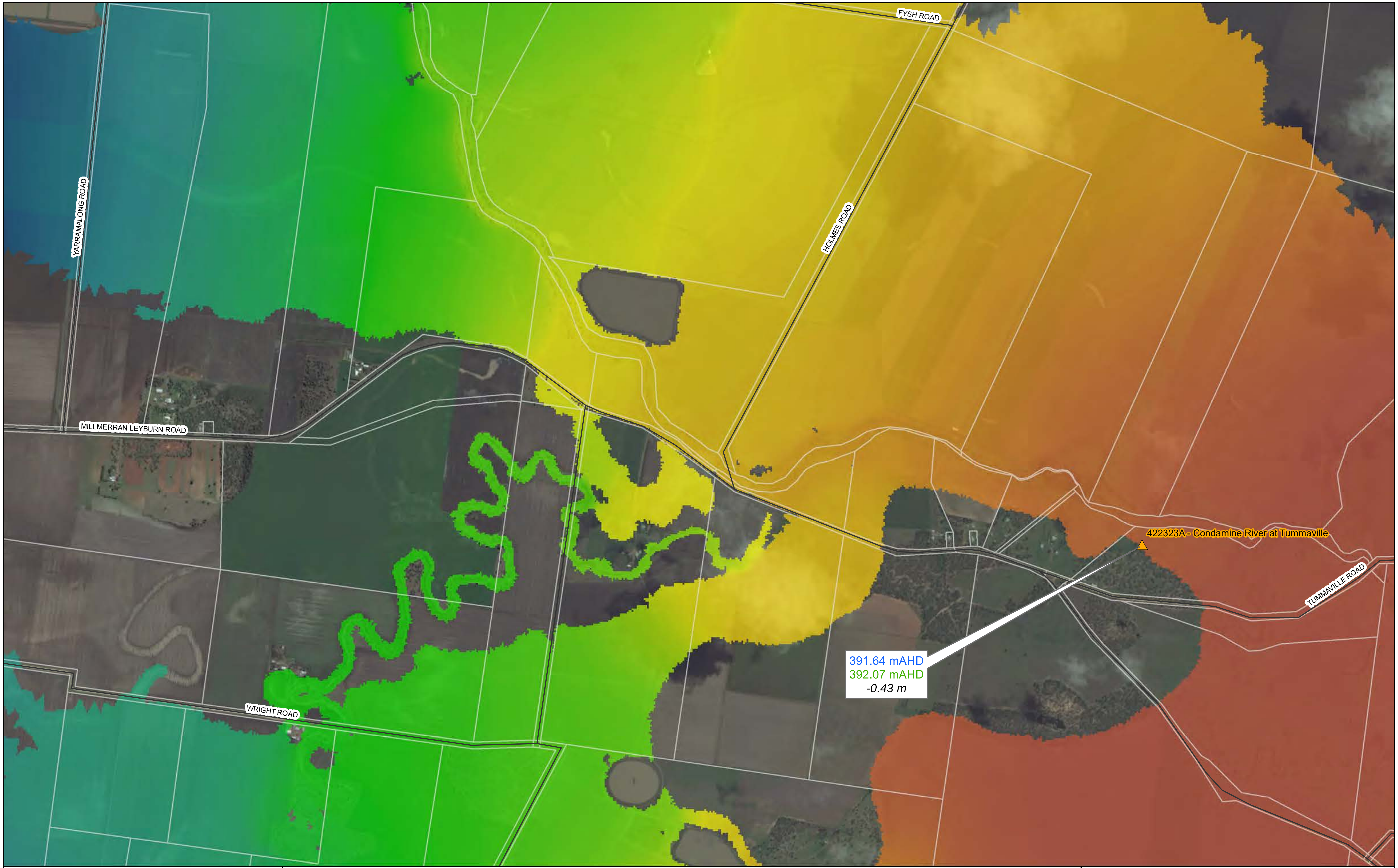
✚ Emergency Locations
—+— Rail
▭ Cadastre
—— Roads
△ BoM Gauges
▲ DNRM Gauges

Peak Depth [m]
- ■ 0 - 0.25
- ■ 0.25 - 0.50
- ■ 0.5 - 1.0
- ■ 1.0 - 1.5
- ■ 1.5 - 2.0
- ■ 2.0 - 2.5
- ■ 2.5 - 3.0
- ■ 3.0 - 3.5
- ■ 3.5 - 4.0
- ■ 4.0 - 4.5
- ■ 4.5 - 5.0
- ■ >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
Dec 2010 / Jan 2011 Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Validation\PAM_Map02_FloodDepth_2011.mxd
Date Saved: 14/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

Legend

Surface Elevation (mAHD)

392

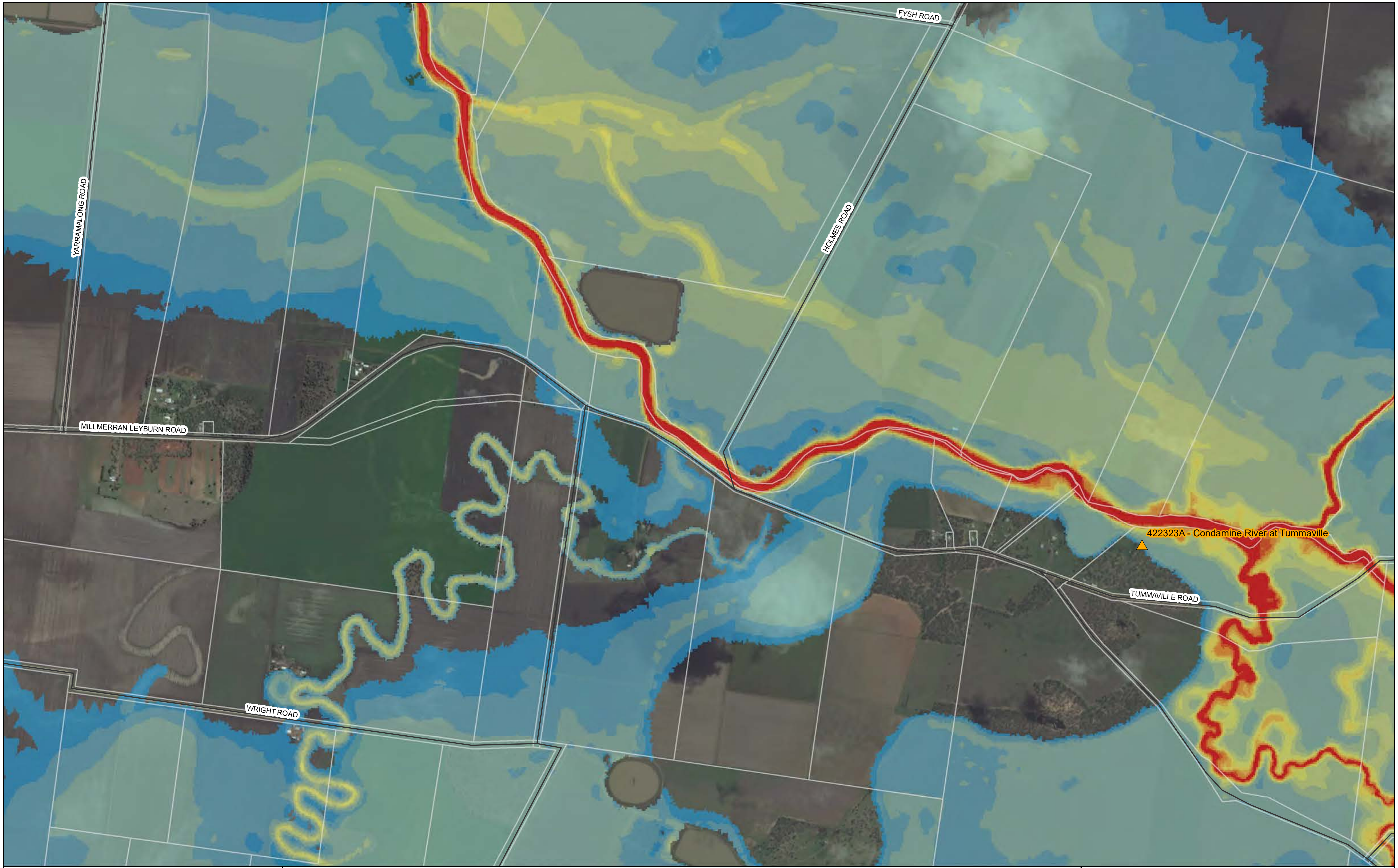
385

┼ Rail	△ BoM Gauges
☐ Cadastre	▲ DNRM Gauges
— Roads	✚ Emergency Locations

Modelled
Observed
Difference

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
Dec 2010 / Jan 2011 Event
Peak Water Level

\\wms-stor\Public\PROJECTS\10026-CondamineHydraulicModelBuild\GIS\Mapping\Validation\TUM_Map01_SurfaceElevation_2011.mxd
Date Saved: 27/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

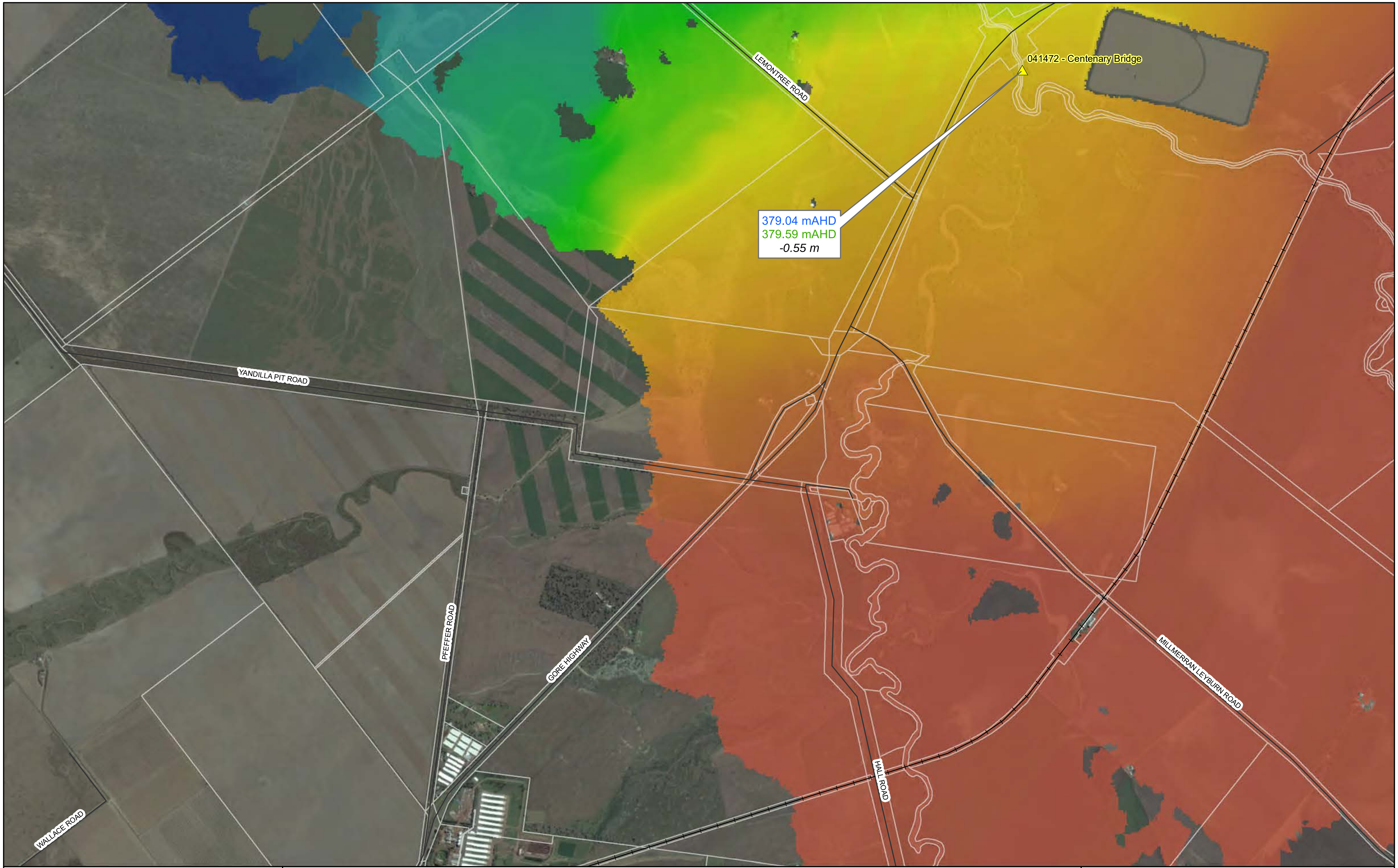
✚ Emergency Locations
—+— Rail
▭ Cadastre
— Roads
△ BoM Gauges
△ DNRM Gauges

Peak Depth [m]
- 0 - 0.25
- 0.25 - 0.50
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- 4.0 - 4.5
- 4.5 - 5.0
- >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
Dec 2010 / Jan 2011 Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Validation\TUM_Map02_FloodDepth_2011.mxd
Date Saved: 14/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

Surface Elevation (mAHD)
380
377

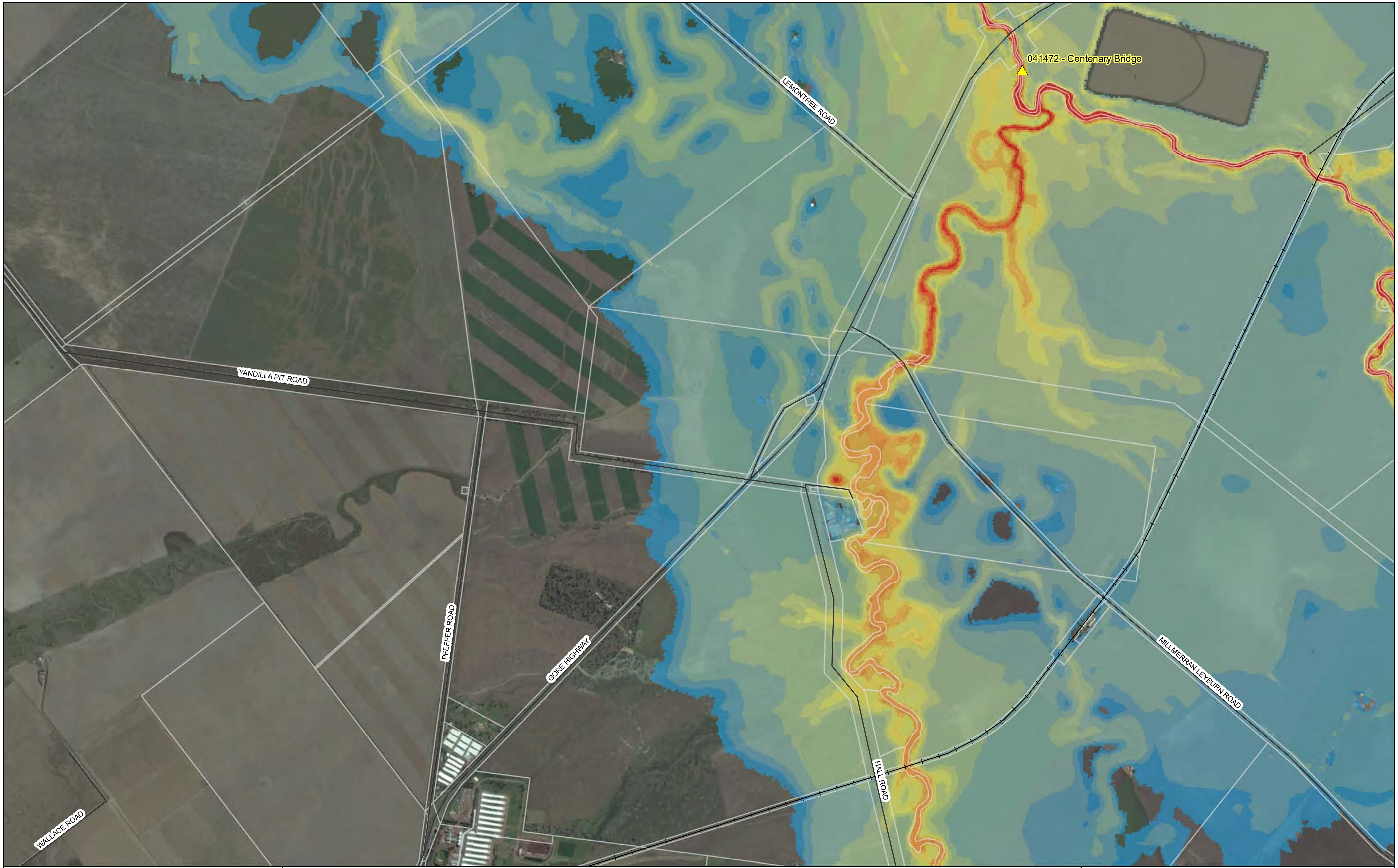
- Rail
- Cadastre
- Roads
- BoM Gauges
- DNRM Gauges
- Emergency Locations

Modelled
Observed
Difference

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
Dec 2010 / Jan 2011 Event
Peak Water Level

C:\Users\Monika\Desktop\CONDAMINE\WP07-CON\GIS\Mapping\Validation\YAN_Map01_SurfaceElevation_2011.mxd
Date Saved: 14/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

- ✚ Emergency Locations
- ─┼─ Rail
- ☐ Cadastre
- ── Roads
- △ BoM Gauges
- △ DNRM Gauges

Peak Depth [m]

- 🟦 0 - 0.25
- 🟦 0.25 - 0.50
- 🟩 0.5 - 1.0
- 🟩 1.0 - 1.5
- 🟩 1.5 - 2.0
- 🟨 2.0 - 2.5
- 🟨 2.5 - 3.0
- 🟧 3.0 - 3.5
- 🟧 3.5 - 4.0
- 🟧 4.0 - 4.5
- 🟥 4.5 - 5.0
- 🟥 >5.0

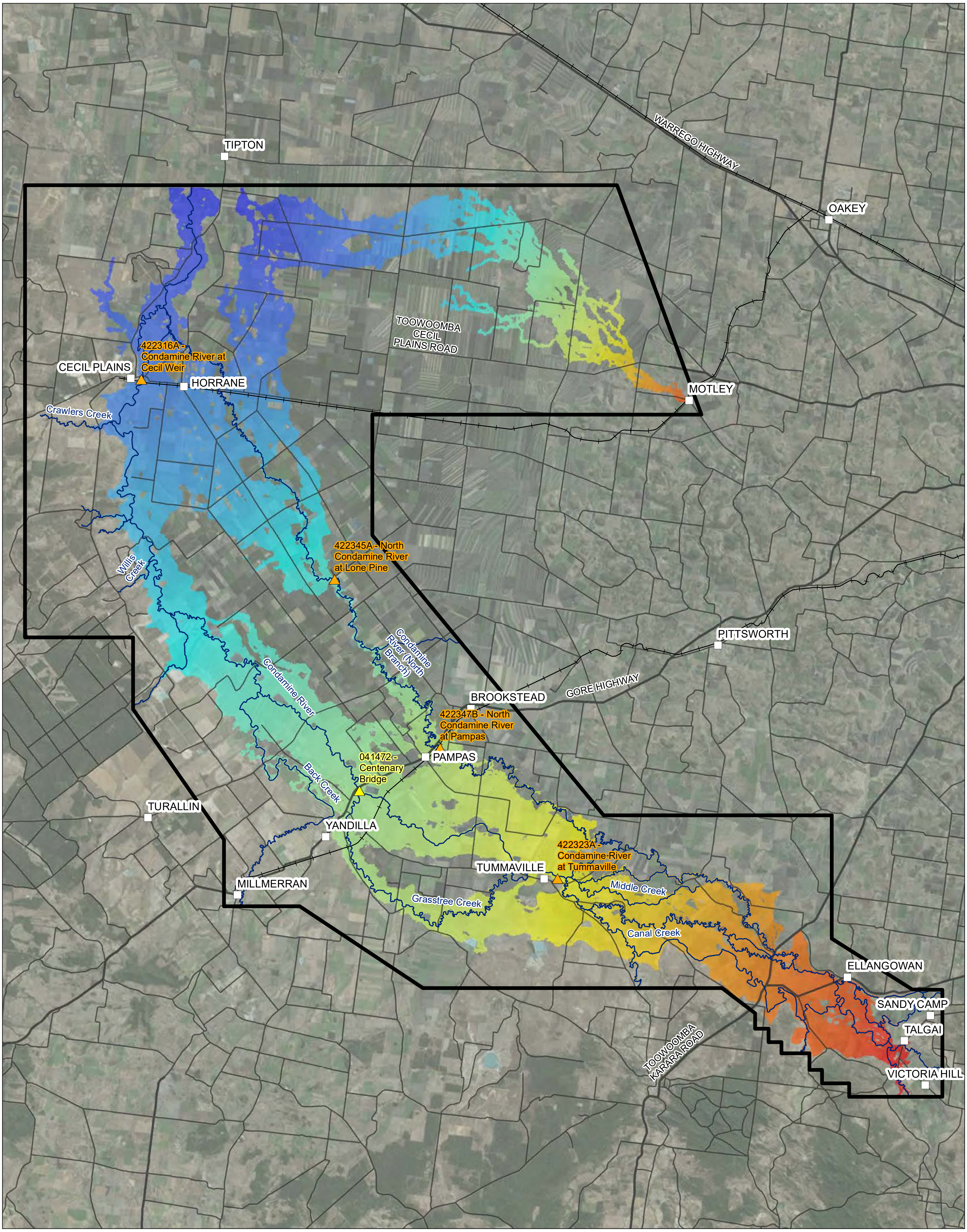
Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
Dec 2010 / Jan 2011 Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Validation\YAN_Map02_FloodDepth_2011.mxd
Date Saved: 14/11/2015

APPENDIX D

Design Event Mapping



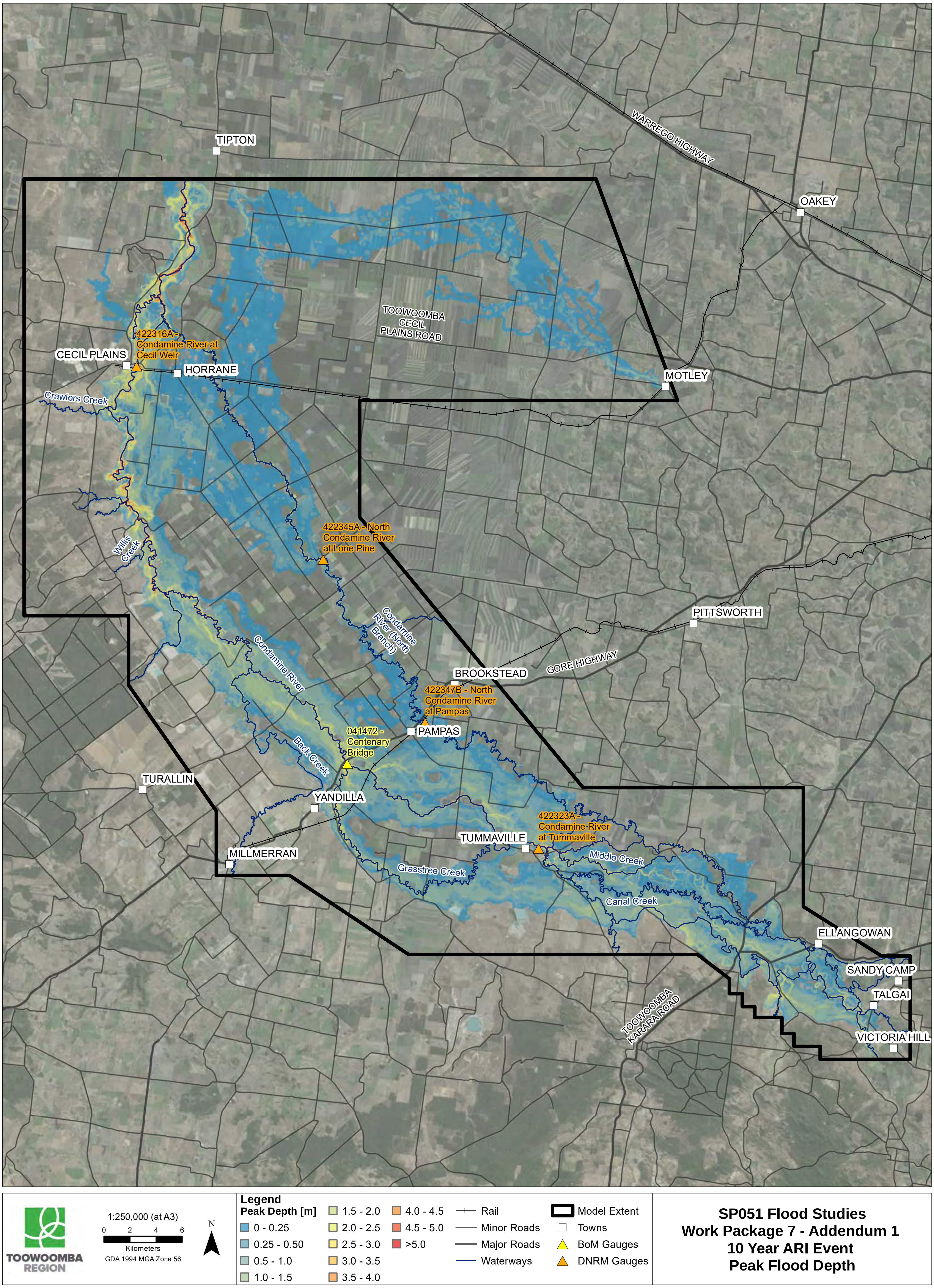
TOOWOOMBA REGION

Legend

- Rail
- Minor Roads
- Major Roads
- Waterways
- ▭ Model Extent
- ☐ Towns
- △ BoM Gauges
- ▲ DNRM Gauges

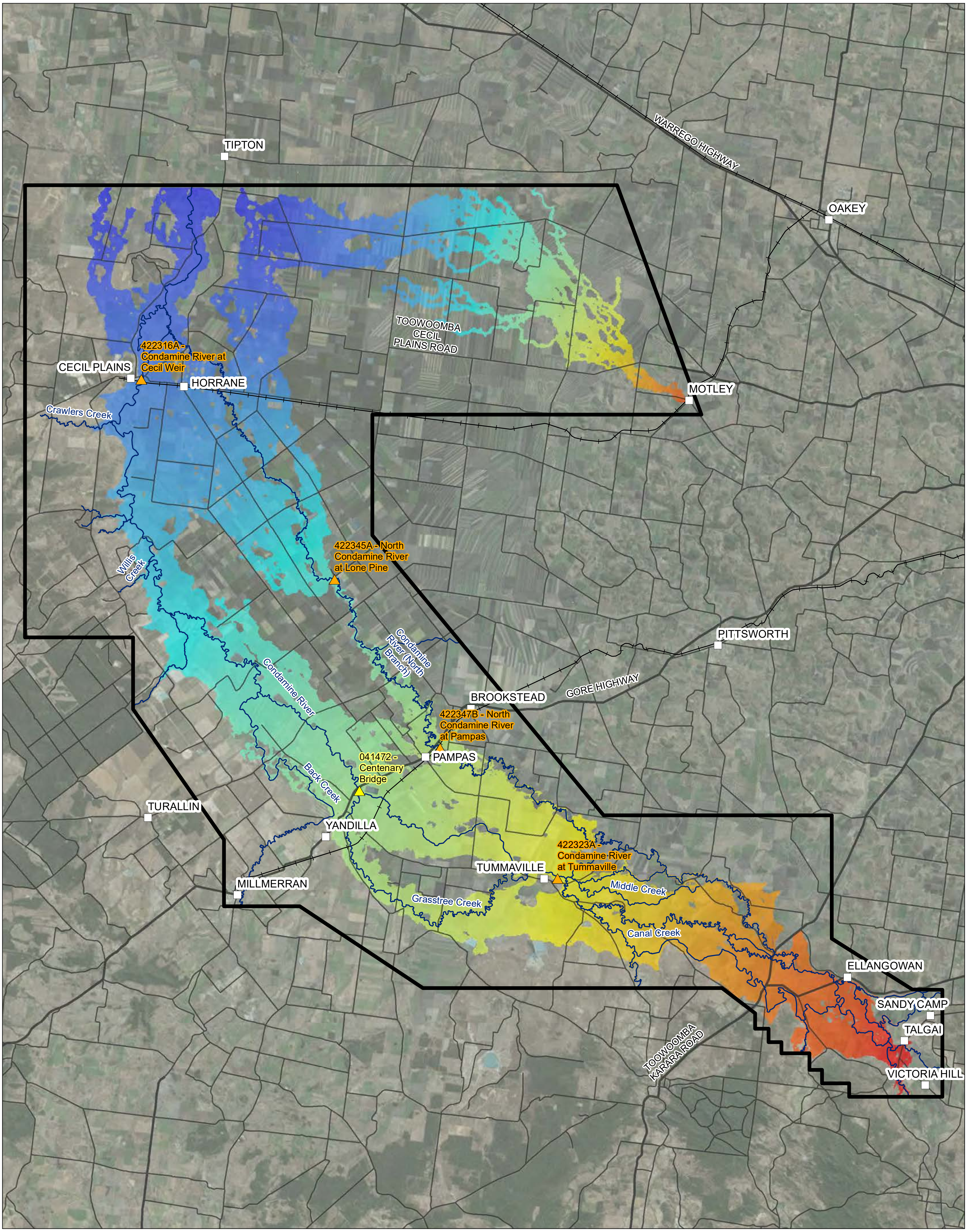
Surface Elevation [mAHD]
415
345

SP051 Flood Studies
Work Package 7 - Addendum 1
10 Year ARI Event
Water Surface Elevation



SP051 Flood Studies
Work Package 7 - Addendum 1
10 Year ARI Event
Peak Flood Depth

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6
Kilometers
GDA 1994 MGA Zone 56

N

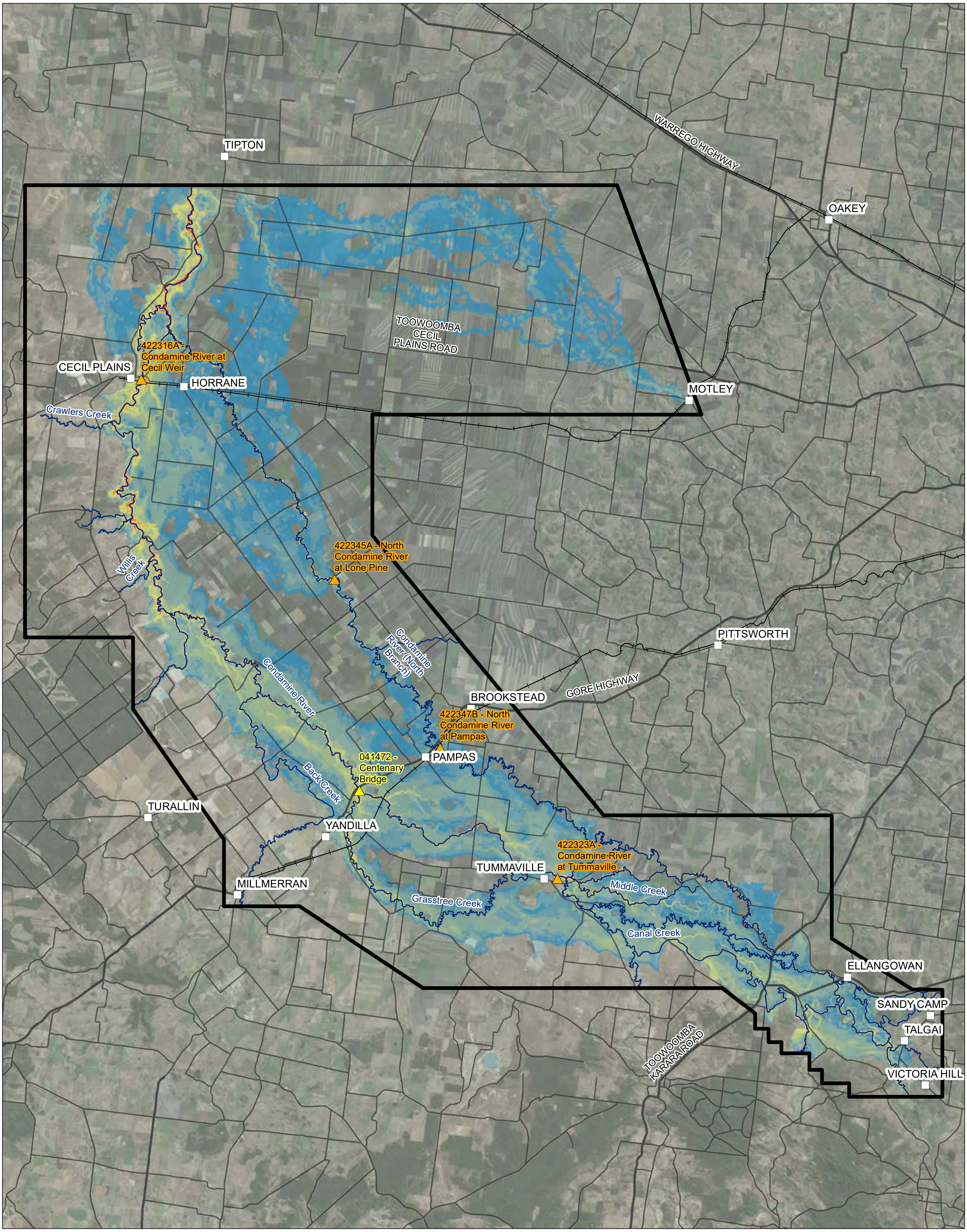
Legend

- Rail
- Minor Roads
- Major Roads
- Waterways
- Model Extent
- ☐ Towns
- △ BoM Gauges
- △ DNRM Gauges

Surface Elevation [mAHD]
415
345

SP051 Flood Studies
Work Package 7 - Addendum 1
20 Year ARI Event
Water Surface Elevation

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

N

Legend

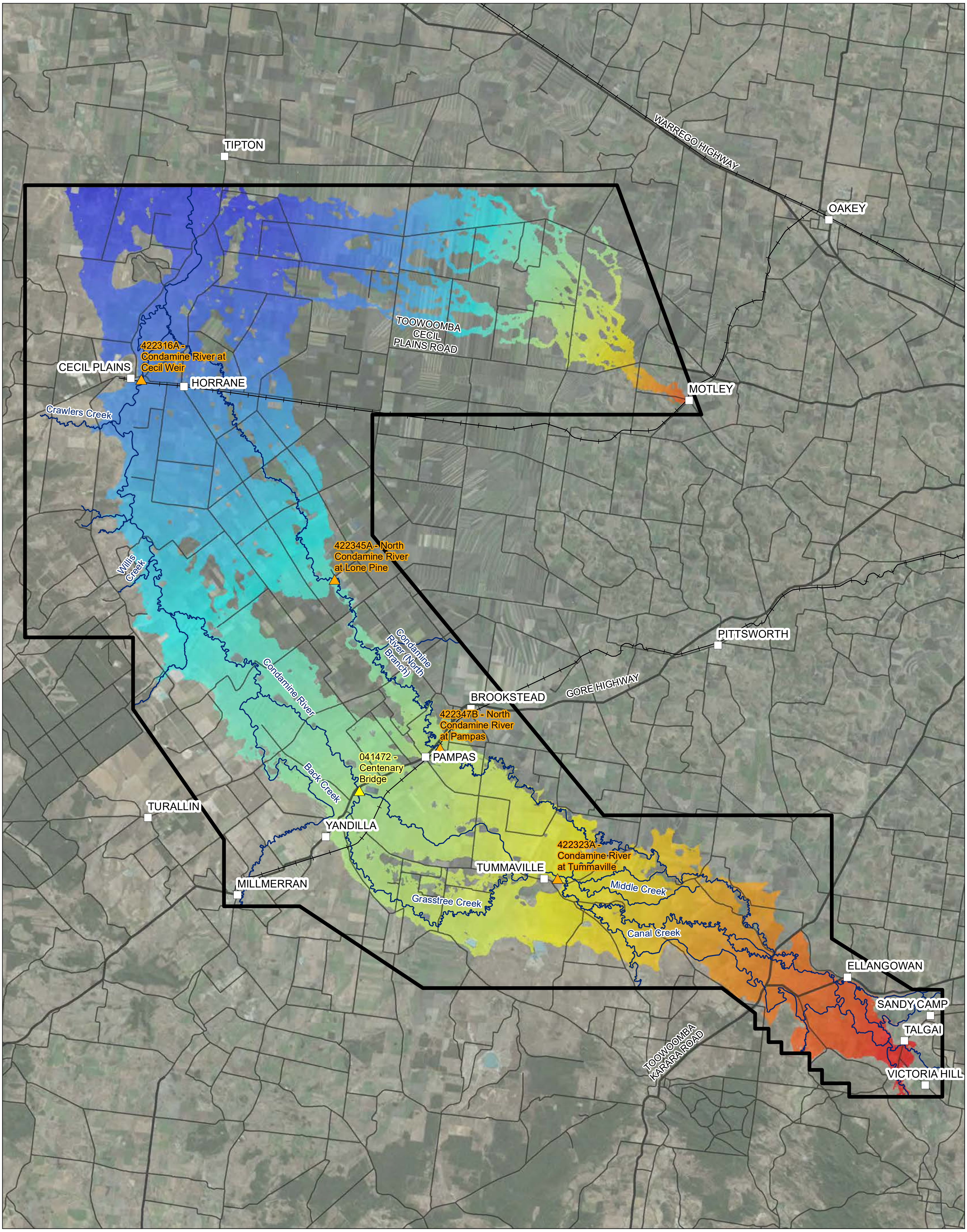
Peak Depth [m]

- 🟦 0 - 0.25
- 🟦 0.25 - 0.50
- 🟩 0.5 - 1.0
- 🟩 1.0 - 1.5
- 🟩 1.5 - 2.0
- 🟨 2.0 - 2.5
- 🟨 2.5 - 3.0
- 🟧 3.0 - 3.5
- 🟧 3.5 - 4.0
- 🟧 4.0 - 4.5
- 🟥 4.5 - 5.0
- 🟥 >5.0
- —+— Rail
- — Minor Roads
- — Major Roads
- — Waterways
- ▭ Model Extent
- □ Towns
- ▲ BoM Gauges
- ▲ DNRM Gauges

SP051 Flood Studies
Work Package 7 - Addendum 1
20 Year ARI Event
Peak Flood Depth

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

Disclaimer: Whilst all due care has been taken in the preparation of the plan and all information (the Plan and all information is referred to as "Plan information"), the accuracy of the Plan Information cannot be guaranteed. The Plan Information is provided as a guide and should not be relied upon in anyway whatsoever. Toowoomba Regional Council takes no responsibility for inaccuracies in the Plan Information and is not liable under any circumstances for any loss or damage whatsoever or howsoever caused arising directly or indirectly in connection with its use. The recipient must verify the Plan Information on site. Please refer any discrepancies to Toowoomba Regional Council - Information, Communications & Technology. No part of the Plan Information should be reproduced without the permission of the Coordinator GIS - ICT Branch, or other delegated representative of Council (131872).



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

N

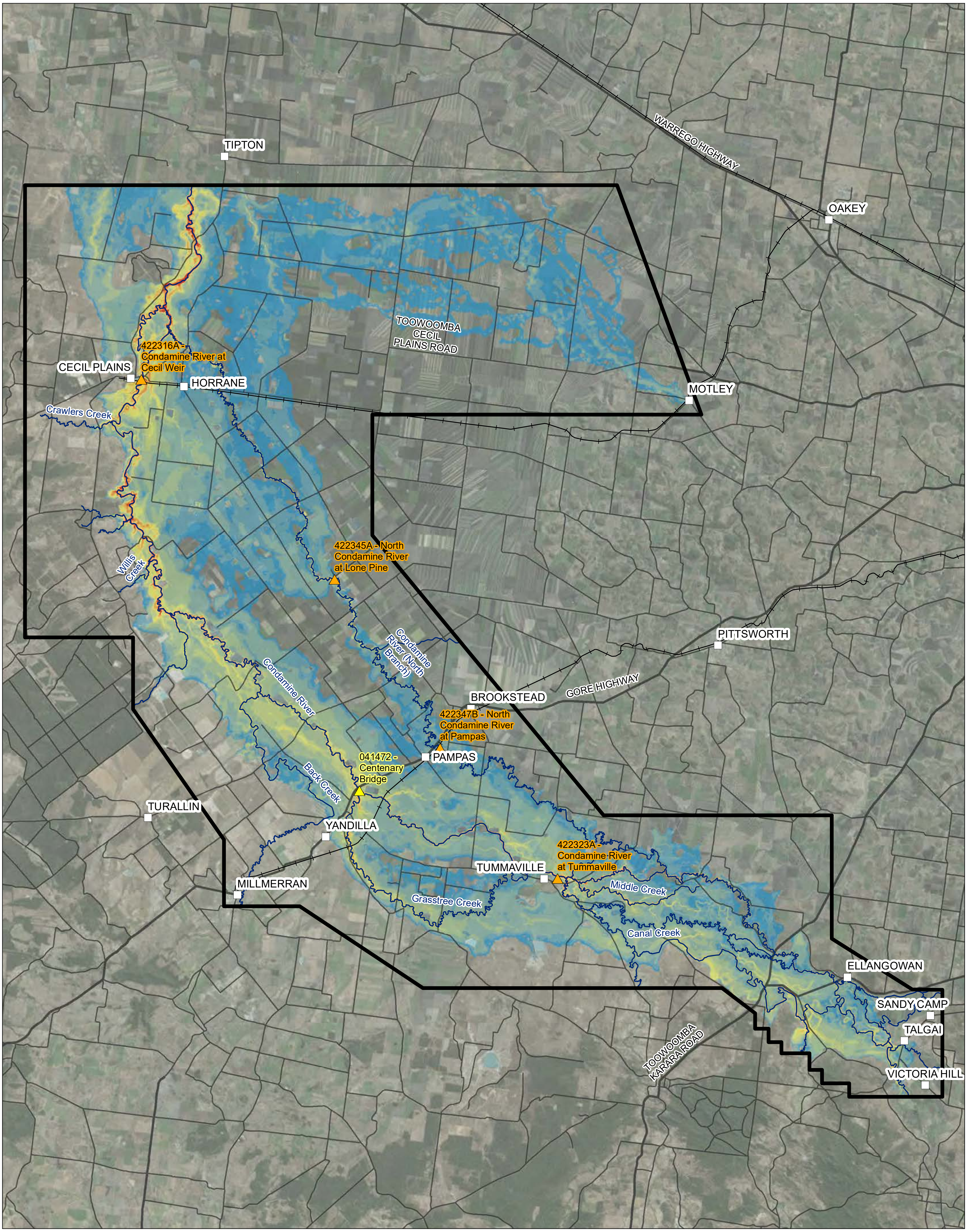
Legend

┼	Rail	▭	Model Extent	Surface Elevation [mAHD]	
—	Minor Roads	☐	Towns		415
—	Major Roads	△	BoM Gauges		
—	Waterways	▲	DNRM Gauges		345

SP051 Flood Studies
Work Package 7 - Addendum 1
100 Year ARI Event
Water Surface Elevation

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 - Addendum 1
100 Year ARI Event
Peak Flood Depth



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

N

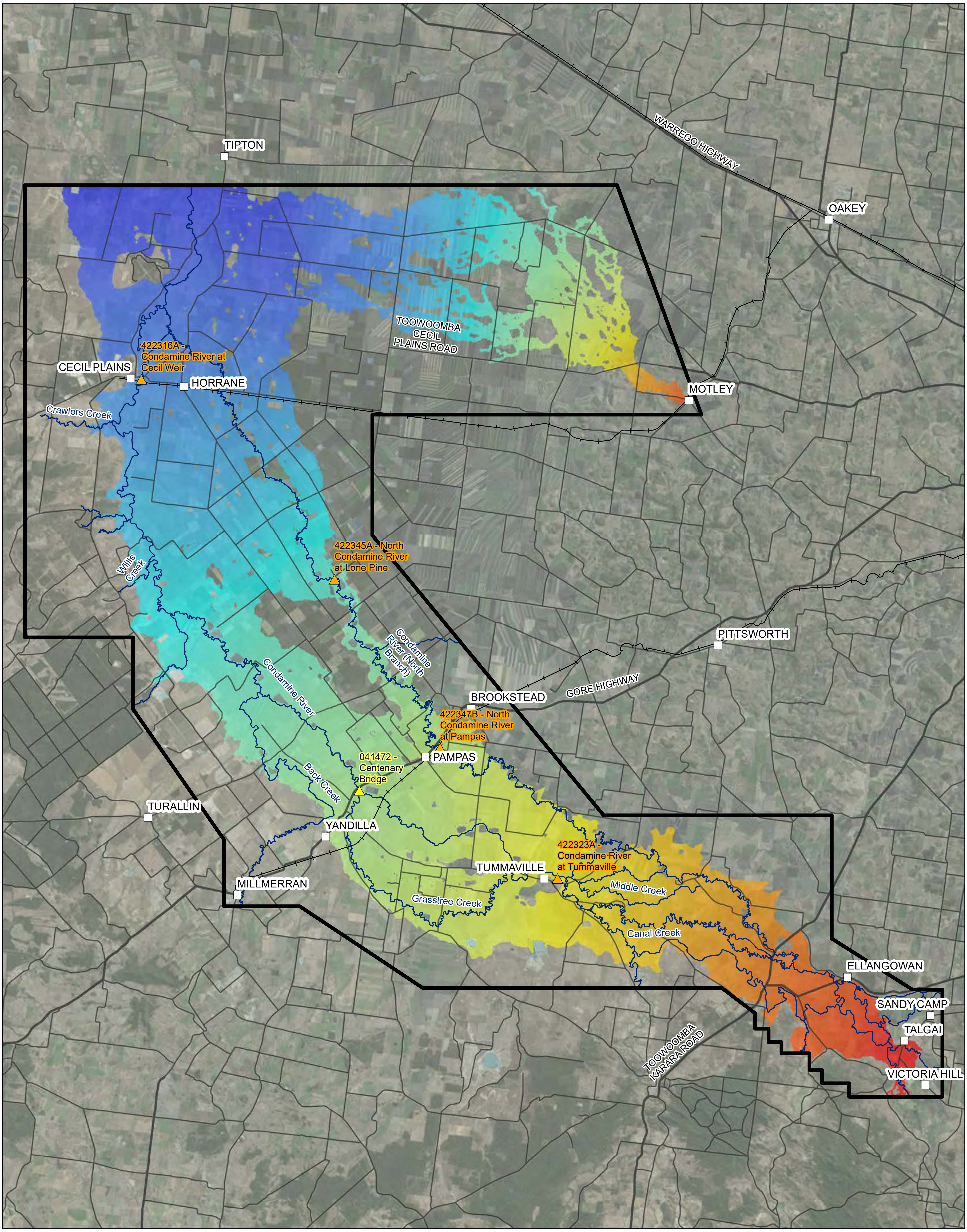
Legend

Peak Depth [m]

- 🟦 0 - 0.25
- 🟦 0.25 - 0.50
- 🟩 0.5 - 1.0
- 🟩 1.0 - 1.5
- 🟩 1.5 - 2.0
- 🟨 2.0 - 2.5
- 🟨 2.5 - 3.0
- 🟧 3.0 - 3.5
- 🟧 3.5 - 4.0
- 🟧 4.0 - 4.5
- 🟥 4.5 - 5.0
- 🟥 >5.0

- ┼ Rail
- — Minor Roads
- — Major Roads
- — Waterways
- ▭ Model Extent
- ☐ Towns
- △ BoM Gauges
- △ DNRM Gauges

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.



1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

N

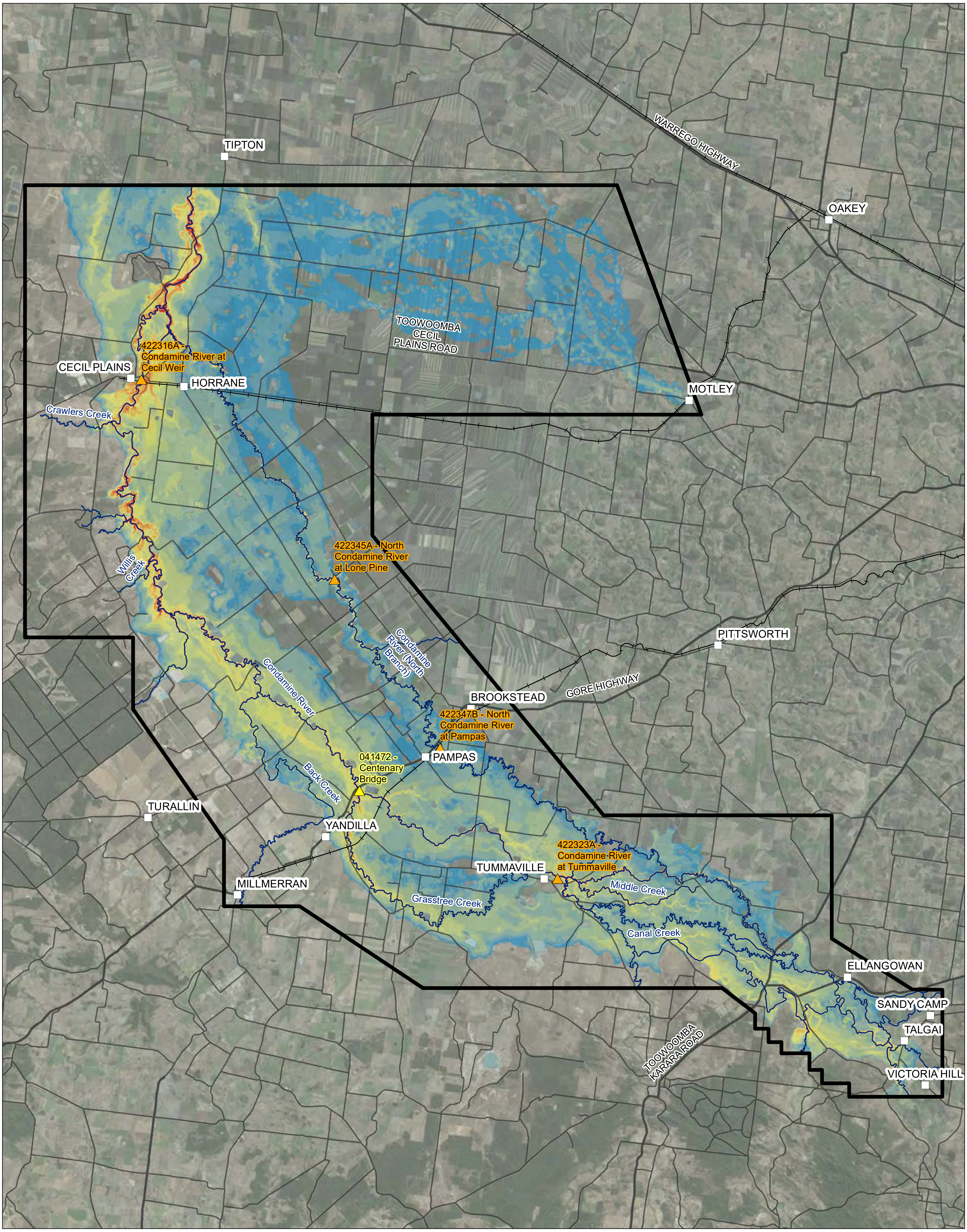
Legend

Rail	Model Extent	Surface Elevation [mAHD]
Minor Roads	☐ Towns	415
Major Roads	△ BoM Gauges	
Waterways	▲ DNRM Gauges	345

SP051 Flood Studies
Work Package 7 - Addendum 1
500 Year ARI Event
Water Surface Elevation

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

Disclaimer: Whilst all due care has been taken in the preparation of the plan and all information (the Plan and all information is referred to as “Plan information”), the accuracy of the Plan Information cannot be guaranteed. The Plan Information is provided as a guide and should not be relied upon in anyway whatsoever. Toowoomba Regional Council takes no responsibility for inaccuracies in the Plan Information and is not liable under any circumstances for any loss or damage whatsoever or howsoever caused arising directly or indirectly in connection with its use. The recipient must verify the Plan Information on site. Please refer any discrepancies to Toowoomba Regional Council - Information, Communications & Technology. No part of the Plan Information should be reproduced without the permission of the Coordinator GIS - ICT Branch, or other delegated representative of Council (131872).



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

N

Legend

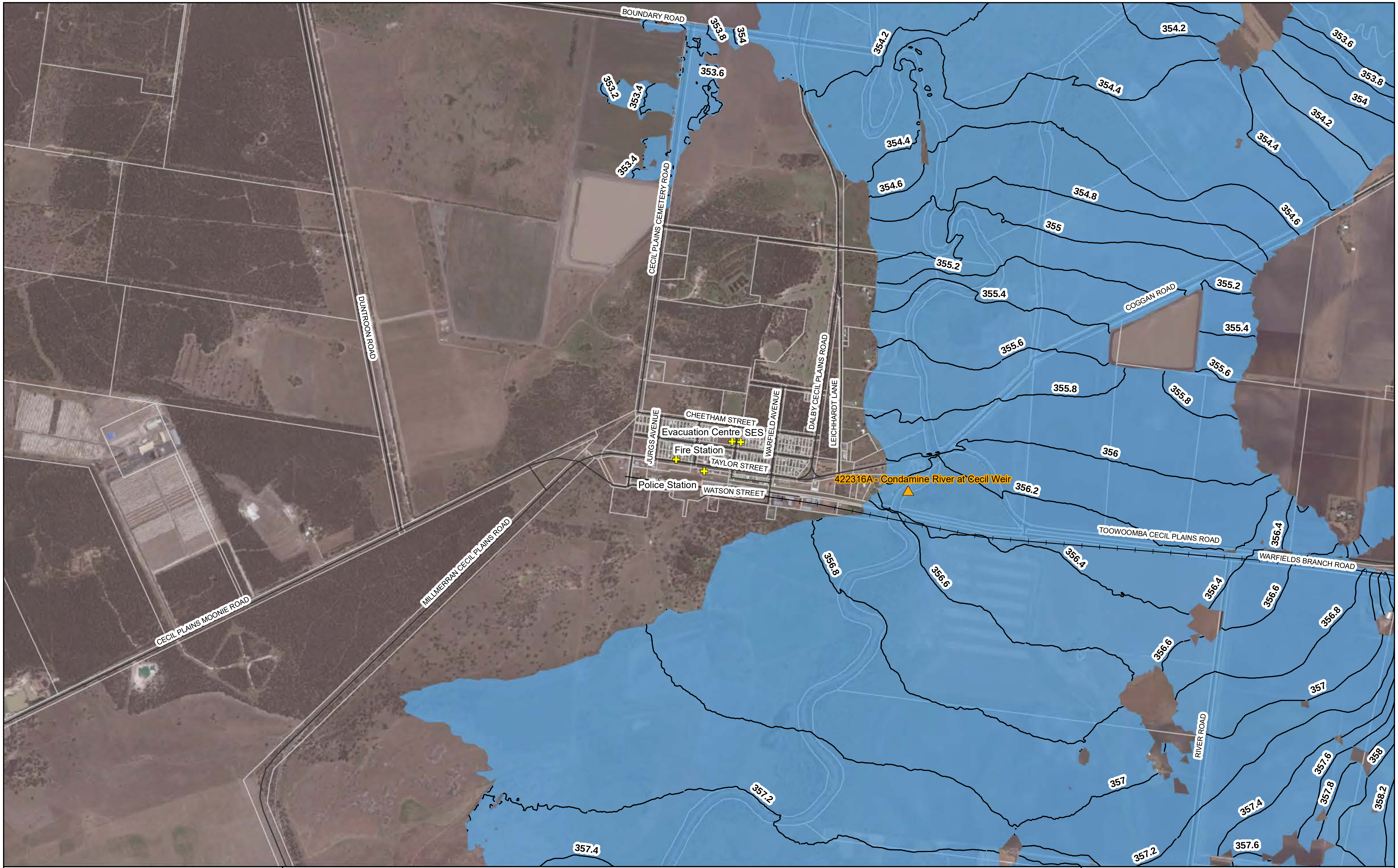
Peak Depth [m]

- 🟦 0 - 0.25
- 🟦 0.25 - 0.50
- 🟩 0.5 - 1.0
- 🟩 1.0 - 1.5
- 🟩 1.5 - 2.0
- 🟨 2.0 - 2.5
- 🟨 2.5 - 3.0
- 🟧 3.0 - 3.5
- 🟧 3.5 - 4.0
- 🟧 4.0 - 4.5
- 🟥 4.5 - 5.0
- 🟥 >5.0

- Rail
- Minor Roads
- Major Roads
- Waterways
- Model Extent
- ☐ Towns
- ▲ BoM Gauges
- ▲ DNRM Gauges

SP051 Flood Studies
Work Package 7 - Addendum 1
500 Year ARI Event
Peak Flood Depth

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

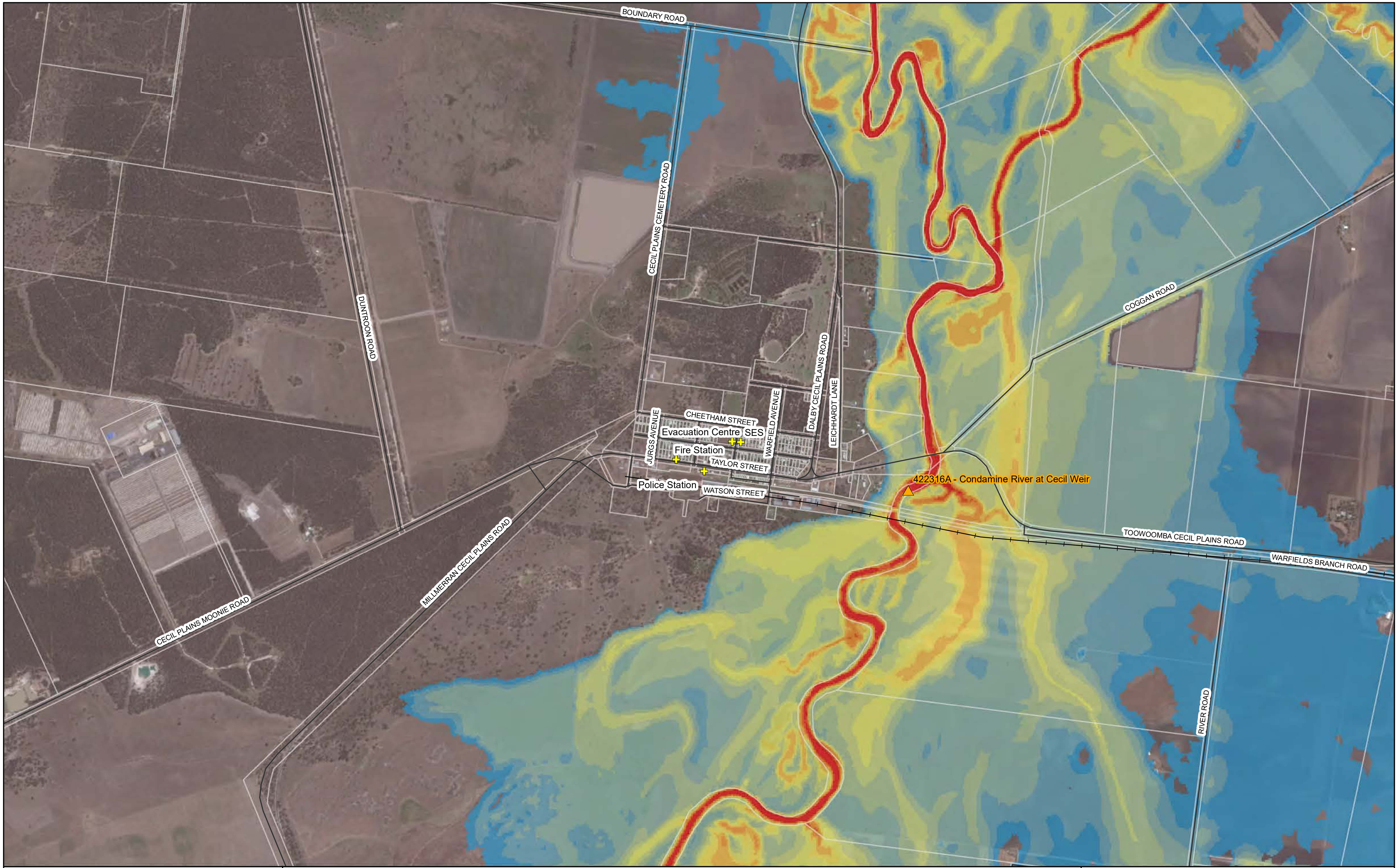
Legend

✚ Emergency Locations	— Roads	▭ Inundation Extent
┼ Rail	△ BoM Gauges	— Water Level Contours [mAHD]
▭ Cadastre	△ DNRM Gauges	

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
10 Year ARI Event Peak Water Level

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\CEC_Map01_SurfaceElevation_Q010.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

Legend

✚ Emergency Locations
—— Roads
─┼─ Rail
△ BoM Gauges
☐ Cadastre
▲ DNRM Gauges

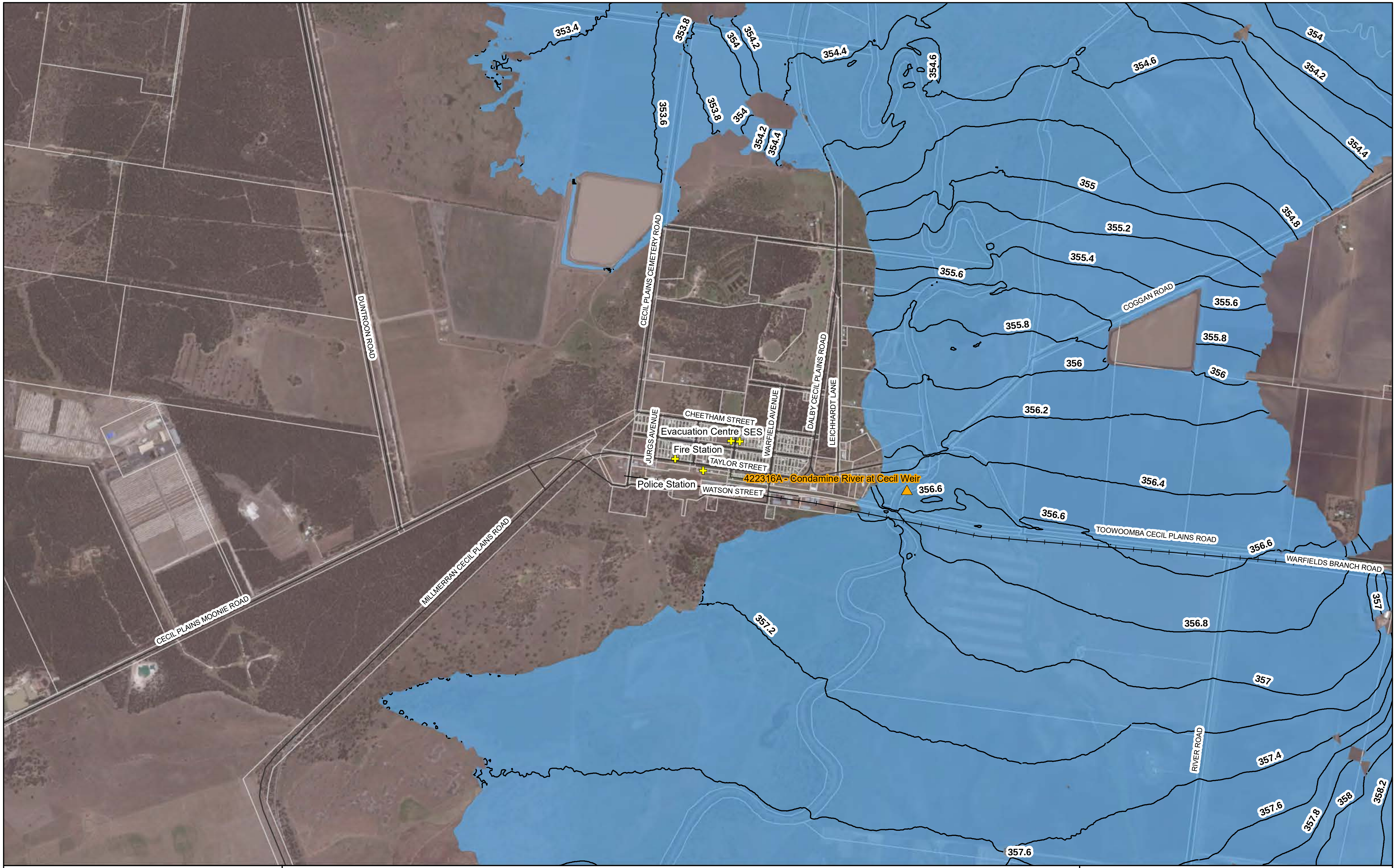
Peak Depth [m]

🟦 0 - 0.25	0.5 - 1.0	2.0 - 2.5	3.5 - 4.0
🟦 0.25 - 0.50	1.0 - 1.5	2.5 - 3.0	4.0 - 4.5
	1.5 - 2.0	3.0 - 3.5	4.5 - 5.0
			🟥 >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
10 Year ARI Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Design\CEC_Map02_FloodDepth_Q010.mxd
Date Saved: 14/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

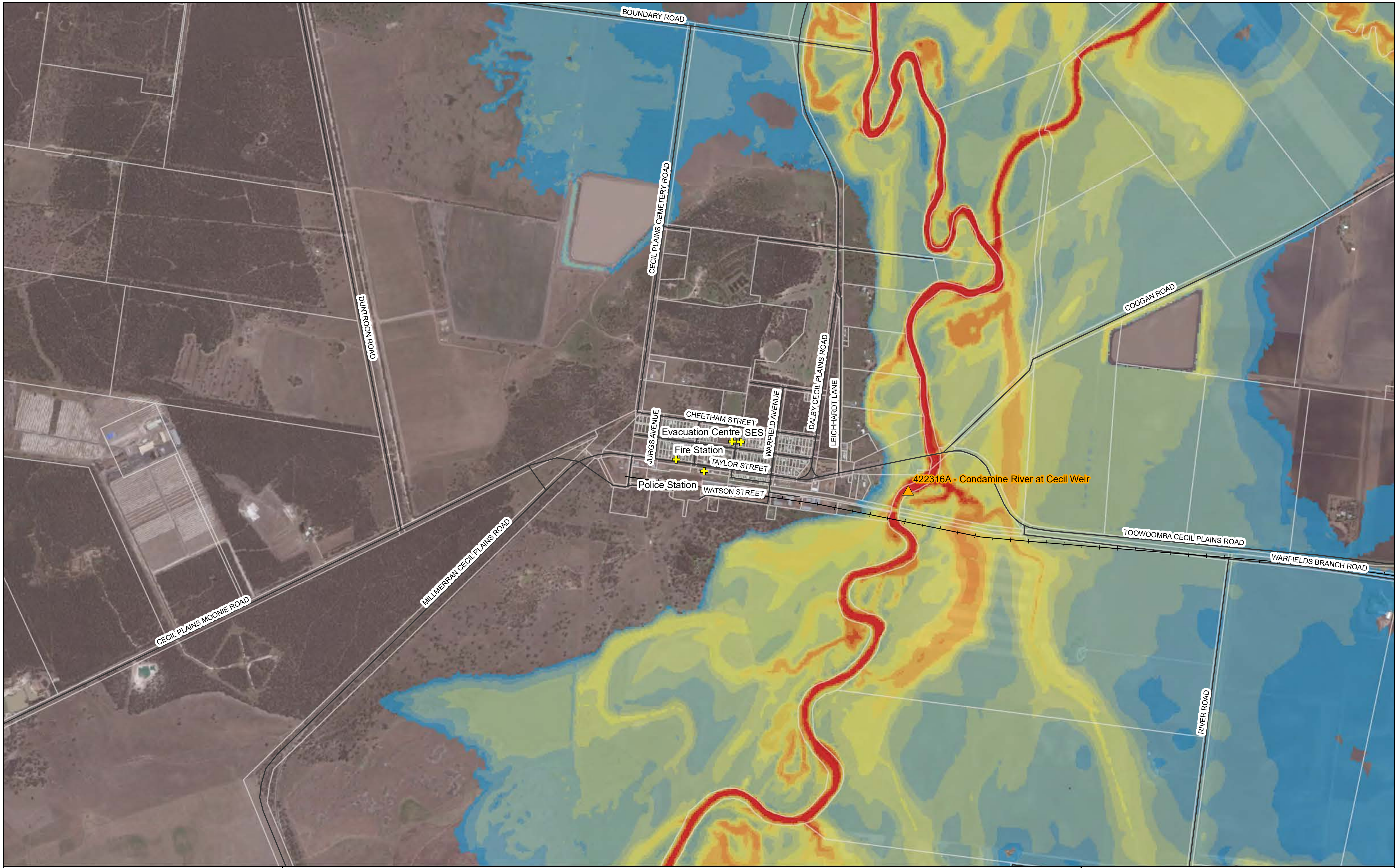
Legend

✚ Emergency Locations	— Roads	▭ Inundation Extent
–+– Rail	△ BoM Gauges	— Water Level Contours [mAHD]
▭ Cadastre	▲ DNRM Gauges	

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

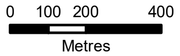
SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
20 Year ARI Event Peak Water Level

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\CEC_Map01_SurfaceElevation_Q020.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)



GDA 1994 MGA Zone 56

Legend

✚ Emergency Locations	Roads	Peak Depth [m]	▨ 0.5 - 1.0	▨ 2.0 - 2.5	▨ 3.5 - 4.0
Rail	△ BoM Gauges	▨ 0 - 0.25	▨ 1.0 - 1.5	▨ 2.5 - 3.0	▨ 4.0 - 4.5
☐ Cadastre	△ DNRM Gauges	▨ 0.25 - 0.50	▨ 1.5 - 2.0	▨ 3.0 - 3.5	▨ 4.5 - 5.0
					▨ >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
20 Year ARI Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Design\CEC_Map02_FloodDepth_Q020.mxd
Date Saved: 14/11/2015

TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

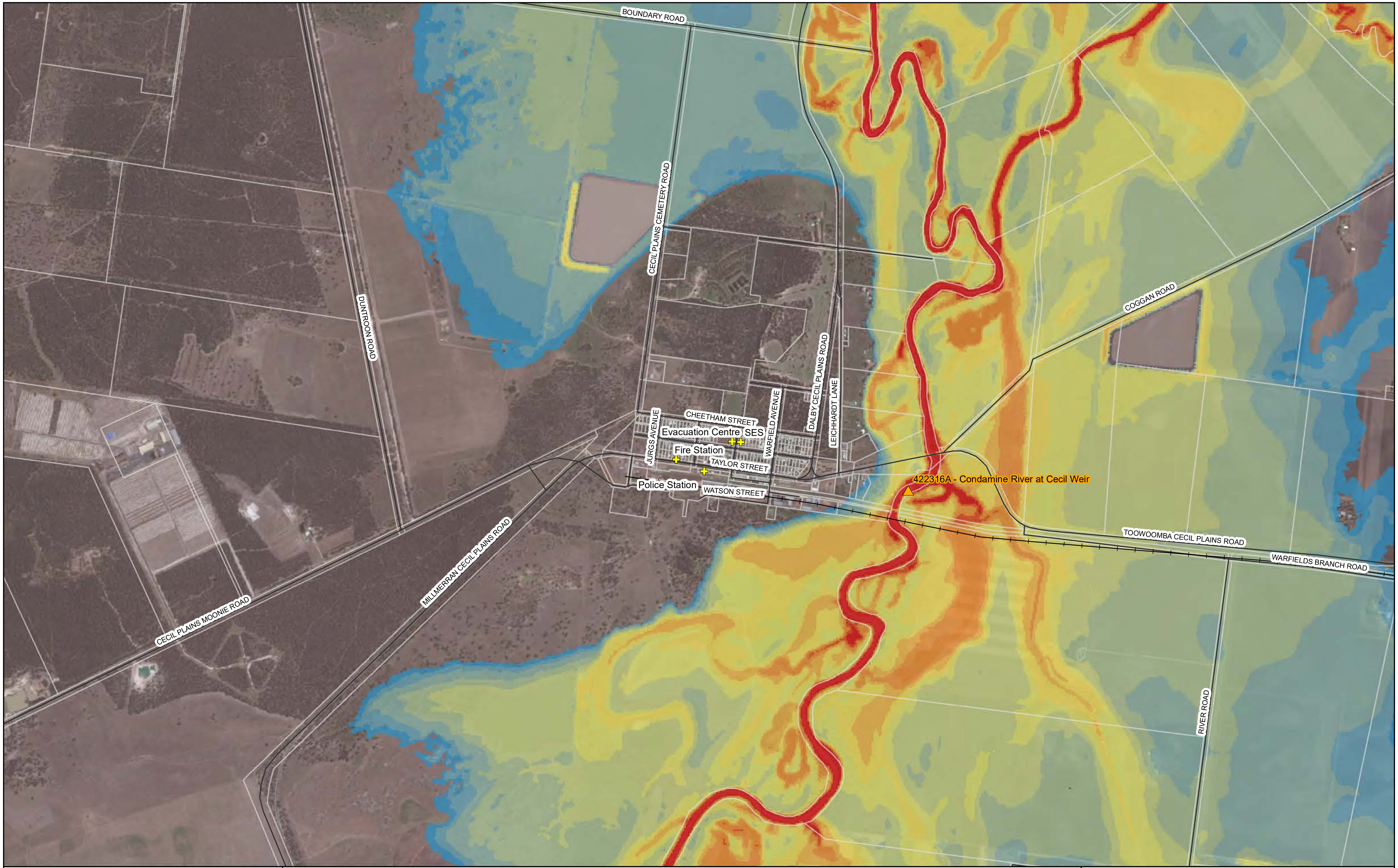
Legend

- ✚ Emergency Locations
- ┼ Rail
- ☐ Cadastre
- — Roads
- △ BoM Gauges
- ▲ DNRM Gauges
- 🟦 Inundation Extent
- — Water Level Contours [mAHD]

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
100 Year ARI Event Peak Water Level

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\CEC_Map01_SurfaceElevation_Q100.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

- ✚ Emergency Locations
- ─┼─ Rail
- ▭ Cadastre
- ── Roads
- △ BoM Gauges
- ▲ DNRM Gauges

Peak Depth [m]

- 🟦 0 - 0.25
- 🟦 0.25 - 0.50
- 🟩 0.5 - 1.0
- 🟩 1.0 - 1.5
- 🟩 1.5 - 2.0
- 🟨 2.0 - 2.5
- 🟨 2.5 - 3.0
- 🟨 3.0 - 3.5
- 🟧 3.5 - 4.0
- 🟧 4.0 - 4.5
- 🟥 4.5 - 5.0
- 🟥 >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
100 Year ARI Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Design\CEC_Map02_FloodDepth_Q100.mxd
Date Saved: 14/11/2015

TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

Legend

✚ Emergency Locations

┼ Rail

▭ Cadastre

— Roads

△ BoM Gauges

▲ DNRM Gauges

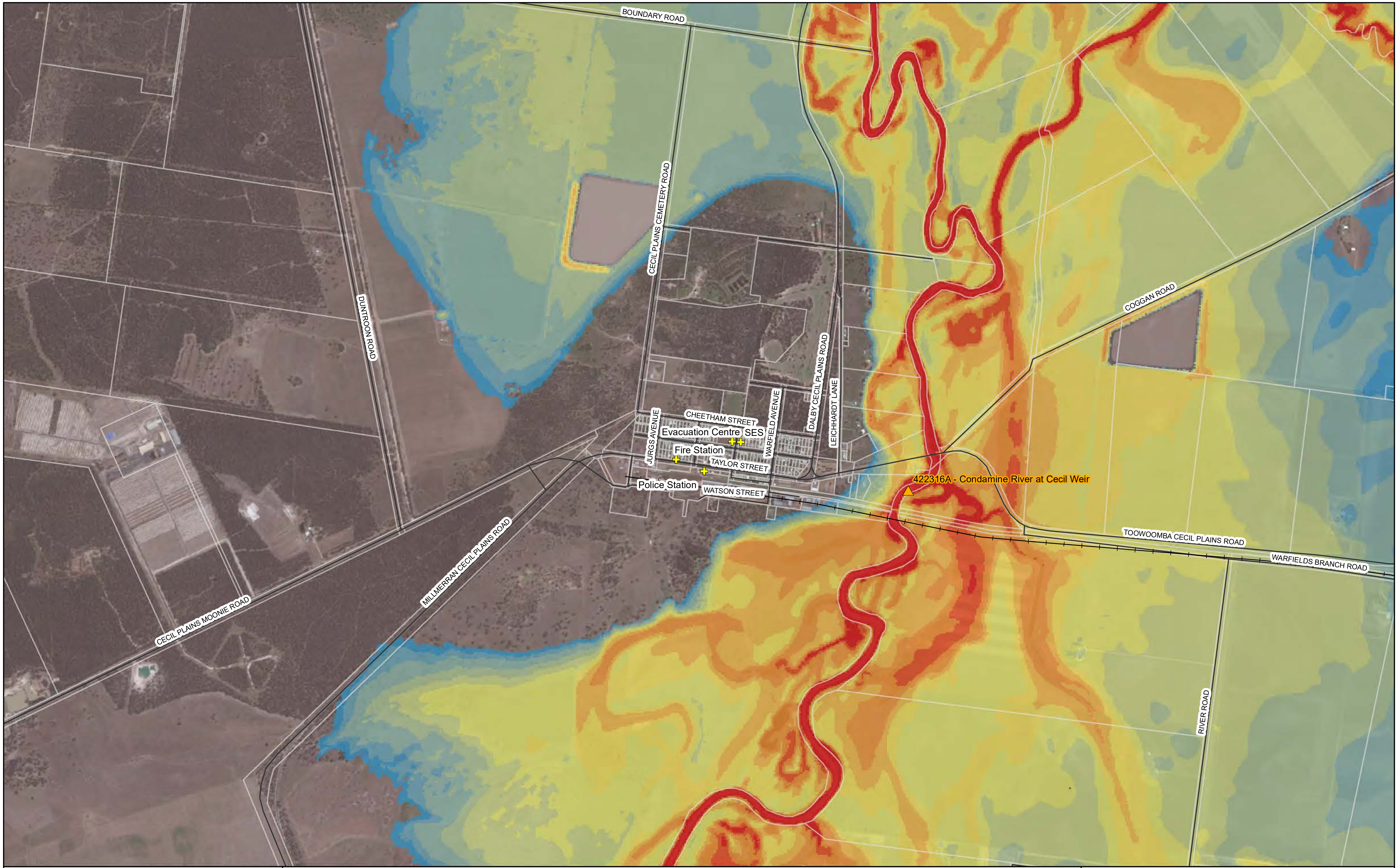
🟦 Inundation Extent

— Water Level Contours [mAHD]

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
500 Year ARI Event Peak Water Level

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\CEC_Map01_SurfaceElevation_Q500.mxd
Date Saved: 8/11/2015



TOOWOOMBA
REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

Legend

✚ Emergency Locations

— Roads

┼ Rail

△ BoM Gauges

▭ Cadastre

▲ DNRM Gauges

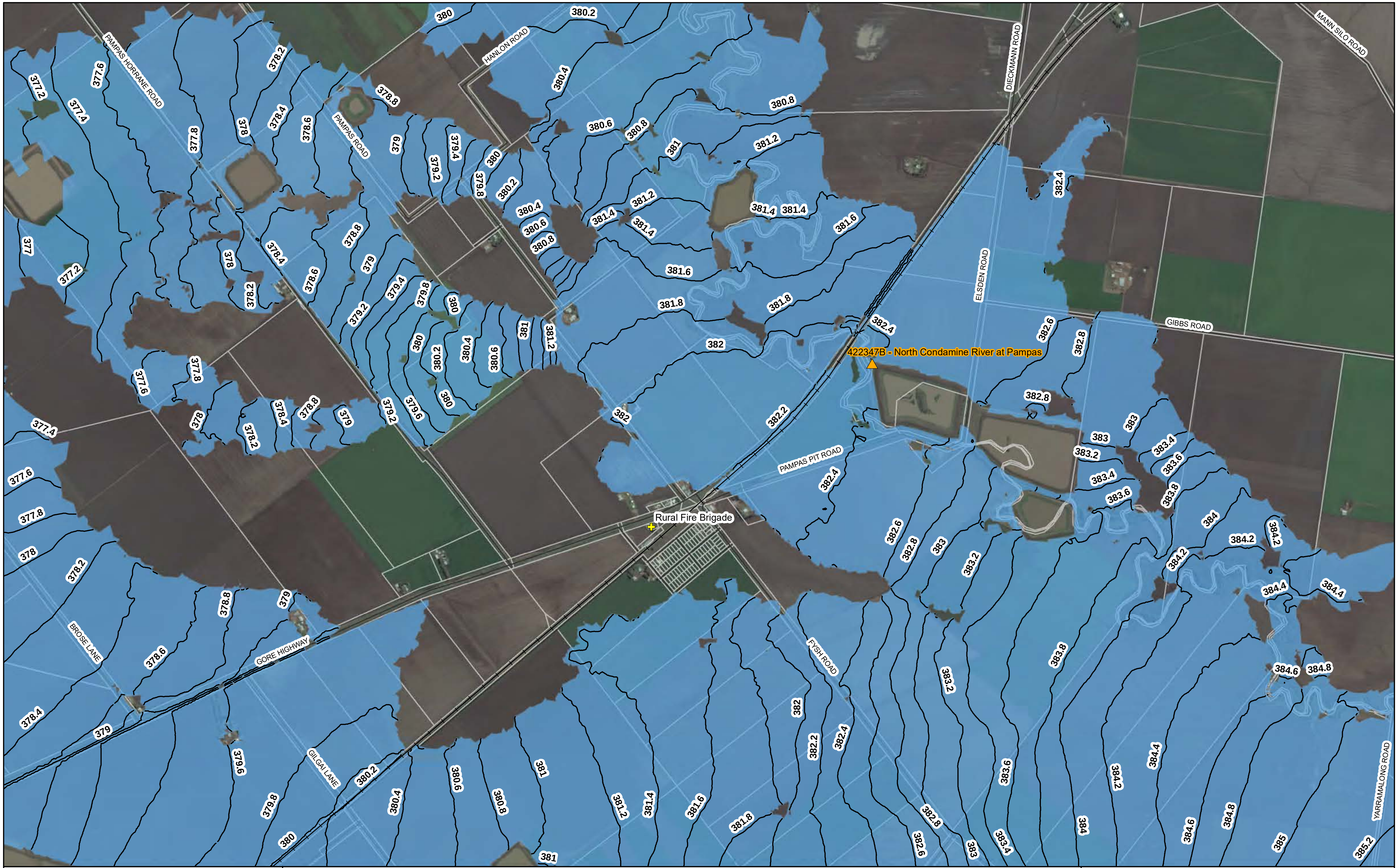
Peak Depth [m]

- 🟦 0 - 0.25
- 🟦 0.25 - 0.50
- 🟩 0.5 - 1.0
- 🟩 1.0 - 1.5
- 🟩 1.5 - 2.0
- 🟨 2.0 - 2.5
- 🟨 2.5 - 3.0
- 🟧 3.0 - 3.5
- 🟧 3.5 - 4.0
- 🟧 4.0 - 4.5
- 🟥 4.5 - 5.0
- 🟥 >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
500 Year ARI Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Design\CEC_Map02_FloodDepth_Q500.mxd
Date Saved: 14/11/2015



1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

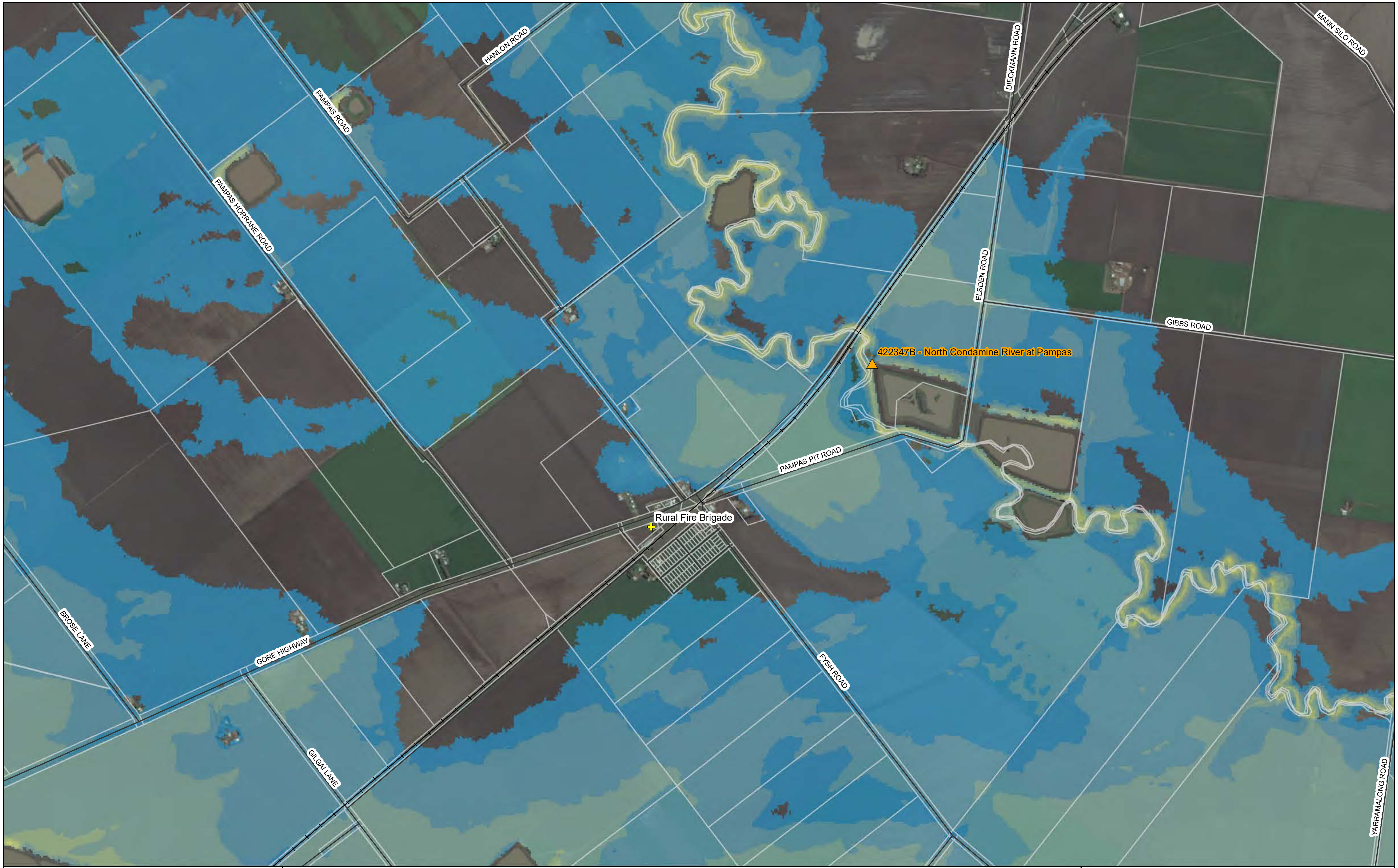
Legend

✚ Emergency Locations	— Roads	▭ Inundation Extent
┼ Rail	△ BoM Gauges	— Water Level Contours [mAHD]
▭ Cadastre	△ DNRM Gauges	

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
10 Year ARI Event Peak Water Level

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\PAM_Map01_SurfaceElevation_Q010.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

Legend

- ✚ Emergency Locations
- Rail
- Cadastre
- Roads
- △ BoM Gauges
- ▲ DNRM Gauges

Peak Depth [m]

- 🟦 0 - 0.25
- ▨ 0.25 - 0.50
- ▨ 0.5 - 1.0
- ▨ 1.0 - 1.5
- ▨ 1.5 - 2.0
- 🟨 2.0 - 2.5
- 🟨 2.5 - 3.0
- 🟧 3.0 - 3.5
- 🟧 3.5 - 4.0
- 🟧 4.0 - 4.5
- 🟧 4.5 - 5.0
- 🟥 >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
10 Year ARI Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Design\PAM_Map02_FloodDepth_Q010.mxd
Date Saved: 14/11/2015

TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

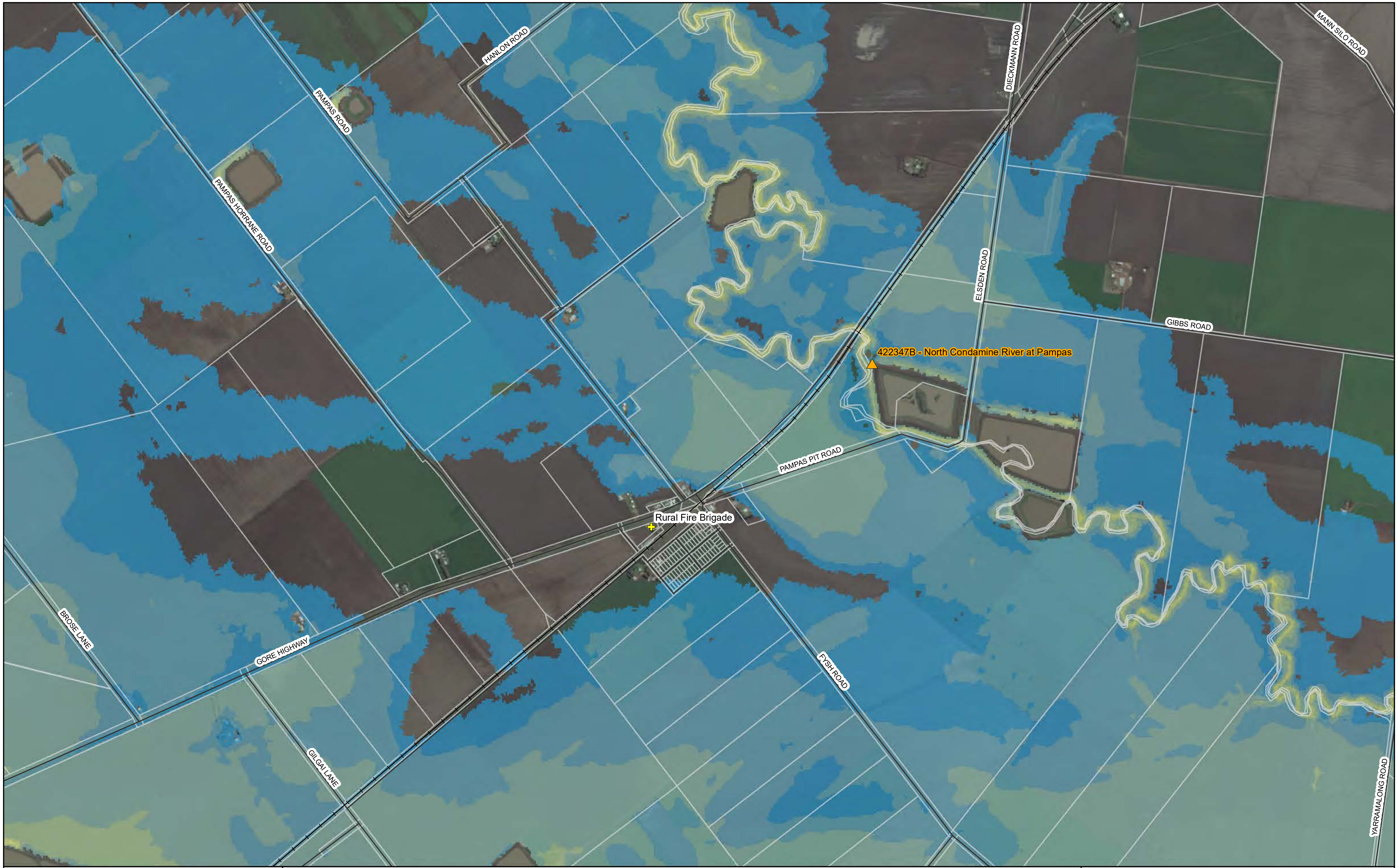
Legend

✚ Emergency Locations	— Roads	▭ Inundation Extent
┼ Rail	▲ BoM Gauges	— Water Level Contours [mAHD]
▭ Cadastre	▲ DNRM Gauges	

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
20 Year ARI Event Peak Water Level

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\PAM_Map01_SurfaceElevation_Q020.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

- ✚ Emergency Locations
- ┼ Rail
- ▭ Cadastre
- — Roads
- △ BoM Gauges
- ▲ DNRM Gauges

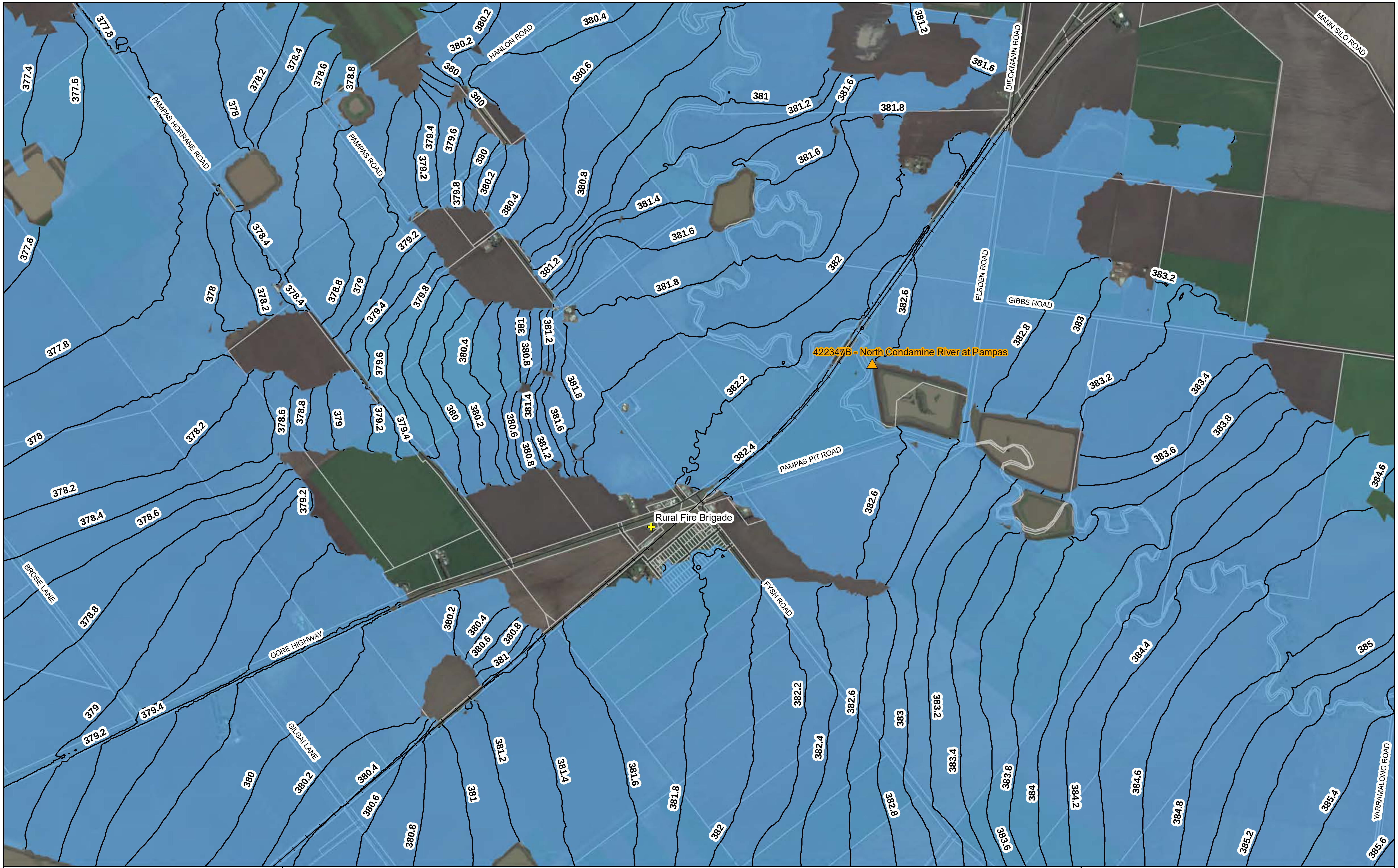
Peak Depth [m]

- ▨ 0 - 0.25
- ▨ 0.25 - 0.50
- ▨ 0.5 - 1.0
- ▨ 1.0 - 1.5
- ▨ 1.5 - 2.0
- ▨ 2.0 - 2.5
- ▨ 2.5 - 3.0
- ▨ 3.0 - 3.5
- ▨ 3.5 - 4.0
- ▨ 4.0 - 4.5
- ▨ 4.5 - 5.0
- ▨ >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
20 Year ARI Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Design\PAM_Map02_FloodDepth_Q020.mxd
Date Saved: 14/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

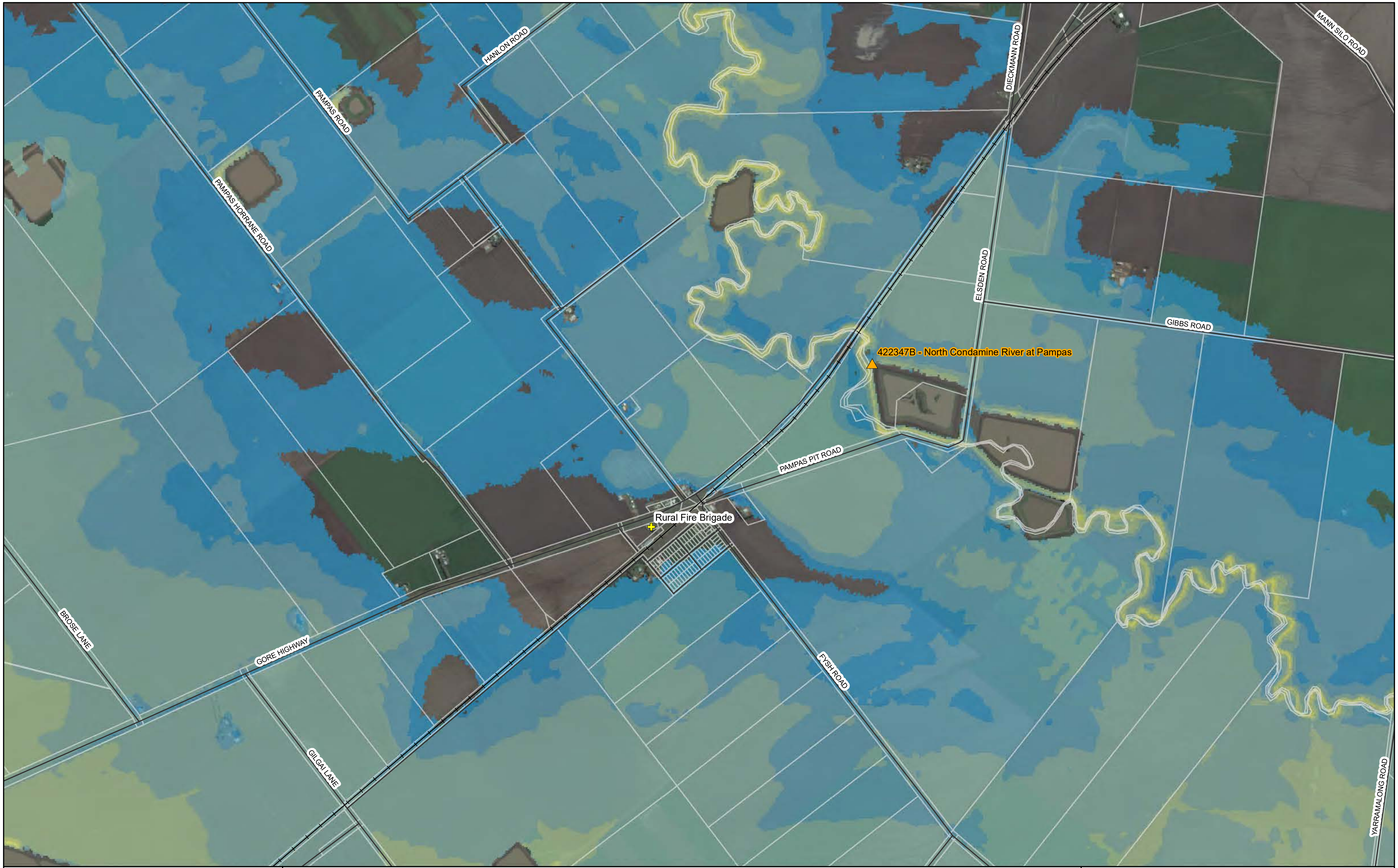
Legend

- ✚ Emergency Locations
- ┼ Rail
- ☐ Cadastre
- — Roads
- △ BoM Gauges
- △ DNRM Gauges
- ▭ Inundation Extent
- — Water Level Contours [mAHD]

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
100 Year ARI Event Peak Water Level

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\PAM_Map01_SurfaceElevation_Q100.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

Legend

- ✚ Emergency Locations
- —+— Rail
- ☐ Cadastre
- —— Roads
- △ BoM Gauges
- ▲ DNRM Gauges

Peak Depth [m]

- ■ 0 - 0.25
- ■ 0.25 - 0.50
- ■ 0.5 - 1.0
- ■ 1.0 - 1.5
- ■ 1.5 - 2.0
- ■ 2.0 - 2.5
- ■ 2.5 - 3.0
- ■ 3.0 - 3.5
- ■ 3.5 - 4.0
- ■ 4.0 - 4.5
- ■ 4.5 - 5.0
- ■ >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
100 Year ARI Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Design\PAM_Map02_FloodDepth_Q100.mxd
Date Saved: 14/11/2015

Legend

- ✚ Emergency Locations
- —+— Rail
- ☐ Cadastre
- — Roads
- △ BoM Gauges
- △ DNRM Gauges
- ▭ Inundation Extent
- — Water Level Contours [mAHD]

TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

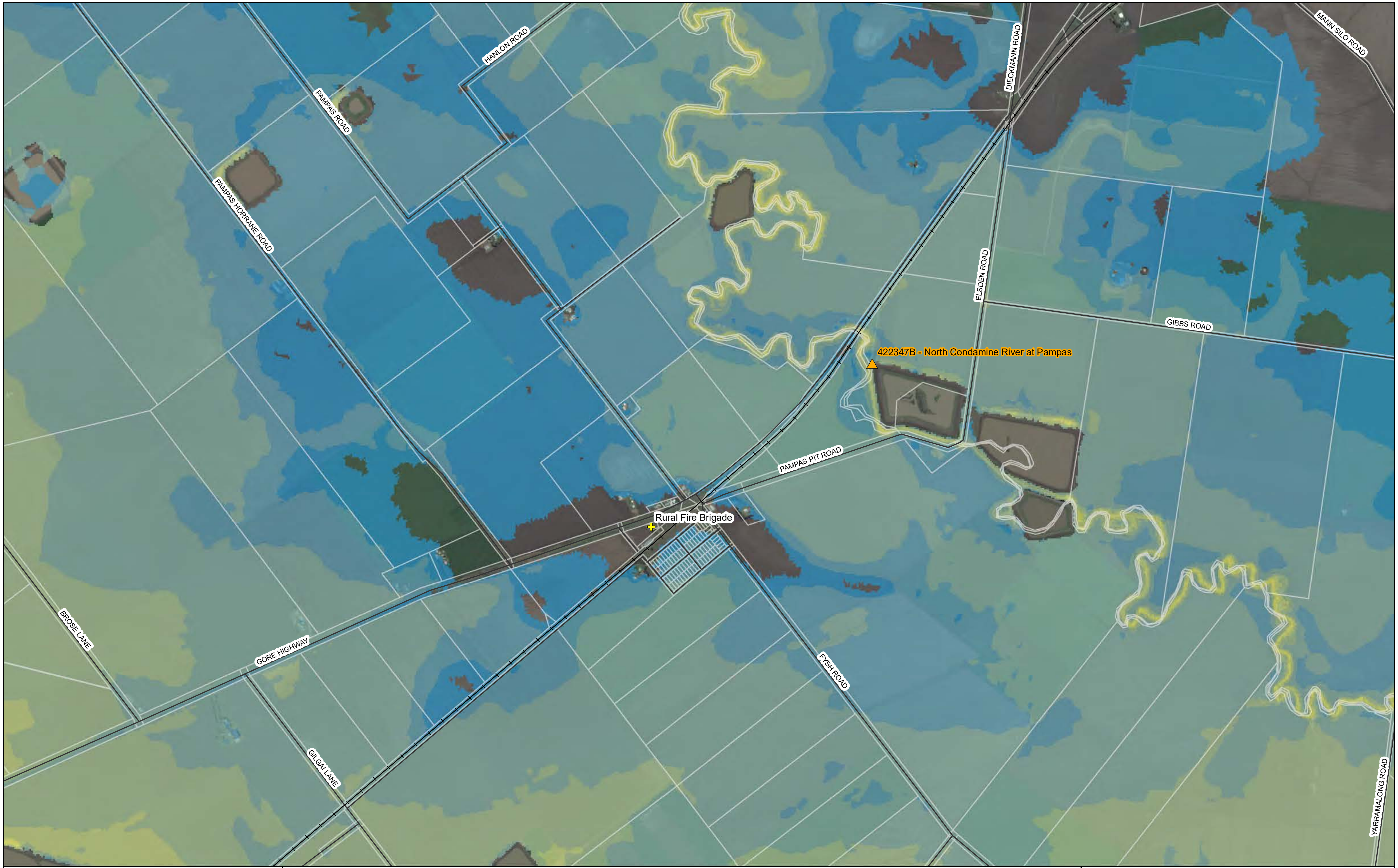
Metres

GDA 1994 MGA Zone 56

N

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
500 Year ARI Event Peak Water Level



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

- ✚ Emergency Locations
- ─ Roads
- ┼ Rail
- △ BoM Gauges
- ▢ Cadastre
- ▲ DNRM Gauges

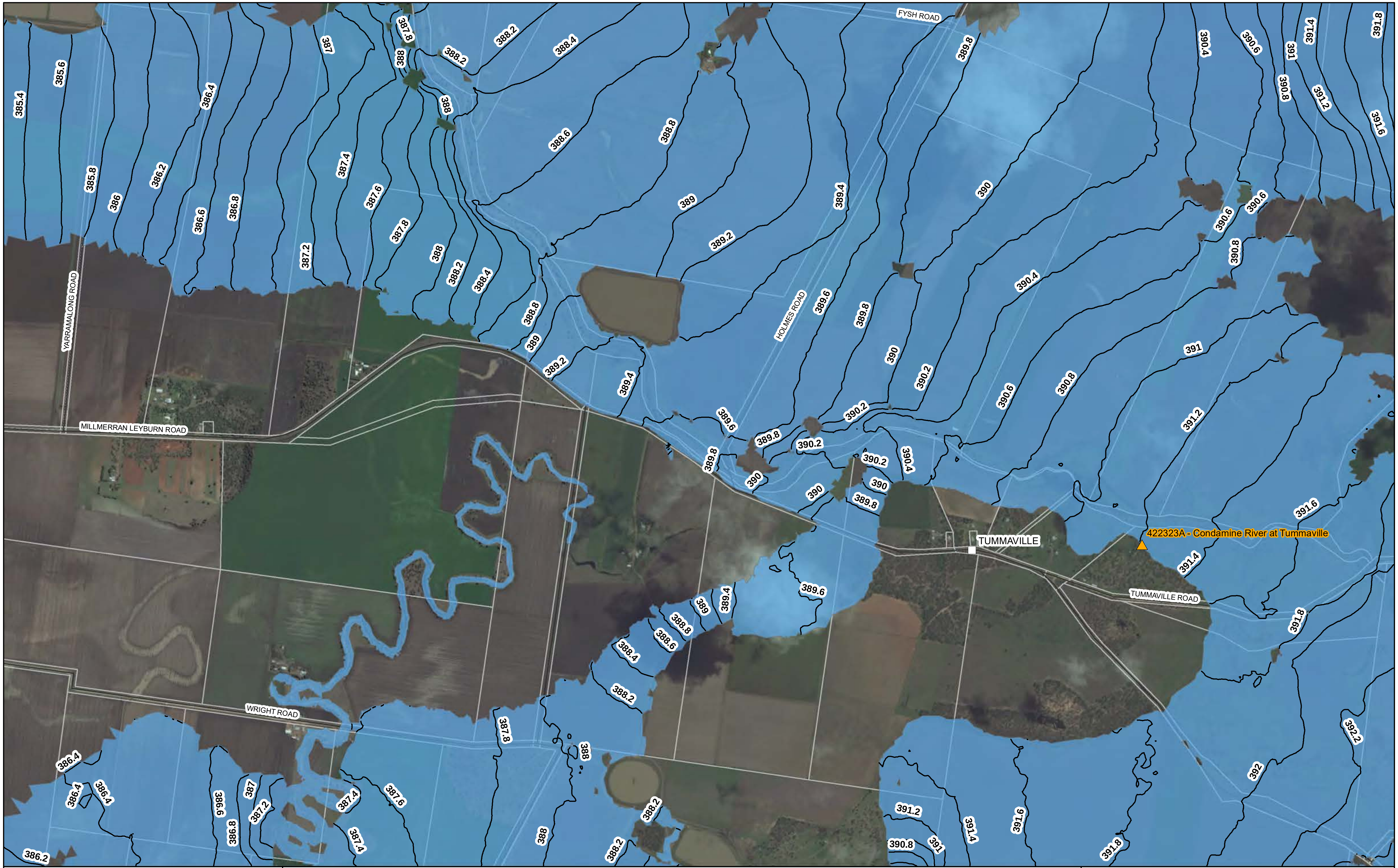
Peak Depth [m]

- ■ 0 - 0.25
- ■ 0.25 - 0.50
- ■ 0.5 - 1.0
- ■ 1.0 - 1.5
- ■ 1.5 - 2.0
- ■ 2.0 - 2.5
- ■ 2.5 - 3.0
- ■ 3.0 - 3.5
- ■ 3.5 - 4.0
- ■ 4.0 - 4.5
- ■ 4.5 - 5.0
- ■ >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
500 Year ARI Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Design\PAM_Map02_FloodDepth_Q500.mxd
Date Saved: 14/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

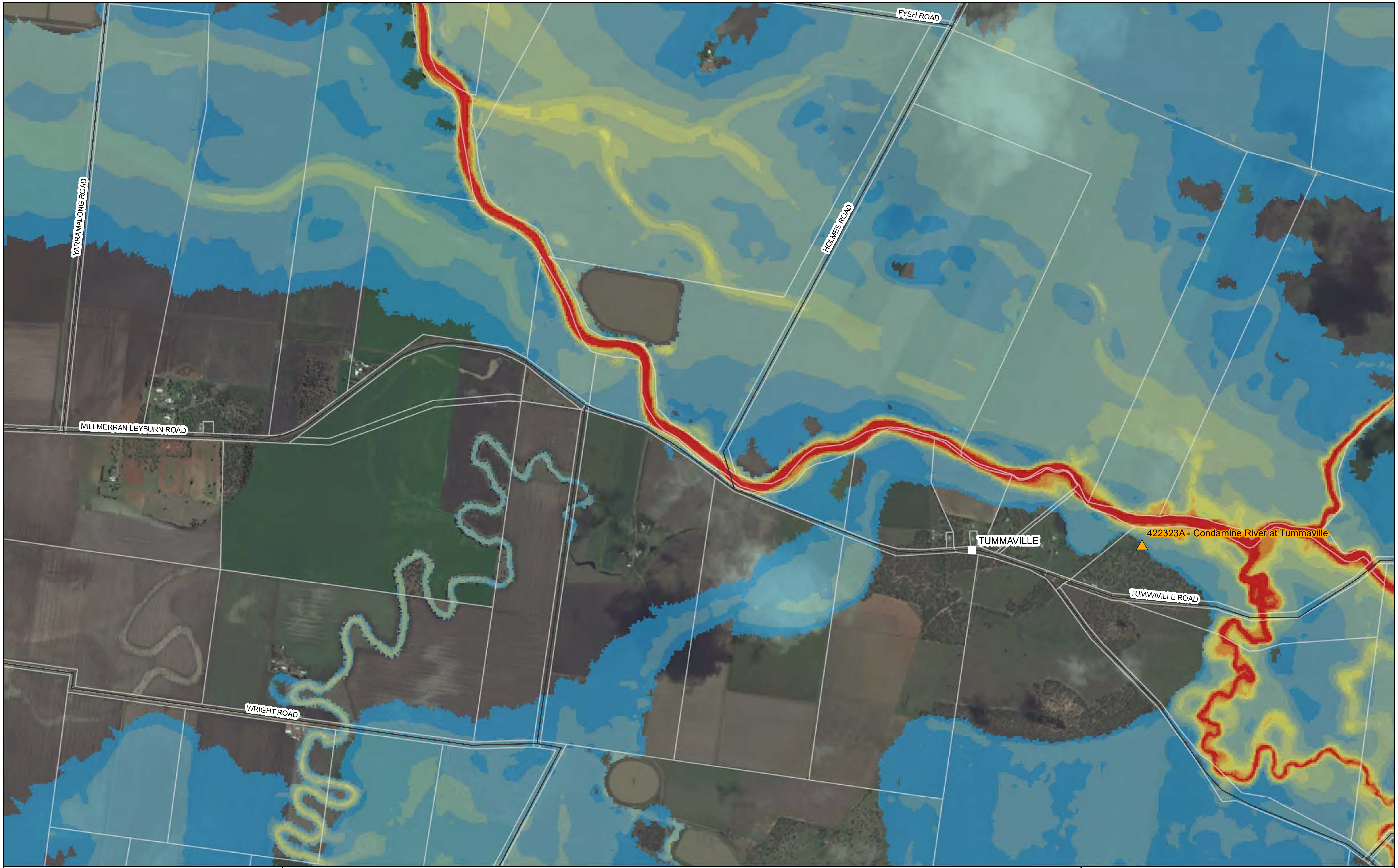
Legend

✚ Emergency Locations	—— Roads	☐ Towns
—+— Rail	△ BoM Gauges	▭ Inundation Extent
☐ Cadastre	▲ DNRM Gauges	—— Water Level Contours [mAHD]

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
10 Year ARI Event Peak Water Level

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\TUM_Map01_SurfaceElevation_Q010.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

- ✚ Emergency Locations
- Rail
- Cadastre
- Roads
- □ Towns
- △ BoM Gauges
- △ DNRM Gauges

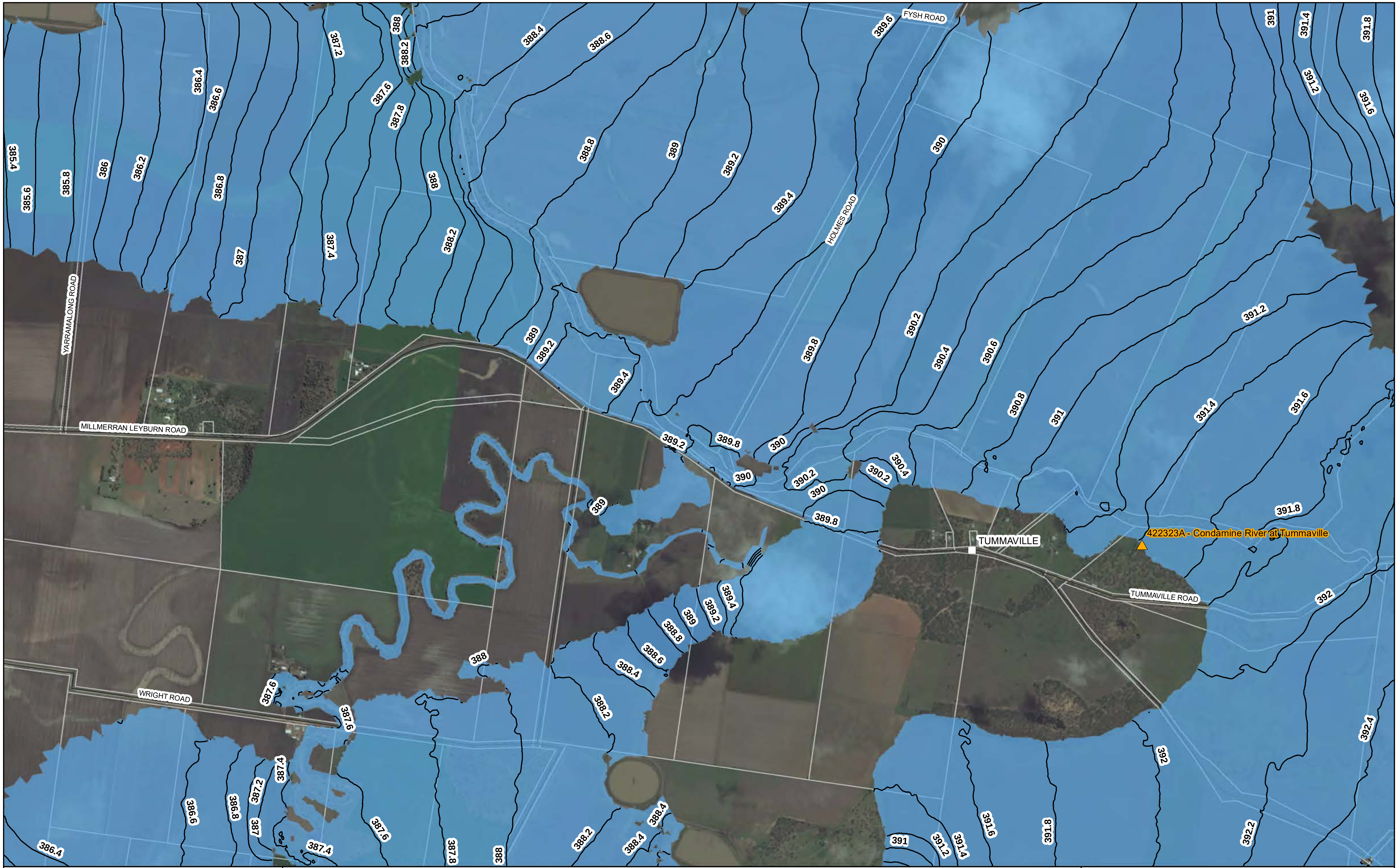
Peak Depth [m]

- ■ 0 - 0.25
- ■ 0.25 - 0.50
- ■ 0.5 - 1.0
- ■ 1.0 - 1.5
- ■ 1.5 - 2.0
- ■ 2.0 - 2.5
- ■ 2.5 - 3.0
- ■ 3.0 - 3.5
- ■ 3.5 - 4.0
- ■ 4.0 - 4.5
- ■ 4.5 - 5.0
- ■ >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
10 Year ARI Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Design\TUM_Map02_FloodDepth_Q010.mxd
Date Saved: 14/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

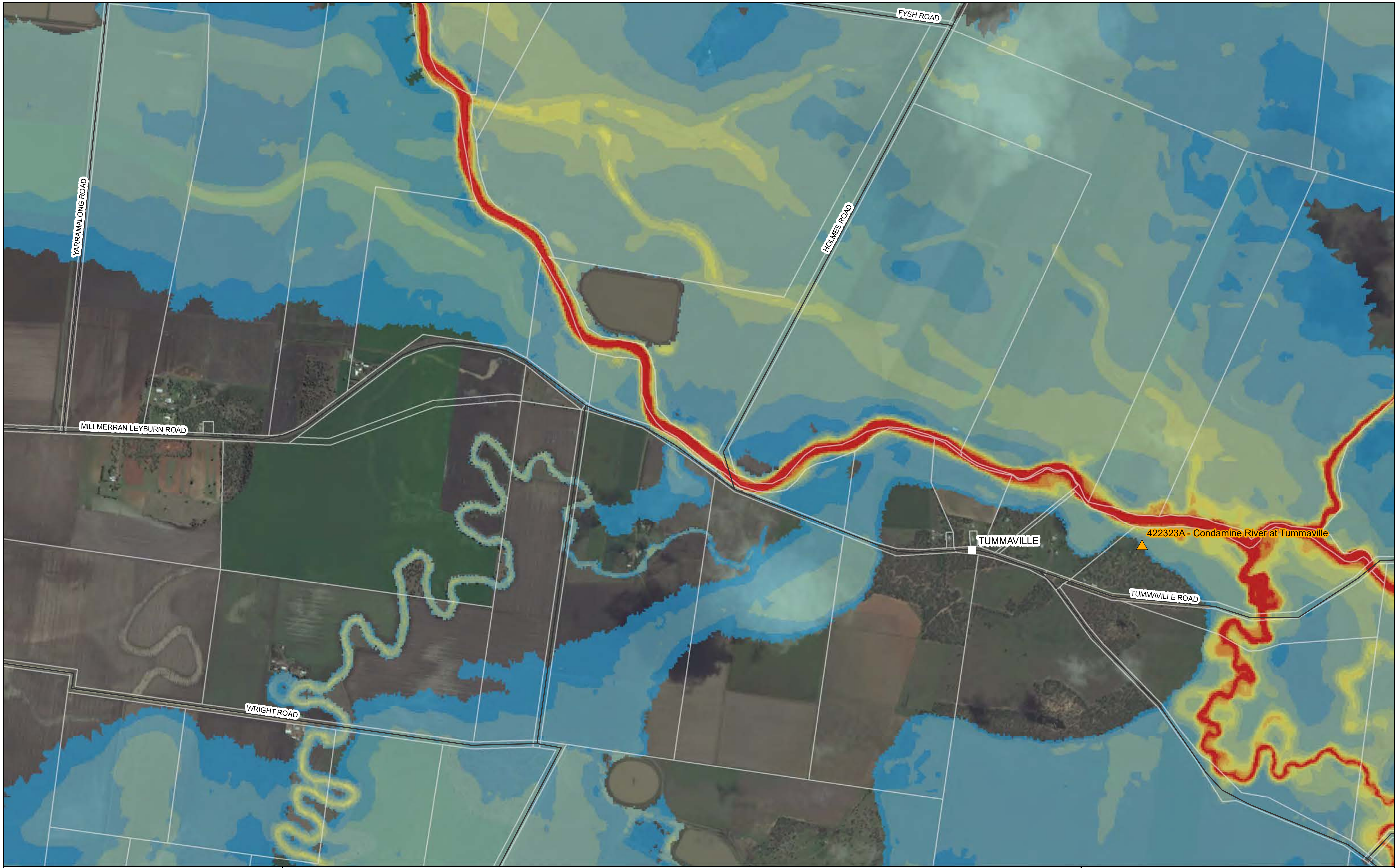
Legend

- ✚ Emergency Locations
- —+— Rail
- ☐ Cadastre
- — Roads
- △ BoM Gauges
- △ DNRM Gauges
- ☐ Towns
- 🟦 Inundation Extent
- — Water Level Contours [mAHD]

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
20 Year ARI Event Peak Water Level

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\TUM_Map01_SurfaceElevation_Q020.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

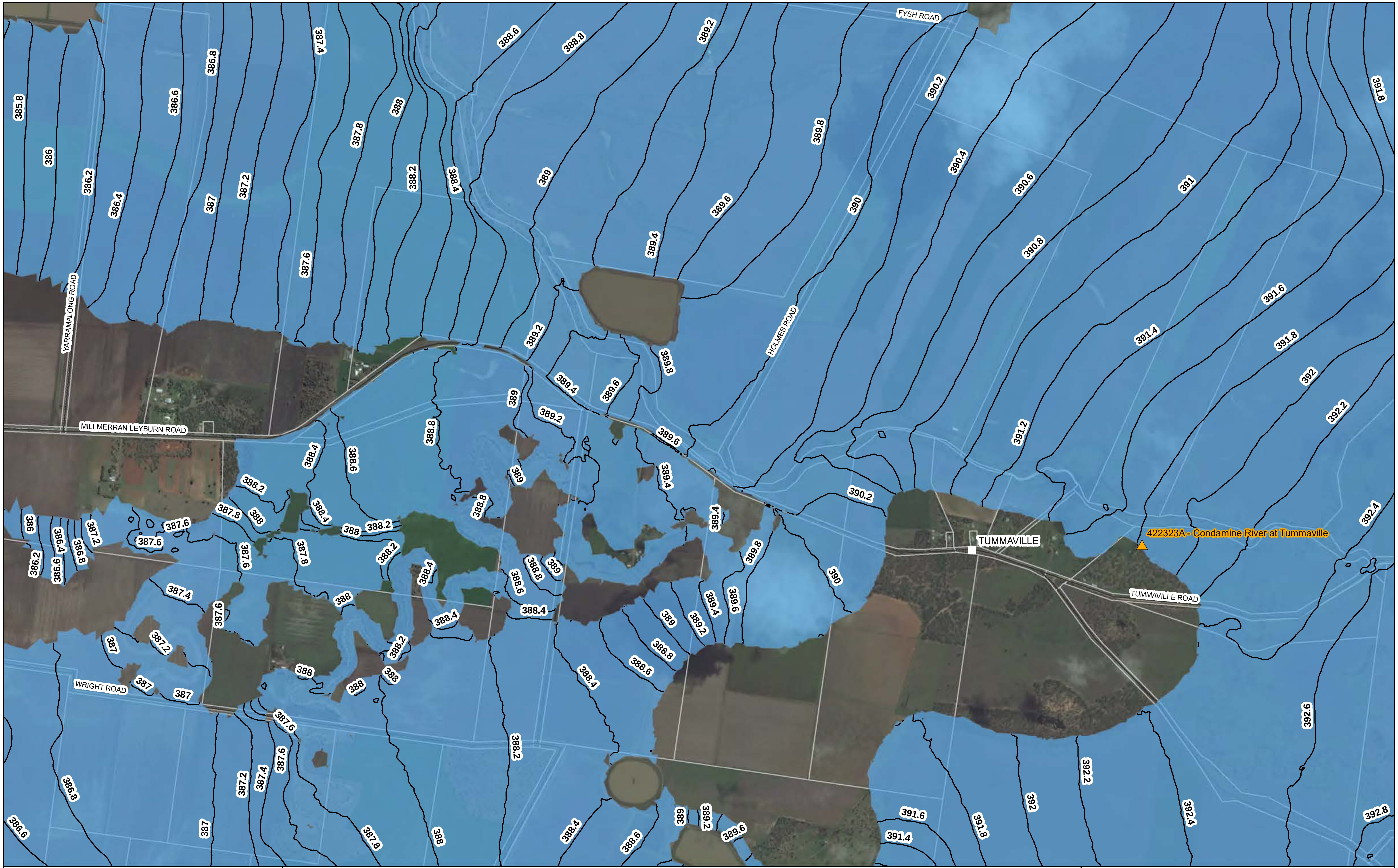
Legend

✚ Emergency Locations	☐ Towns	Peak Depth [m]	■ 0.5 - 1.0	■ 2.0 - 2.5	■ 3.5 - 4.0
─┼─ Rail	△ BoM Gauges	■ 0 - 0.25	■ 1.0 - 1.5	■ 2.5 - 3.0	■ 4.0 - 4.5
☐ Cadastre	▲ DNRM Gauges	■ 0.25 - 0.50	■ 1.5 - 2.0	■ 3.0 - 3.5	■ 4.5 - 5.0
── Roads					■ >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
20 Year ARI Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Design\TUM_Map02_FloodDepth_Q020.mxd
Date Saved: 14/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

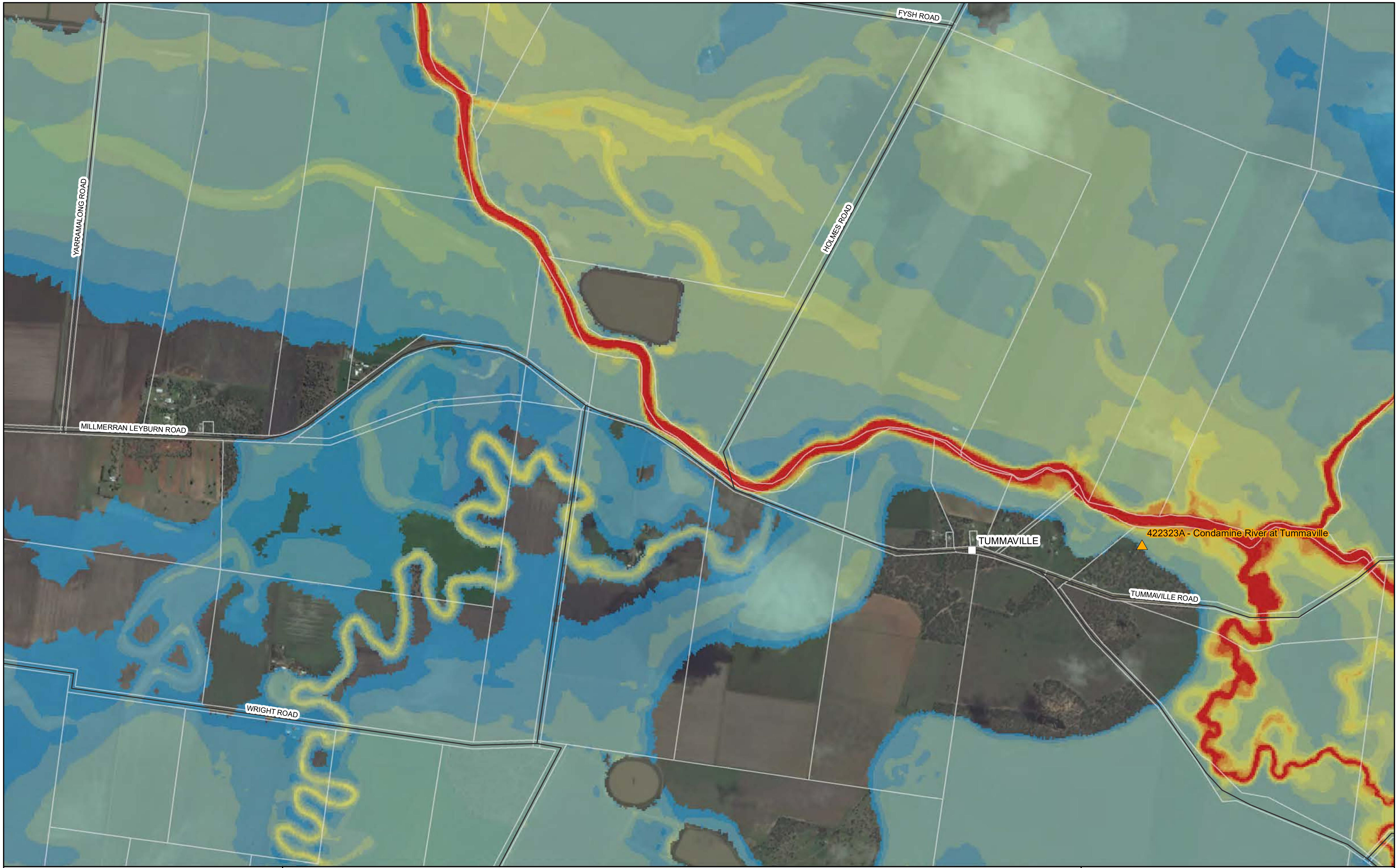
Legend

- ✚ Emergency Locations
- ┼ Rail
- ☐ Cadastre
- ― Roads
- △ BoM Gauges
- ▲ DNRM Gauges
- ☐ Towns
- 🟦 Inundation Extent
- ― Water Level Contours [mAHD]

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
100 Year ARI Event Peak Water Level

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\TUM_Map01_SurfaceElevation_Q100.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

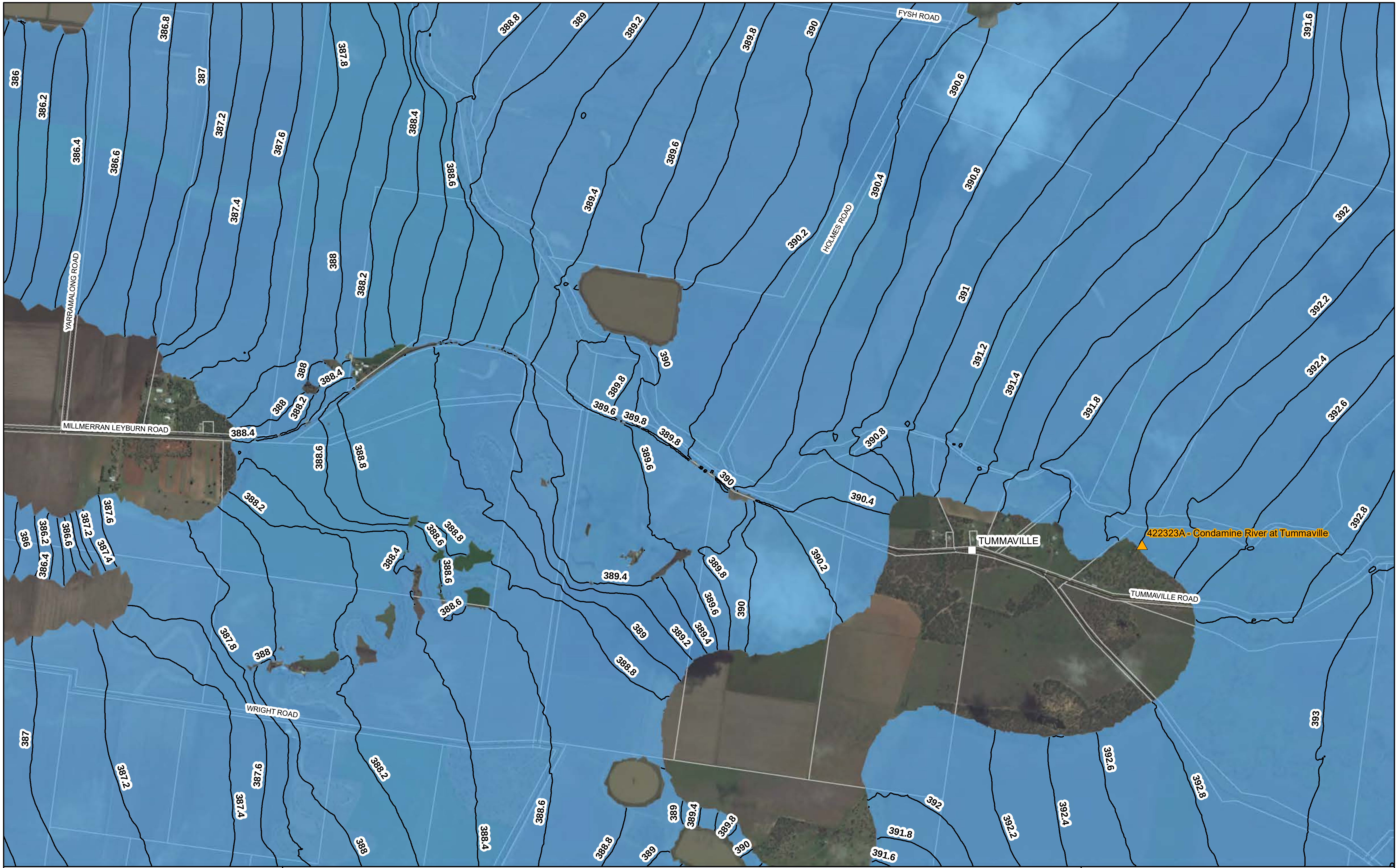
- ✚ Emergency Locations
- ┼ Rail
- ▭ Cadastre
- ── Roads
- □ Towns
- △ BoM Gauges
- △ DNRM Gauges

Peak Depth [m]

- ■ 0 - 0.25
- ■ 0.25 - 0.50
- ■ 0.5 - 1.0
- ■ 1.0 - 1.5
- ■ 1.5 - 2.0
- ■ 2.0 - 2.5
- ■ 2.5 - 3.0
- ■ 3.0 - 3.5
- ■ 3.5 - 4.0
- ■ 4.0 - 4.5
- ■ 4.5 - 5.0
- ■ >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
100 Year ARI Event
Peak Flood Depth



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

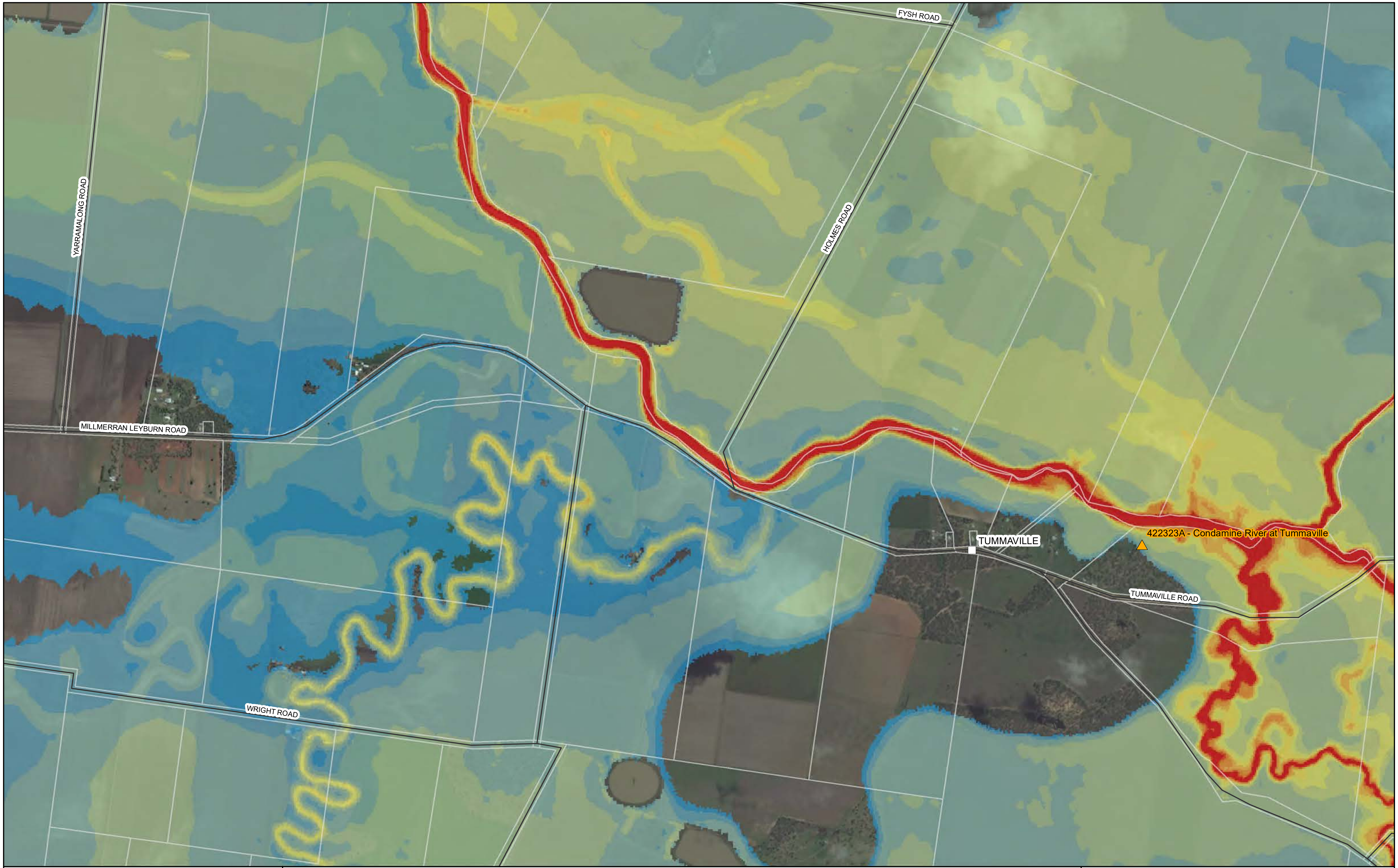
Legend

✚ Emergency Locations	— Roads	☐ Towns
—+— Rail	△ BoM Gauges	▨ Inundation Extent
☐ Cadastre	△ DNRM Gauges	— Water Level Contours [mAHD]

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
500 Year ARI Event Peak Water Level

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\TUM_Map01_SurfaceElevation_Q500.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

- ✚ Emergency Locations
- ┼ Rail
- ▭ Cadastre
- — Roads
- ▢ Towns
- △ BoM Gauges
- △ DNRM Gauges

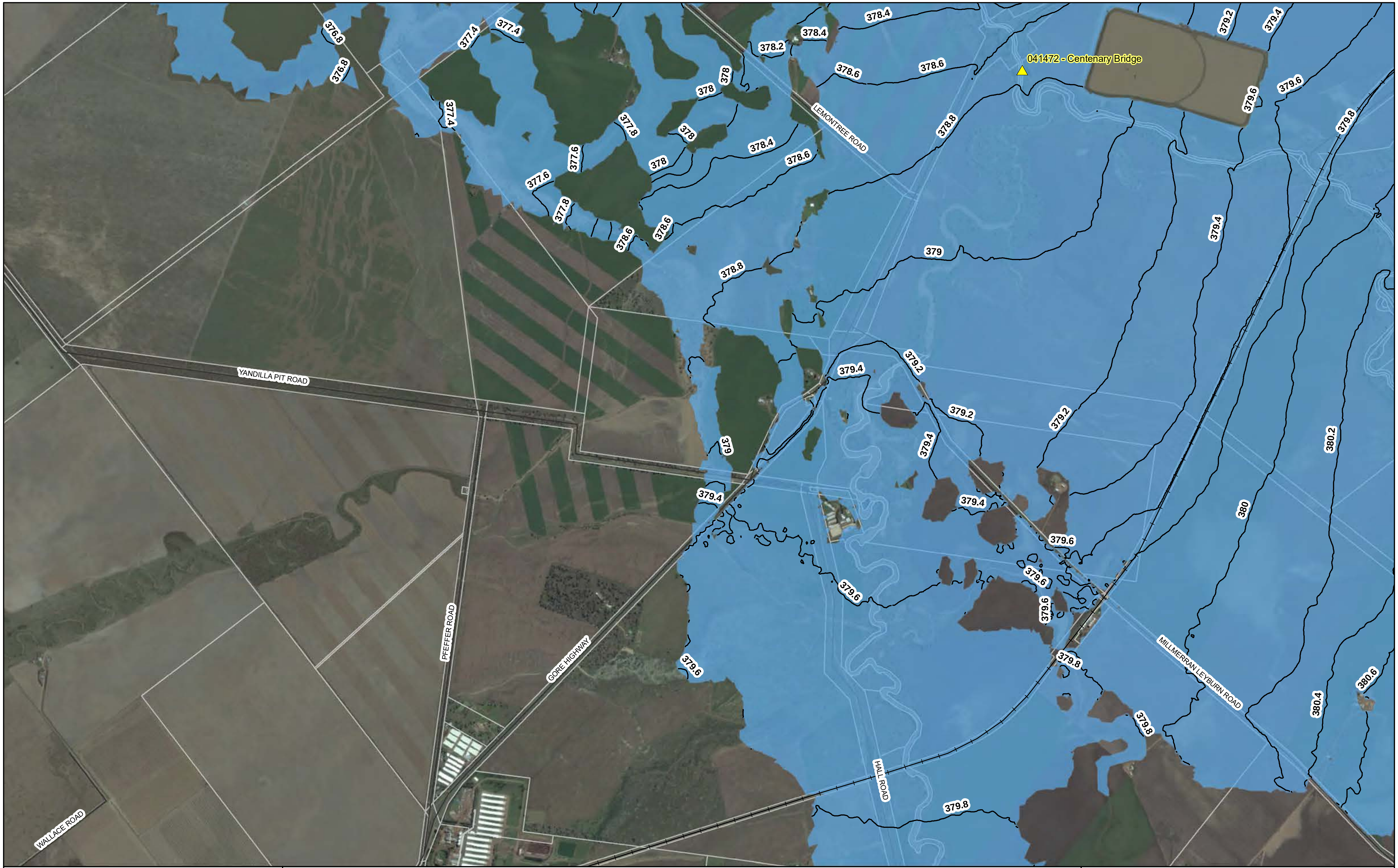
Peak Depth [m]

- ■ 0 - 0.25
- ■ 0.25 - 0.50
- ■ 0.5 - 1.0
- ■ 1.0 - 1.5
- ■ 1.5 - 2.0
- ■ 2.0 - 2.5
- ■ 2.5 - 3.0
- ■ 3.0 - 3.5
- ■ 3.5 - 4.0
- ■ 4.0 - 4.5
- ■ 4.5 - 5.0
- ■ >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
500 Year ARI Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Design\TUM_Map02_FloodDepth_Q500.mxd
Date Saved: 14/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

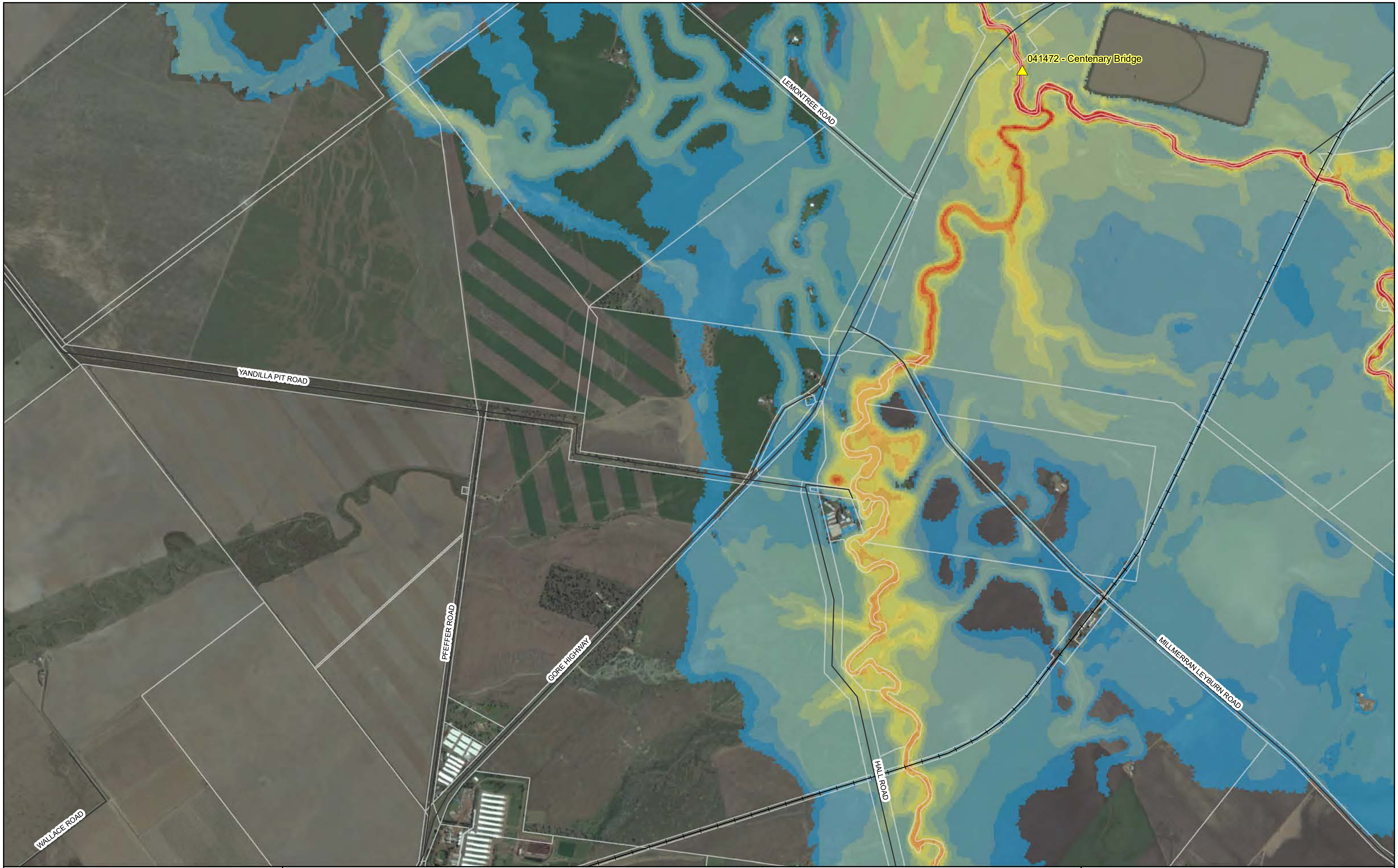
N

Legend

✚ Emergency Locations	— Roads
—+— Rail	△ BoM Gauges
☐ Cadastre	△ DNRM Gauges
▨ Inundation Extent	— Water Level Contours [mAHD]

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
10 Year ARI Event Peak Water Level

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\YAN_Map01_SurfaceElevation_Q010.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

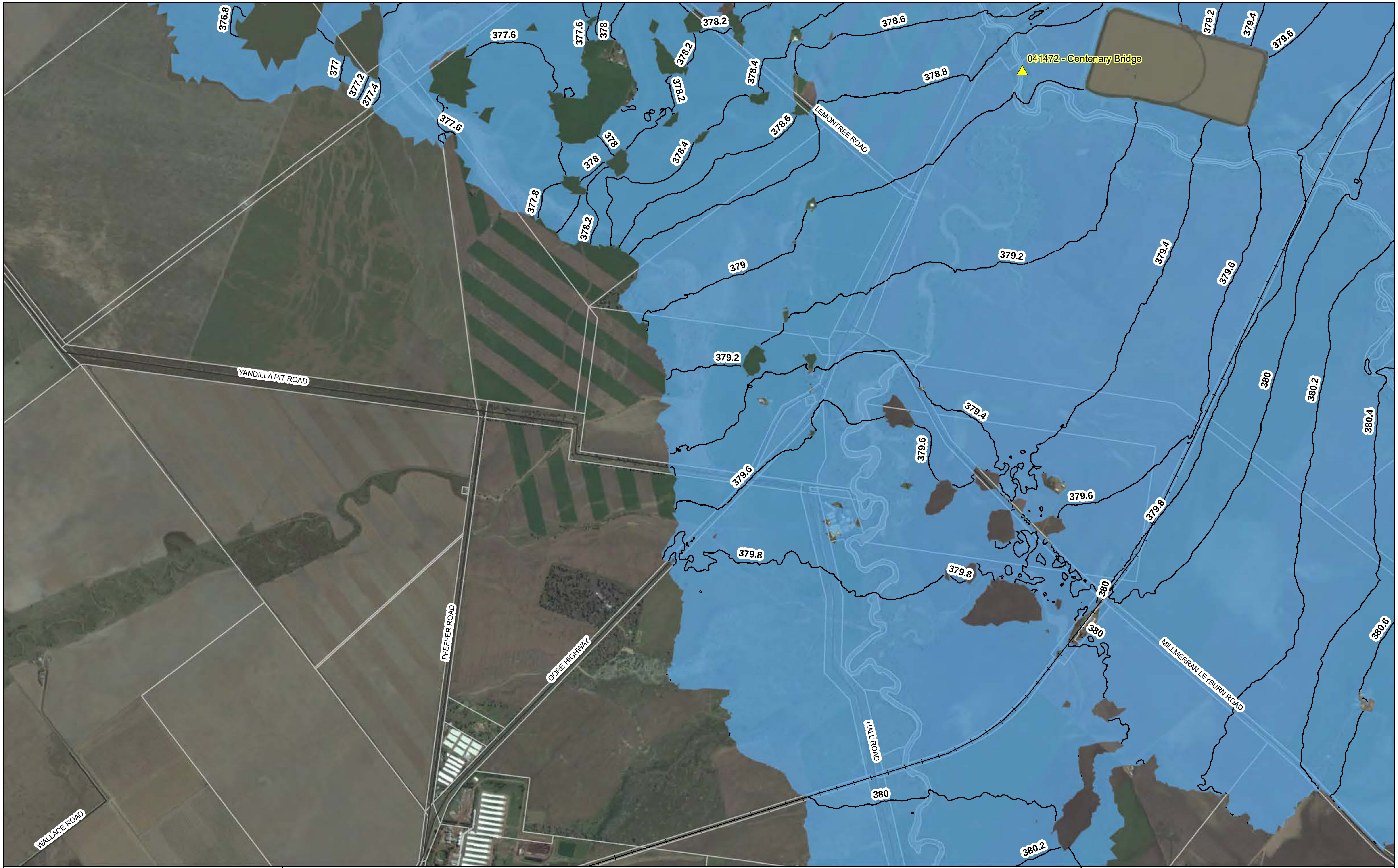
- ✚ Emergency Locations
- —+— Rail
- ☐ Cadastre
- —— Roads
- △ BoM Gauges
- △ DNRM Gauges

Peak Depth [m]

- ■ 0 - 0.25
- ■ 0.25 - 0.50
- ■ 0.5 - 1.0
- ■ 1.0 - 1.5
- ■ 1.5 - 2.0
- ■ 2.0 - 2.5
- ■ 2.5 - 3.0
- ■ 3.0 - 3.5
- ■ 3.5 - 4.0
- ■ 4.0 - 4.5
- ■ 4.5 - 5.0
- ■ >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
10 Year ARI Event
Peak Flood Depth



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

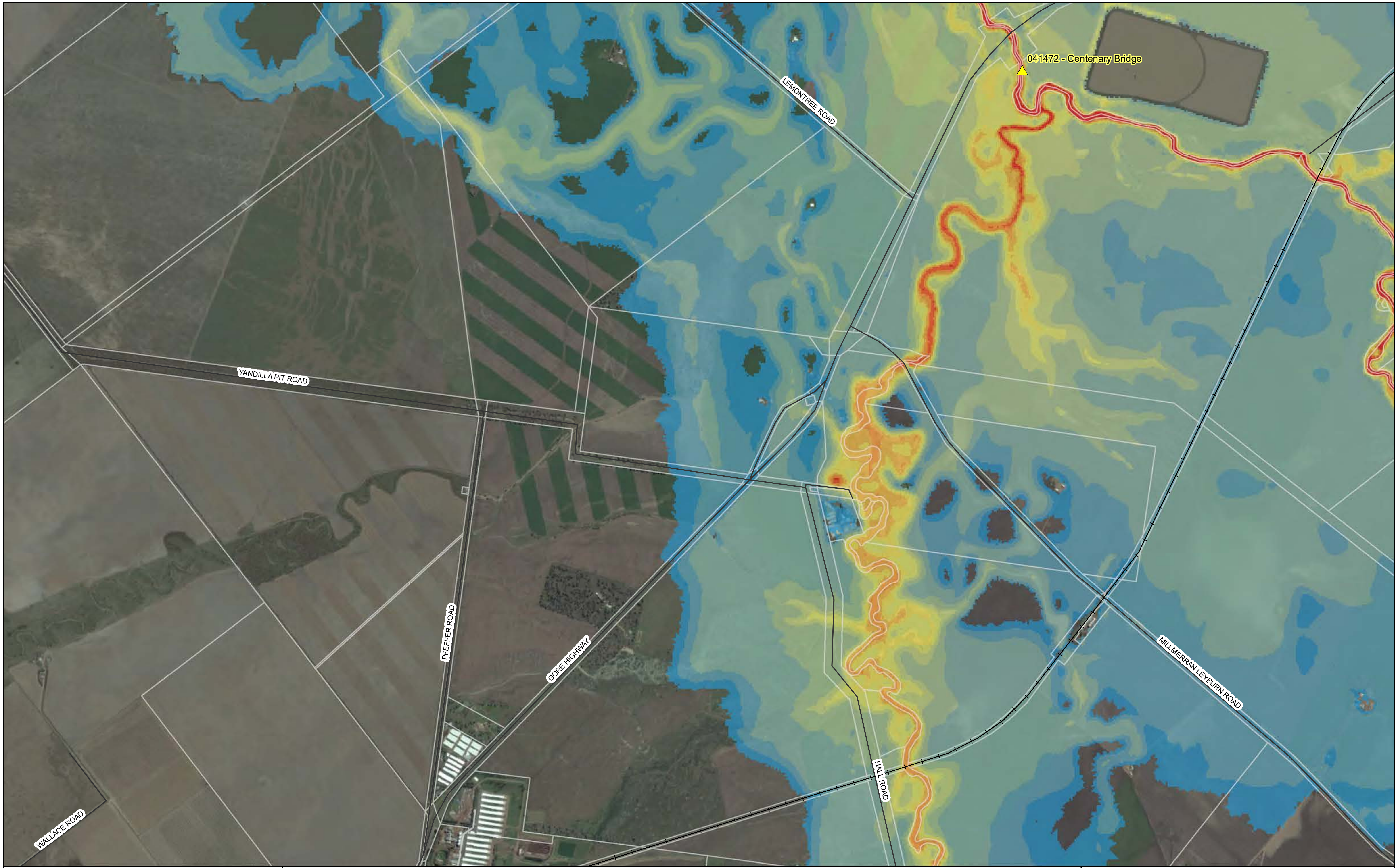
Legend

✚ Emergency Locations	— Roads
┼ Rail	△ BoM Gauges
☐ Cadastre	△ DNRM Gauges
▭ Inundation Extent	— Water Level Contours [mAHD]

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
20 Year ARI Event Peak Water Level

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\YAN_Map01_SurfaceElevation_Q020.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

- ✚ Emergency Locations
- Rail
- Cadastre
- Roads
- △ BoM Gauges
- △ DNRM Gauges

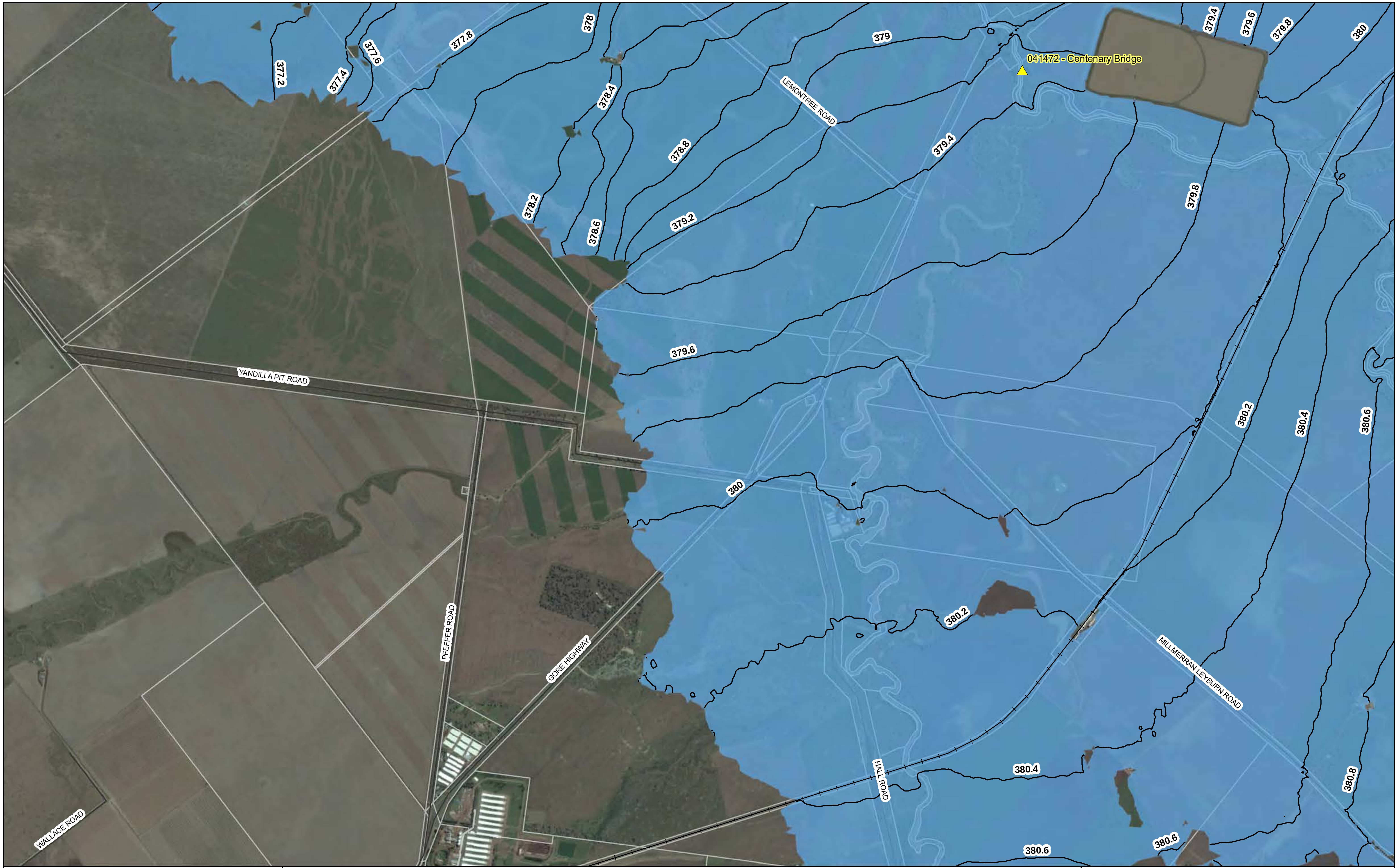
Peak Depth [m]

- ▨ 0 - 0.25
- ▨ 0.25 - 0.50
- ▨ 0.5 - 1.0
- ▨ 1.0 - 1.5
- ▨ 1.5 - 2.0
- ▨ 2.0 - 2.5
- ▨ 2.5 - 3.0
- ▨ 3.0 - 3.5
- ▨ 3.5 - 4.0
- ▨ 4.0 - 4.5
- ▨ 4.5 - 5.0
- ▨ >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
20 Year ARI Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Design\YAN_Map02_FloodDepth_Q020.mxd
Date Saved: 14/11/2015



TOOWOOMBA
REGION

1:20,000 (at A3)
0 100 200 400
Metres
GDA 1994 MGA Zone 56

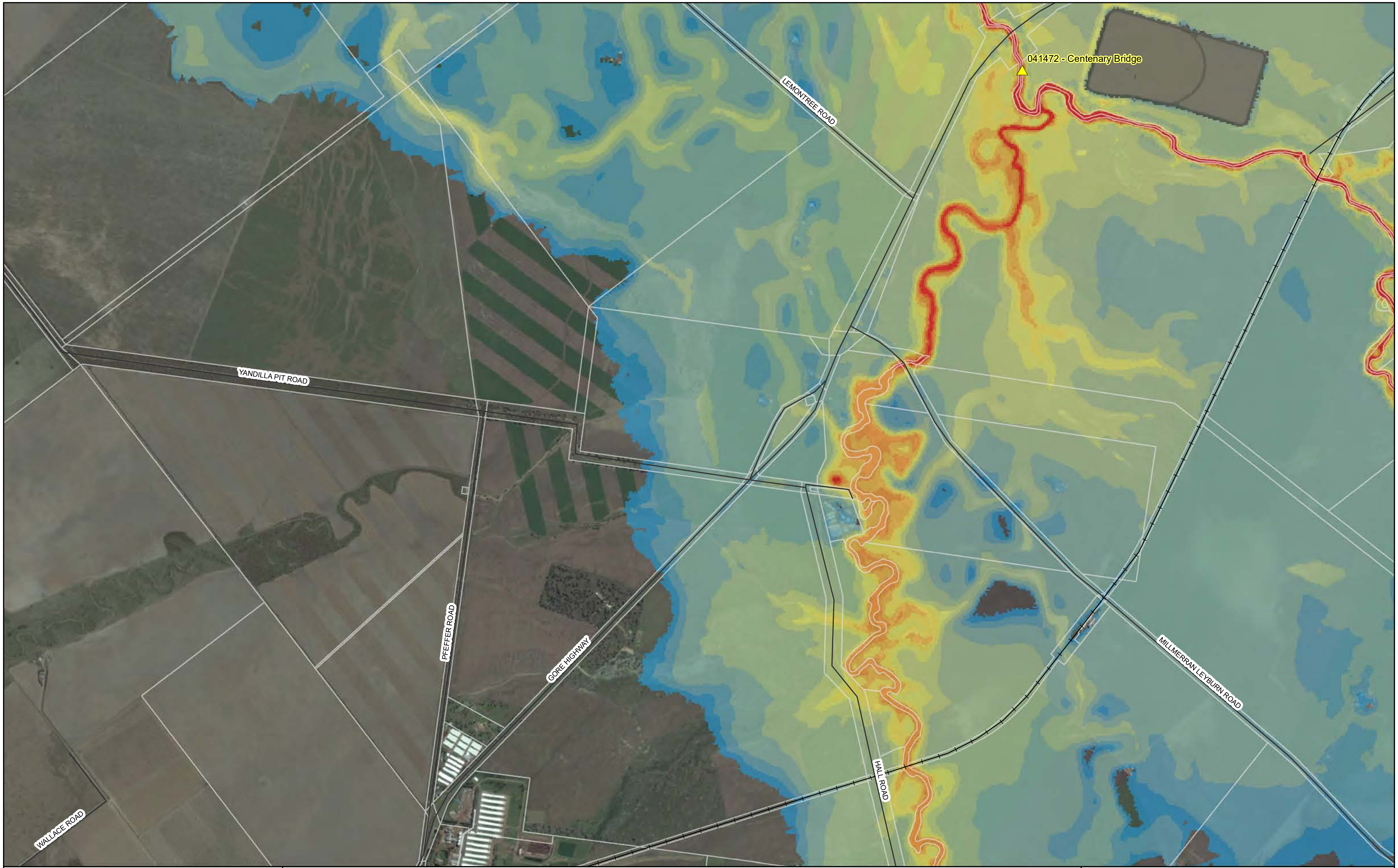
N

Legend

✚ Emergency Locations
—— Roads
▭ Inundation Extent
┼ Rail
△ BoM Gauges
—— Water Level Contours [mAHD]
▭ Cadastre
△ DNRM Gauges

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
100 Year ARI Event Peak Water Level



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

✚ Emergency Locations	Roads
Rail	△ BoM Gauges
Cadastre	▲ DNRM Gauges

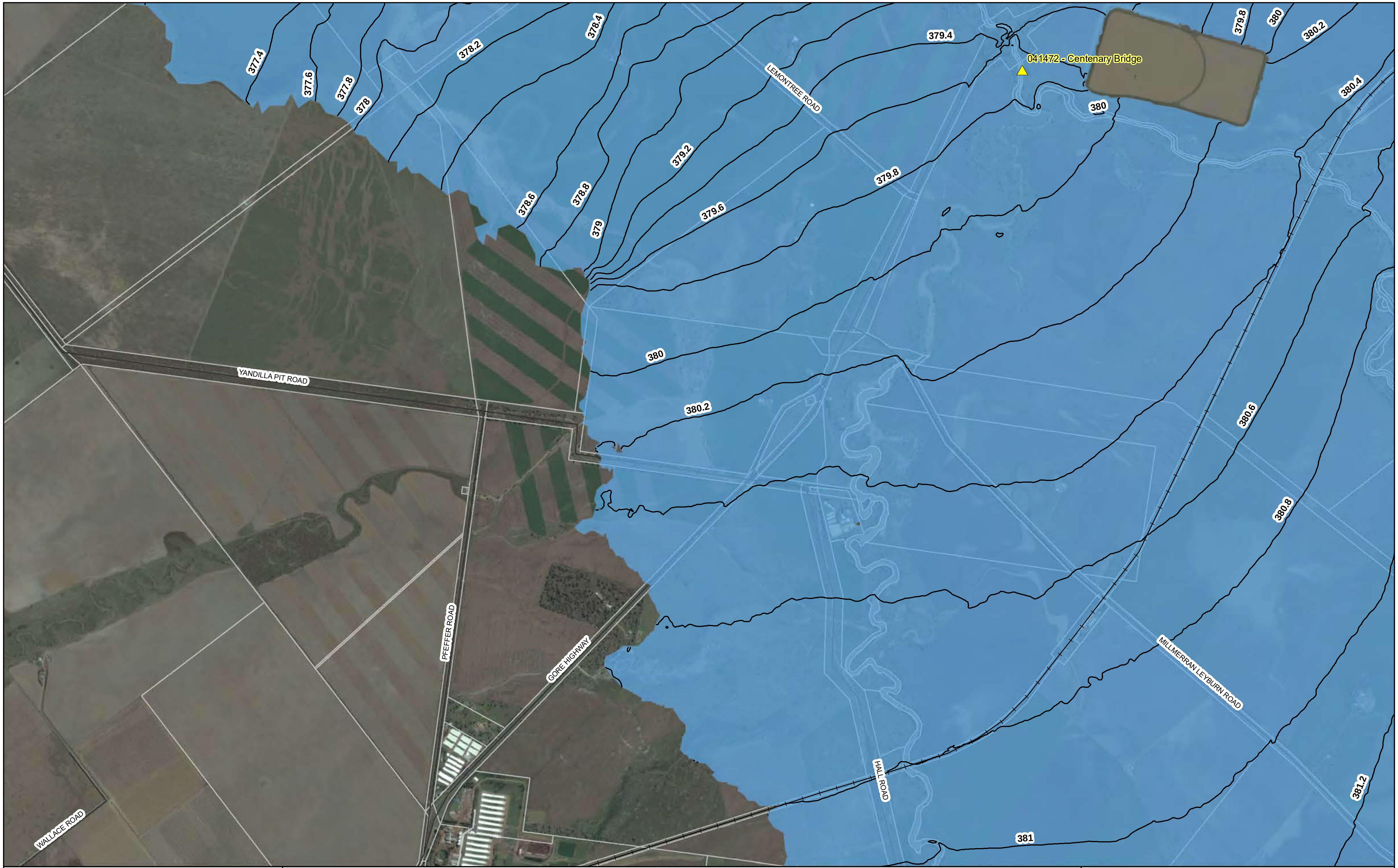
Peak Depth [m]

🟦 0 - 0.25	0.5 - 1.0	2.0 - 2.5	3.5 - 4.0
🟦 0.25 - 0.50	1.0 - 1.5	2.5 - 3.0	4.0 - 4.5
	1.5 - 2.0	3.0 - 3.5	4.5 - 5.0
			🟥 >5.0

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
100 Year ARI Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Design\YAN_Map02_FloodDepth_Q100.mxd
Date Saved: 14/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

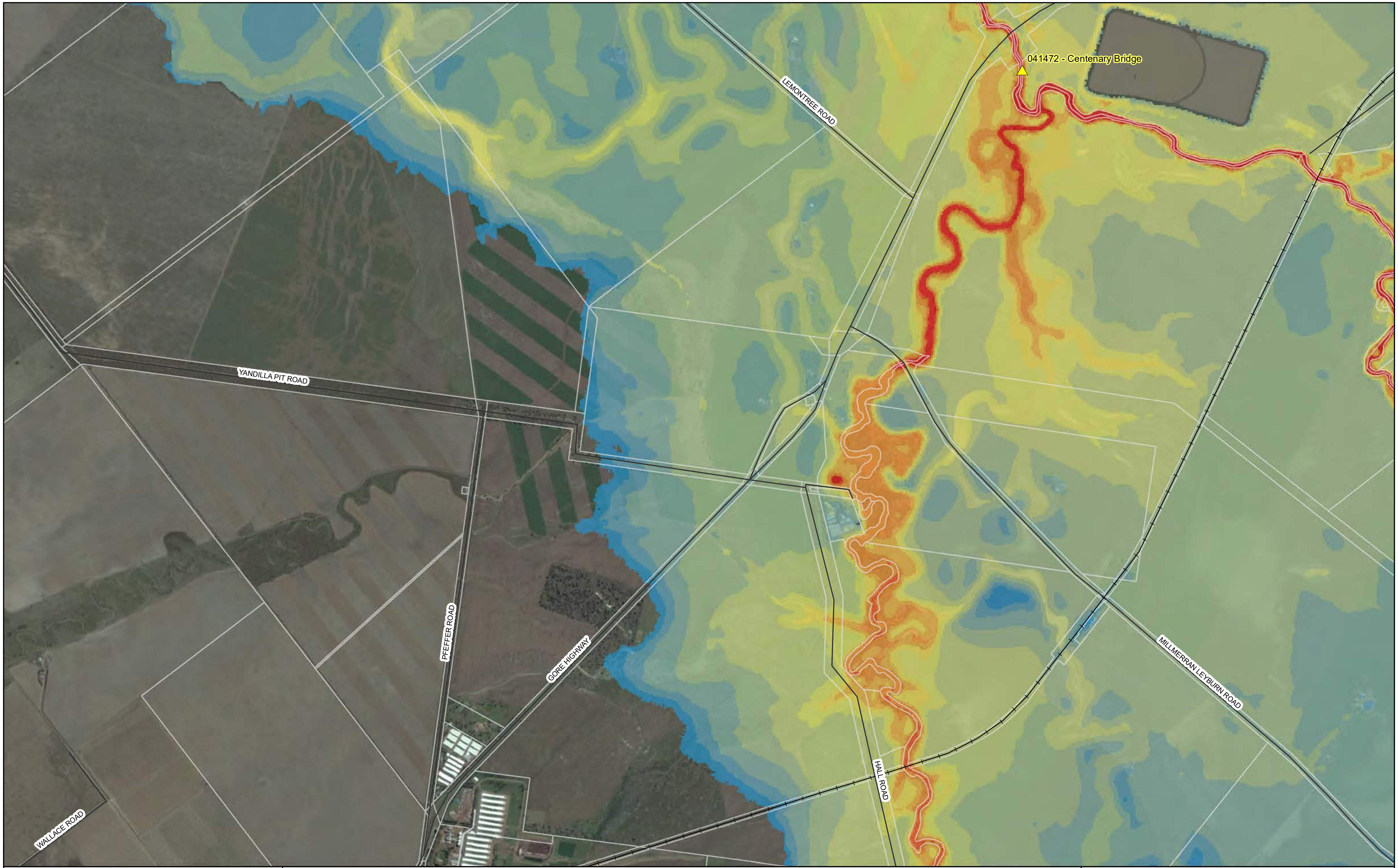
Legend

- ✚ Emergency Locations
- ┼ Rail
- ☐ Cadastre
- — Roads
- △ BoM Gauges
- ▲ DNRM Gauges
- ▨ Inundation Extent
- — Water Level Contours [mAHD]

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
500 Year ARI Event Peak Water Level

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\YAN_Map01_SurfaceElevation_Q500.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

✚ Emergency Locations
—— Roads
—+— Rail
△ BoM Gauges
☐ Cadastre
▲ DNRM Gauges

Peak Depth [m]

🟦 0 - 0.25	■ 0.5 - 1.0	■ 2.0 - 2.5	■ 3.5 - 4.0
🟦 0.25 - 0.50	■ 1.0 - 1.5	■ 2.5 - 3.0	🟧 4.0 - 4.5
	■ 1.5 - 2.0	🟨 3.0 - 3.5	🟧 4.5 - 5.0
			🟥 >5.0

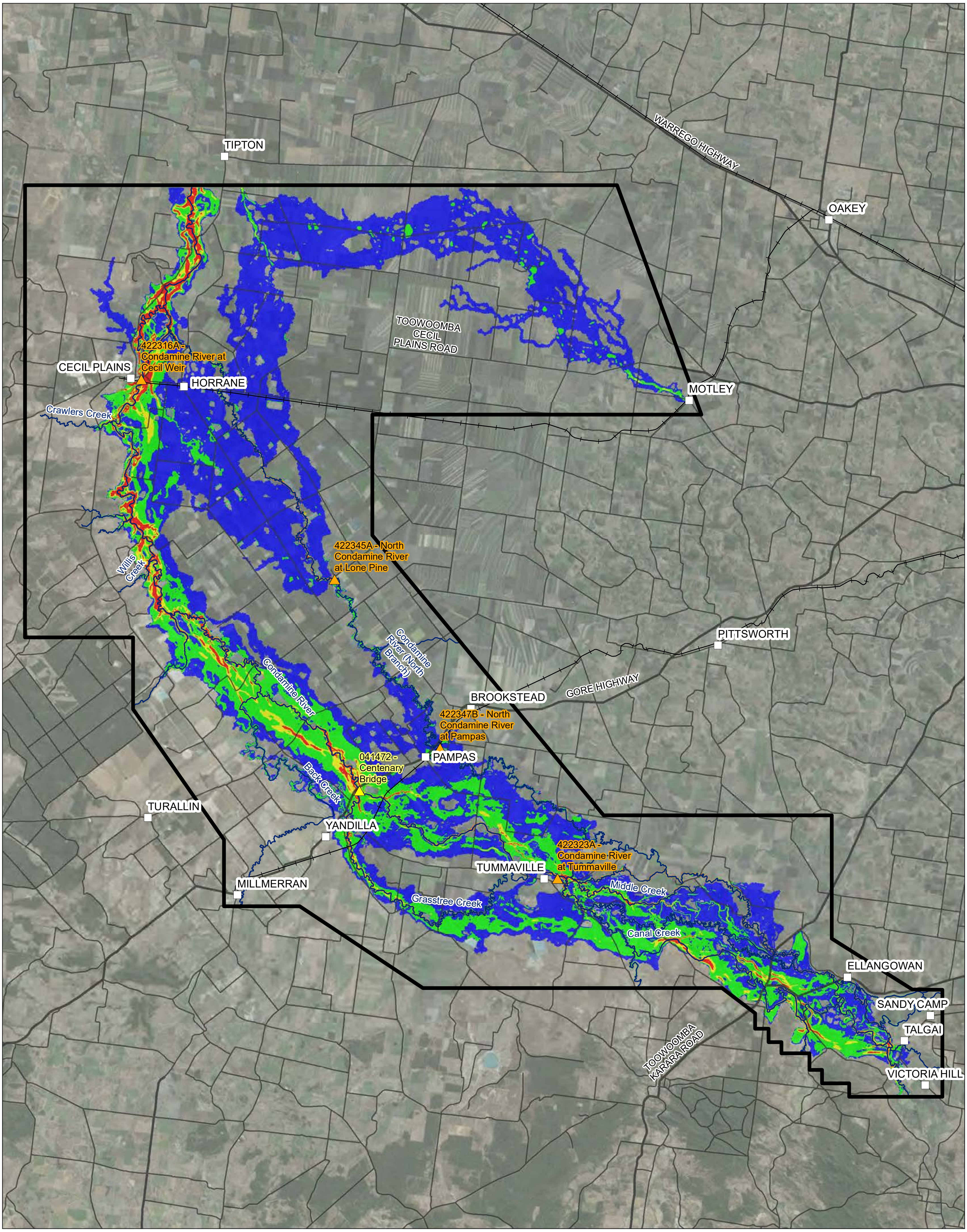
Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
500 Year ARI Event
Peak Flood Depth

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Design\YAN_Map02_FloodDepth_Q500.mxd
Date Saved: 14/11/2015

APPENDIX E

Hazard and Hydraulic Category Mapping



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

N

Legend

- Rail
- Minor Roads
- Major Roads
- Waterways
- Model Extent
- ☐ Towns
- △ BoM Gauges
- △ DNRM Gauges

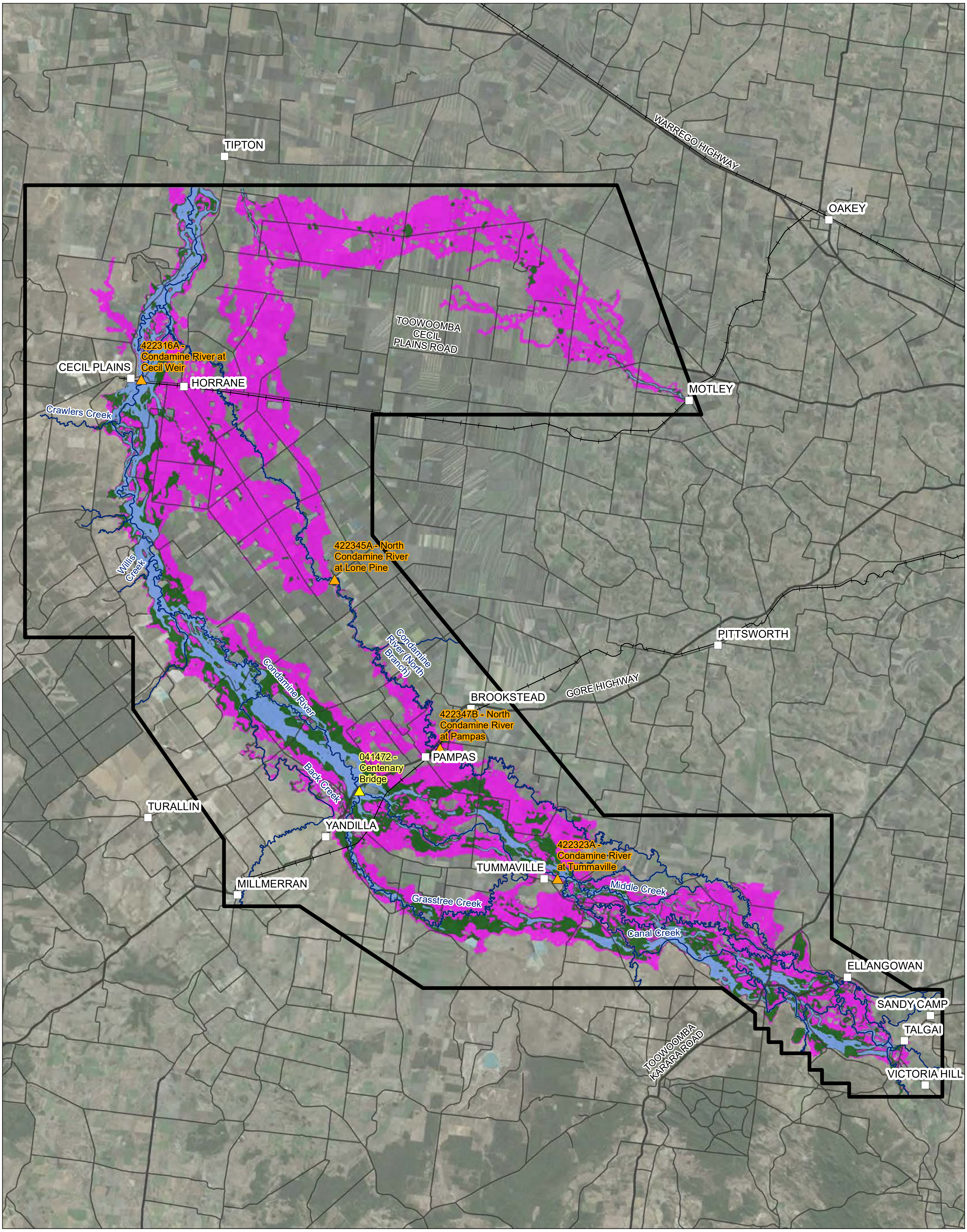
Hazard Category

- 🟦 Low
- 🟩 Significant
- 🟨 High
- 🟥 Extreme

SP051 Flood Studies
Work Package 7 - Addendum 1
10 Year ARI Event
Hazard Category

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

Disclaimer: Whilst all due care has been taken in the preparation of the plan and all information (the Plan and all information is referred to as “Plan information”), the accuracy of the Plan Information cannot be guaranteed. The Plan Information is provided as a guide and should not be relied upon in anyway whatsoever. Toowoomba Regional Council takes no responsibility for inaccuracies in the Plan Information and is not liable under any circumstances for any loss or damage whatsoever or howsoever caused arising directly or indirectly in connection with its use. The recipient must verify the Plan Information on site. Please refer any discrepancies to Toowoomba Regional Council - Information, Communications & Technology. No part of the Plan Information should be reproduced without the permission of the Coordinator GIS - ICT Branch, or other delegated representative of Council (131872).



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

N

Legend

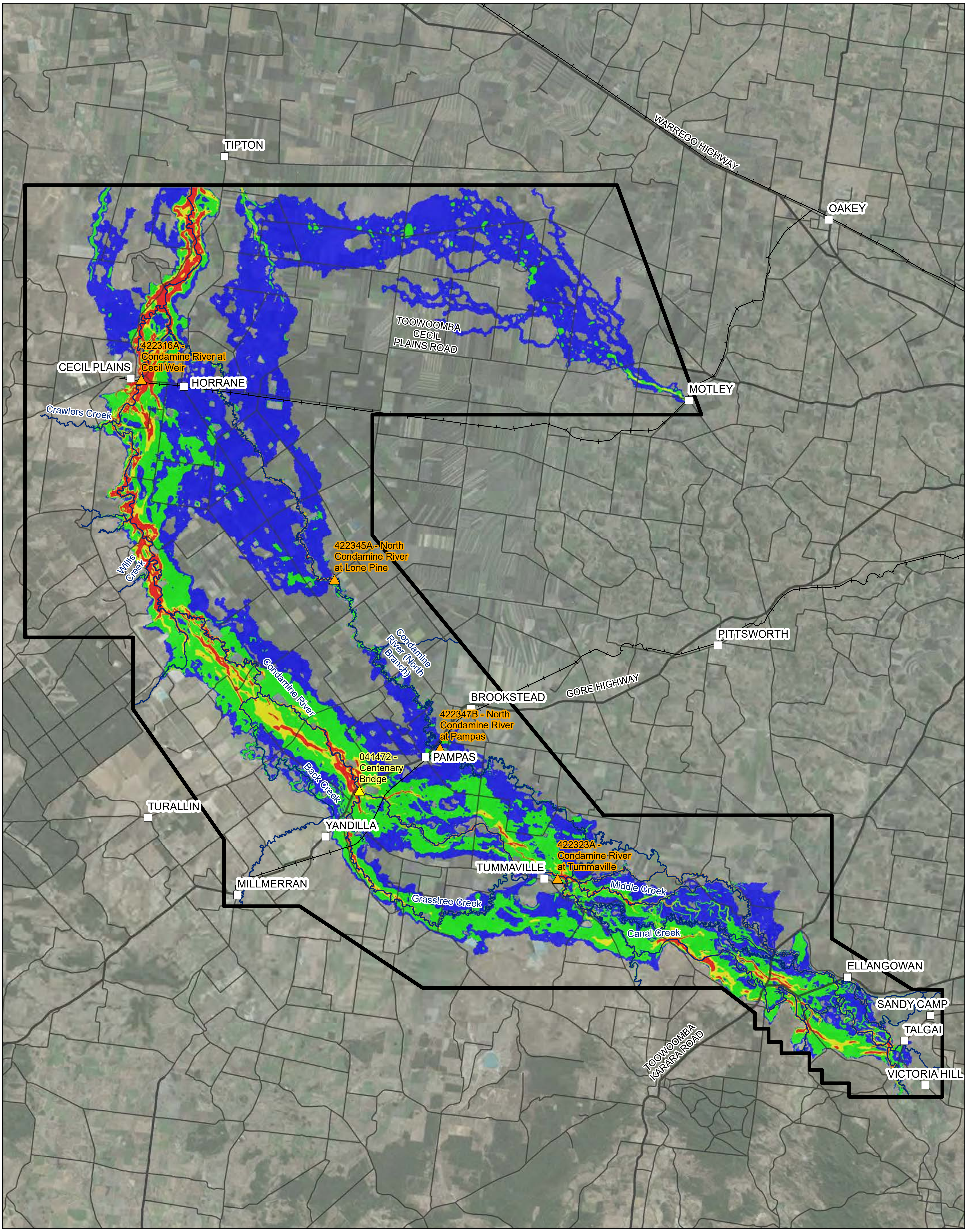
- Rail
- Minor Roads
- Major Roads
- Waterways
- Model Extent
- ☐ Towns
- △ BoM Gauges
- △ DNRM Gauges

Hydraulic Category

- 🟪 Flood Fringe
- 🟩 Flood Storage
- 🟦 Floodway

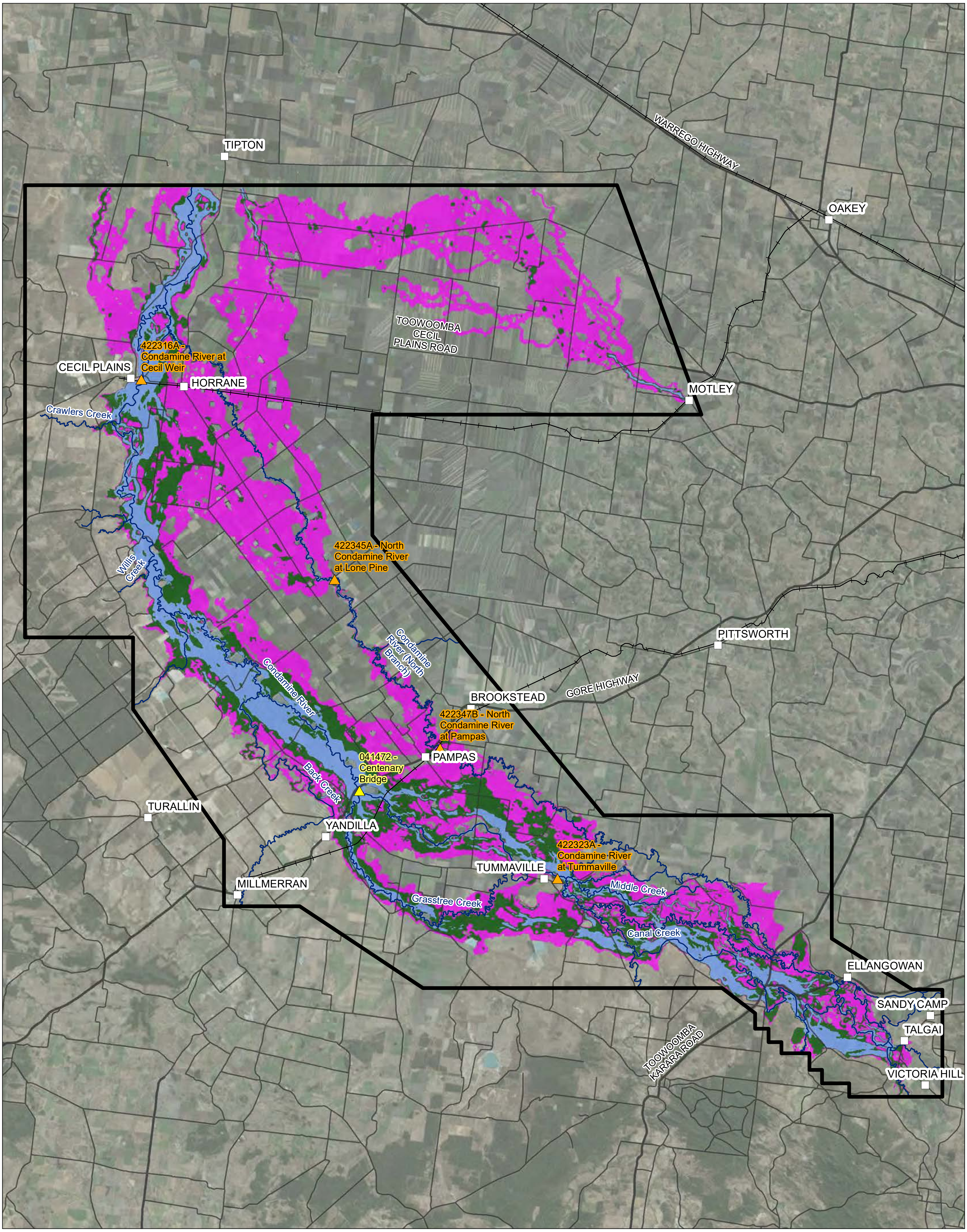
SP051 Flood Studies
Work Package 7 - Addendum 1
10 Year ARI Event
Hydraulic Category

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.



SP051 Flood Studies
Work Package 7 - Addendum 1
20 Year ARI Event
Hazard Category

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

N

Legend

- Rail
- Minor Roads
- Major Roads
- Waterways
- ☐ Model Extent
- □ Towns
- △ BoM Gauges
- △ DNRM Gauges

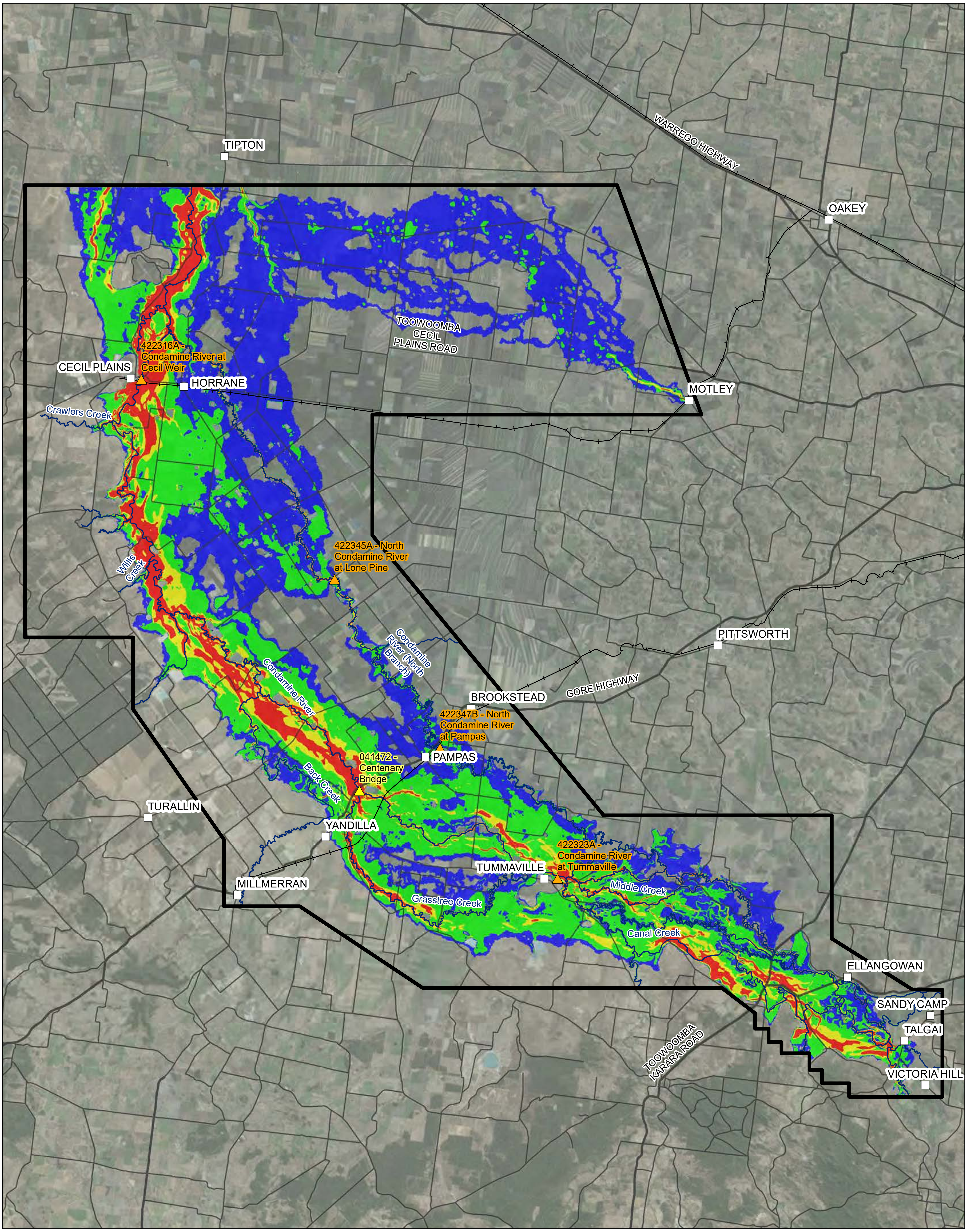
Hydraulic Category

- 🟪 Flood Fringe
- 🟩 Flood Storage
- 🟦 Floodway

SP051 Flood Studies
Work Package 7 - Addendum 1
20 Year ARI Event
Hydraulic Category

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

Disclaimer: Whilst all due care has been taken in the preparation of the plan and all information (the Plan and all information is referred to as “Plan information”), the accuracy of the Plan Information cannot be guaranteed. The Plan Information is provided as a guide and should not be relied upon in anyway whatsoever. Toowoomba Regional Council takes no responsibility for inaccuracies in the Plan Information and is not liable under any circumstances for any loss or damage whatsoever or howsoever caused arising directly or indirectly in connection with its use. The recipient must verify the Plan Information on site. Please refer any discrepancies to Toowoomba Regional Council - Information, Communications & Technology. No part of the Plan Information should be reproduced without the permission of the Coordinator GIS - ICT Branch, or other delegated representative of Council (131872).



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

N

Legend

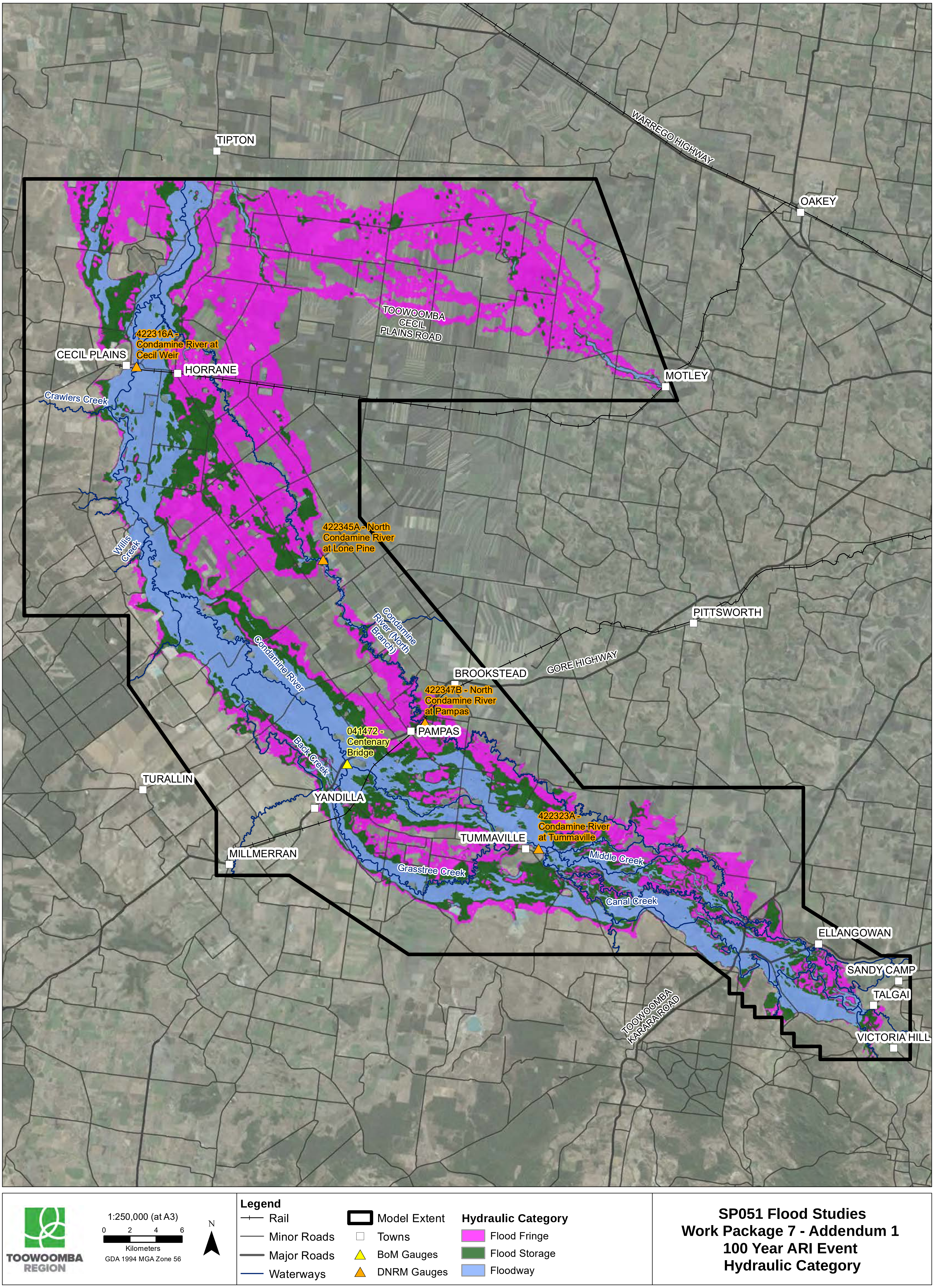
- Rail
- Minor Roads
- Major Roads
- Waterways
- Model Extent
- ☐ Towns
- △ BoM Gauges
- ▲ DNRM Gauges

Hazard Category

- 🟦 Low
- 🟩 Significant
- 🟨 High
- 🟥 Extreme

SP051 Flood Studies
Work Package 7 - Addendum 1
100 Year ARI Event
Hazard Category

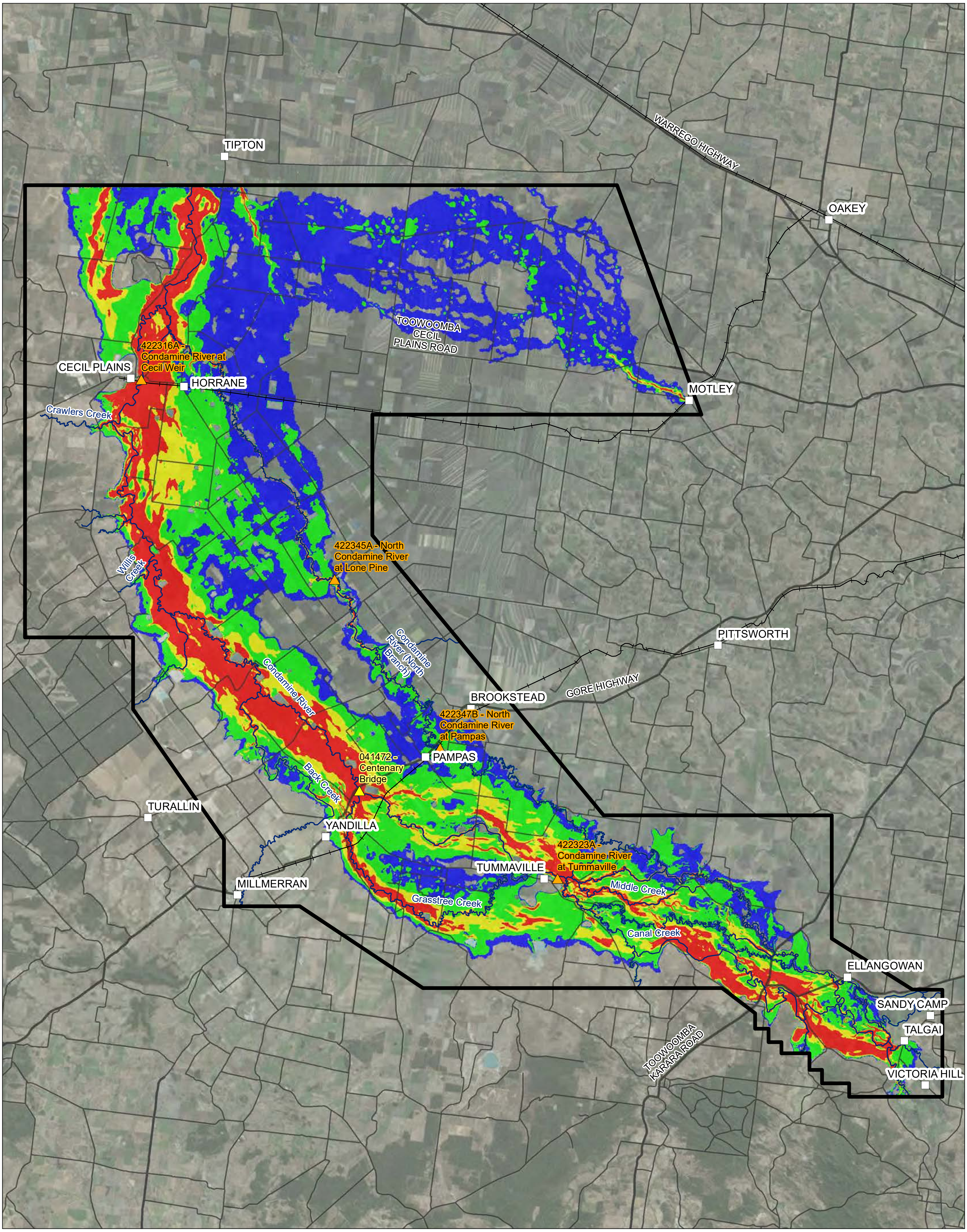
Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.



SP051 Flood Studies
Work Package 7 - Addendum 1
100 Year ARI Event
Hydraulic Category

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

Disclaimer: Whilst all due care has been taken in the preparation of the plan and all information (the Plan and all information is referred to as “Plan information”), the accuracy of the Plan Information cannot be guaranteed. The Plan Information is provided as a guide and should not be relied upon in anyway whatsoever. Toowoomba Regional Council takes no responsibility for inaccuracies in the Plan Information and is not liable under any circumstances for any loss or damage whatsoever or howsoever caused arising directly or indirectly in connection with its use. The recipient must verify the Plan Information on site. Please refer any discrepancies to Toowoomba Regional Council - Information, Communications & Technology. No part of the Plan Information should be reproduced without the permission of the Coordinator GIS - ICT Branch, or other delegated representative of Council (131872).



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

N

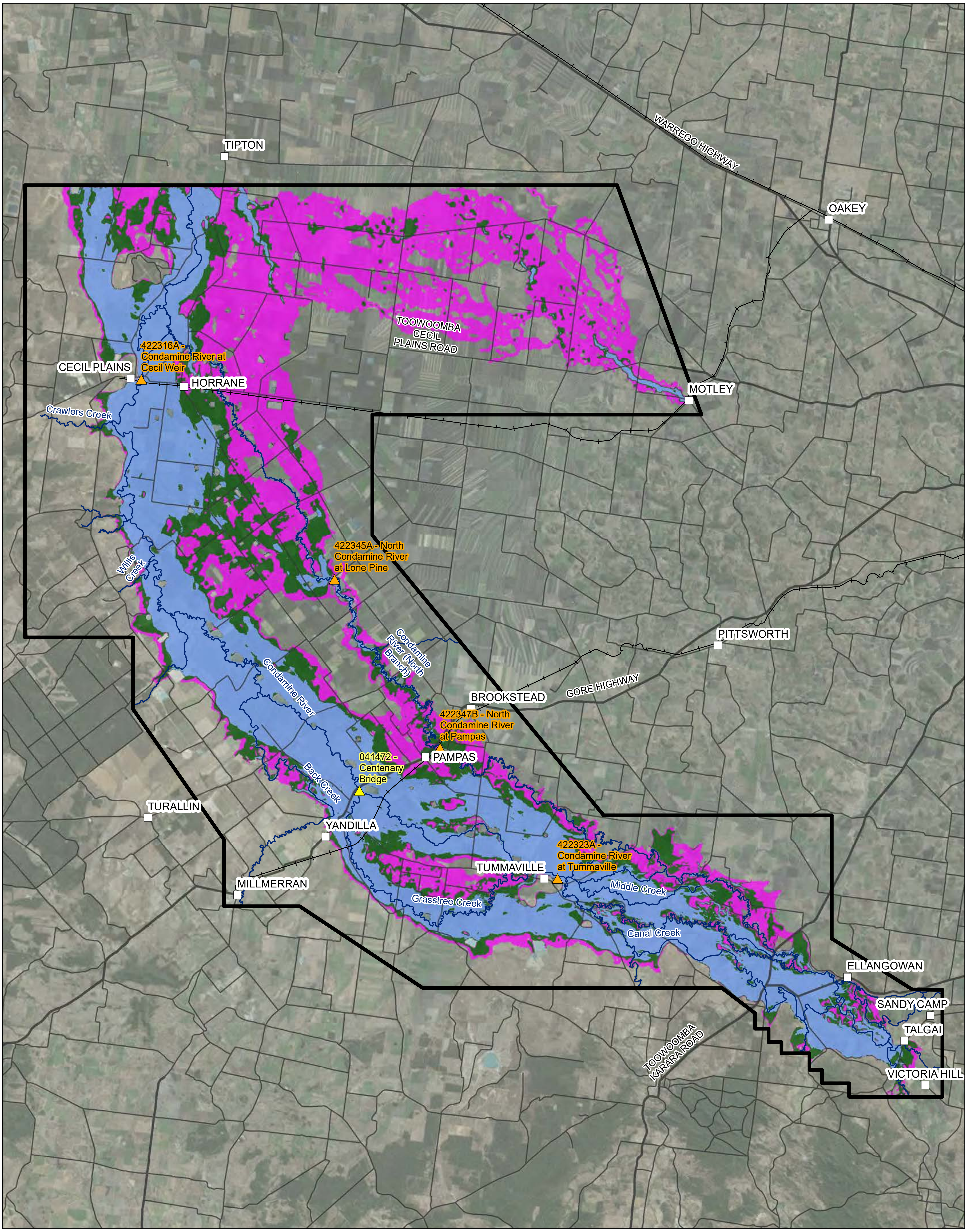
Legend

Rail	Model Extent	**Hazard Category**		
Minor Roads	☐ Towns	🟦 Low	🟨 High	
Major Roads	▲ BoM Gauges	🟩 Significant	🟥 Extreme	
Waterways	▲ DNRM Gauges			

SP051 Flood Studies
Work Package 7 - Addendum 1
500 Year ARI Event
Hazard Category

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

Disclaimer: Whilst all due care has been taken in the preparation of the plan and all information (the Plan and all information is referred to as "Plan information"), the accuracy of the Plan Information cannot be guaranteed. The Plan Information is provided as a guide and should not be relied upon in anyway whatsoever. Toowoomba Regional Council takes no responsibility for inaccuracies in the Plan Information and is not liable under any circumstances for any loss or damage whatsoever or howsoever caused arising directly or indirectly in connection with its use. The recipient must verify the Plan Information on site. Please refer any discrepancies to Toowoomba Regional Council - Information, Communications & Technology. No part of the Plan Information should be reproduced without the permission of the Coordinator GIS - ICT Branch, or other delegated representative of Council (131872).



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

N

Legend

- Rail
- Minor Roads
- Major Roads
- Waterways
- Model Extent
- ☐ Towns
- △ BoM Gauges
- △ DNRM Gauges

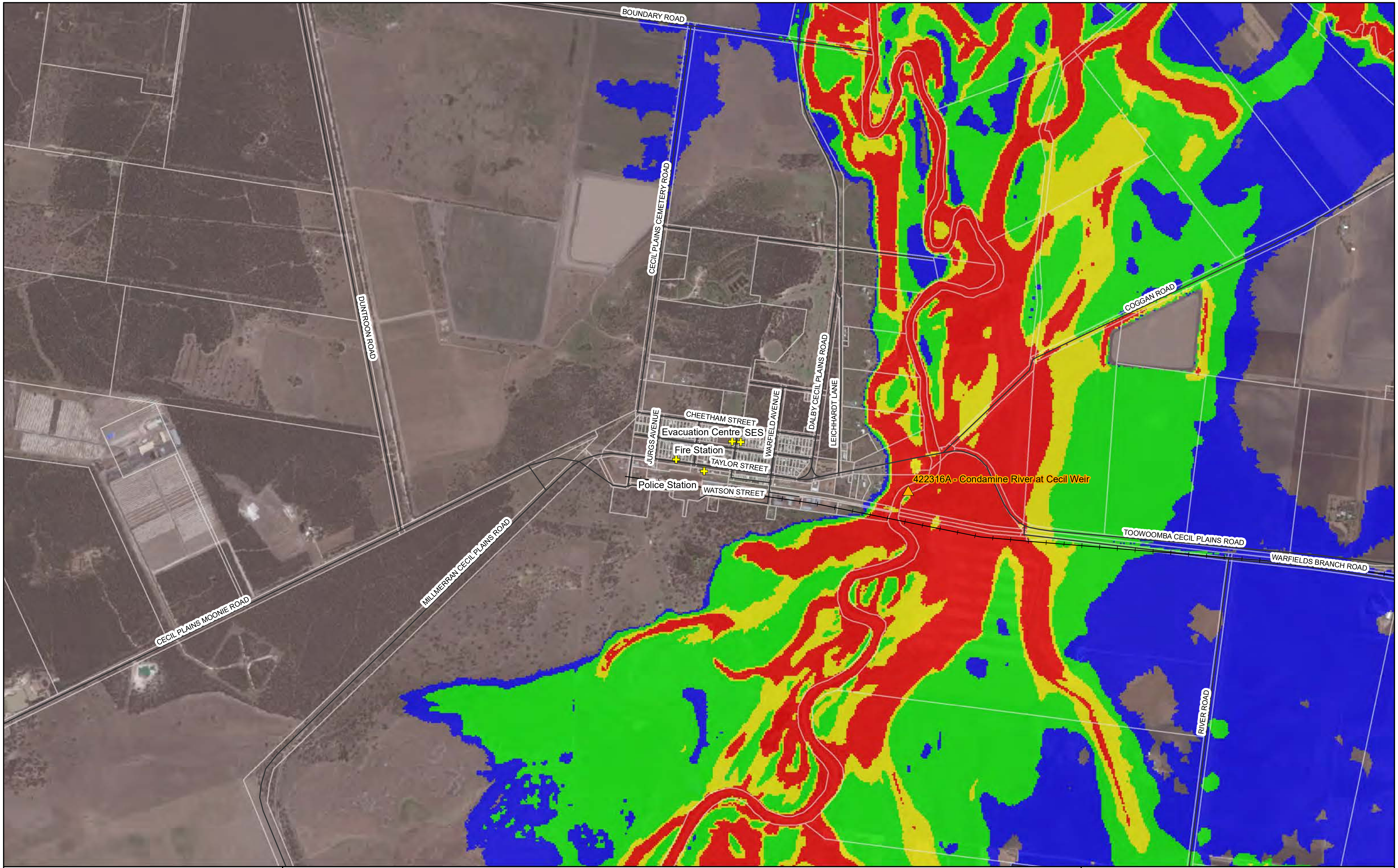
Hydraulic Category

- 🟪 Flood Fringe
- 🟩 Flood Storage
- 🟦 Floodway

SP051 Flood Studies
Work Package 7 - Addendum 1
500 Year ARI Event
Hydraulic Category

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

Disclaimer: Whilst all due care has been taken in the preparation of the plan and all information (the Plan and all information is referred to as "Plan information"), the accuracy of the Plan Information cannot be guaranteed. The Plan Information is provided as a guide and should not be relied upon in anyway whatsoever. Toowoomba Regional Council takes no responsibility for inaccuracies in the Plan Information and is not liable under any circumstances for any loss or damage whatsoever or howsoever caused arising directly or indirectly in connection with its use. The recipient must verify the Plan Information on site. Please refer any discrepancies to Toowoomba Regional Council - Information, Communications & Technology. No part of the Plan Information should be reproduced without the permission of the Coordinator GIS - ICT Branch, or other delegated representative of Council (131872).



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

Legend

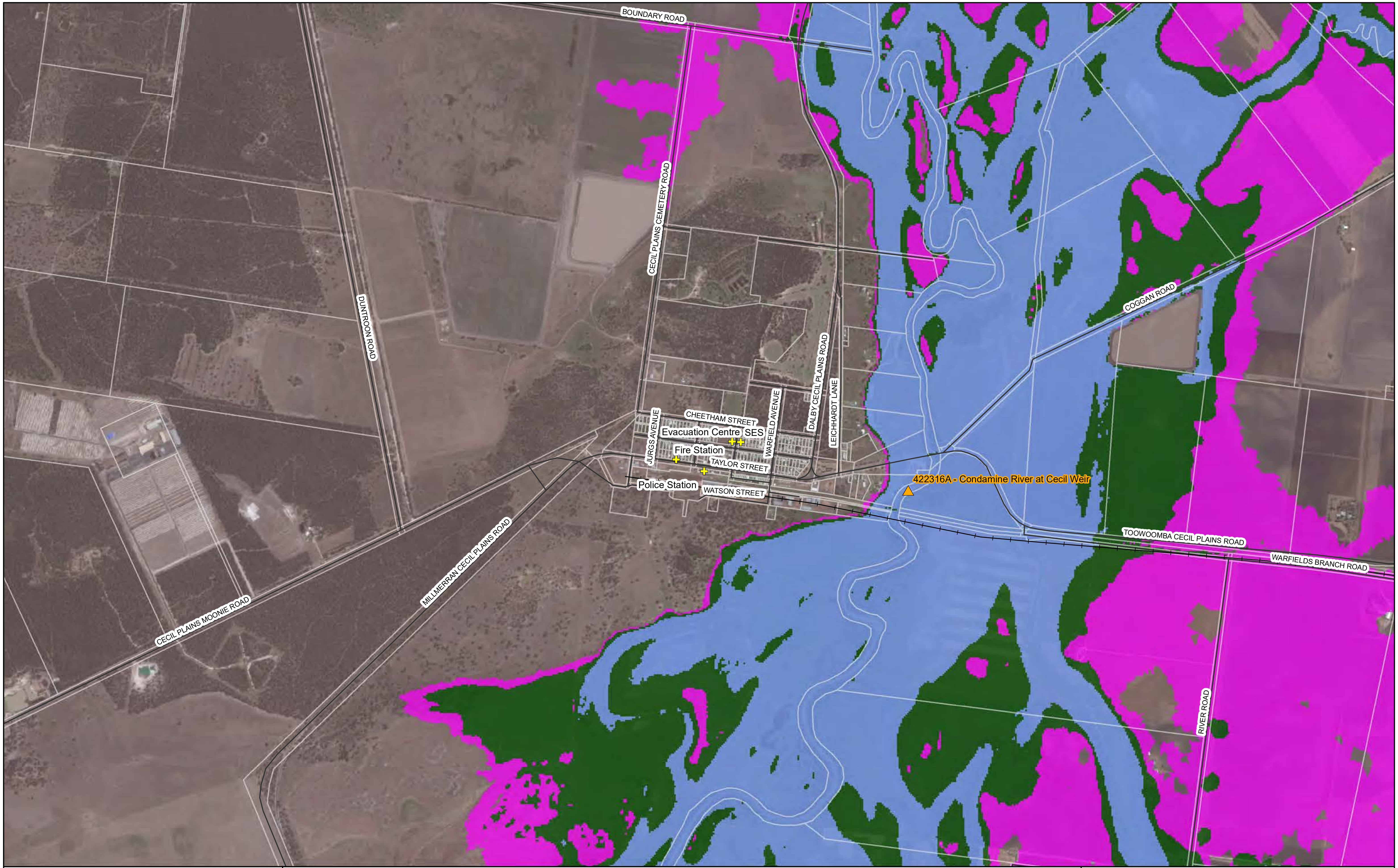
✚ Emergency Locations
—+— Rail
☐ Cadastre
— Roads
△ BoM Gauges
▲ DNRM Gauges

Hazard Category
🟦 Low
🟩 Significant
🟨 High
🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
10 Year ARI Event Peak Hazard

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\CEC_Map03_FloodHazard_Q010.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

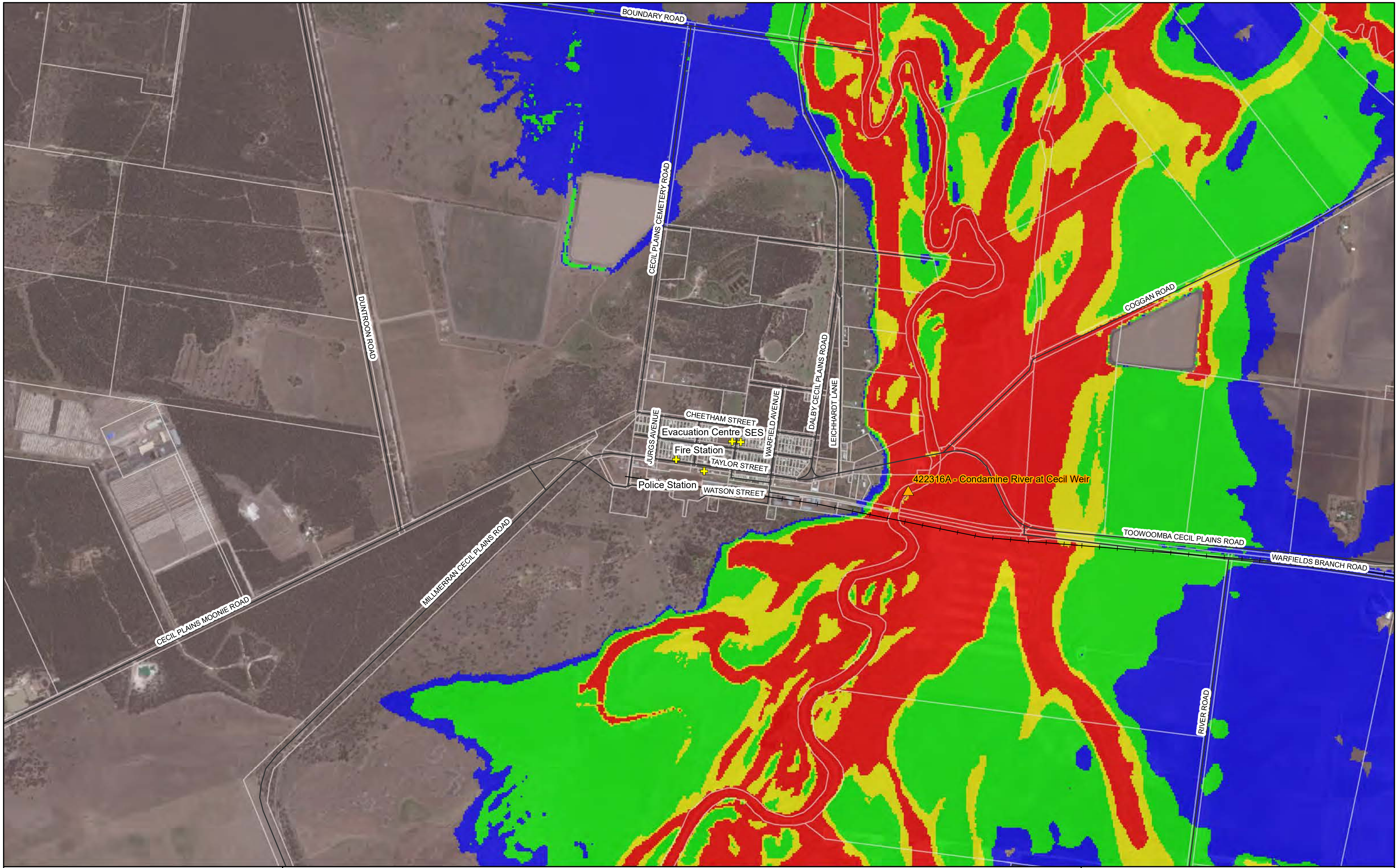
✚ Emergency Locations
—— Roads
—+— Rail
△ BoM Gauges
☐ Cadastre
▲ DNRM Gauges

Hydraulic Category
🟩 Flood Storage
🟪 Flood Fringe
🟦 Floodway

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
10 Year ARI Event Hydraulic Category

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\CEC_Map04_HydraulicCategory_Q010.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

Legend

- ✛ Emergency Locations
- ─┼─ Rail
- ▭ Cadastre
- ── Roads
- △ BoM Gauges
- △ DNRM Gauges

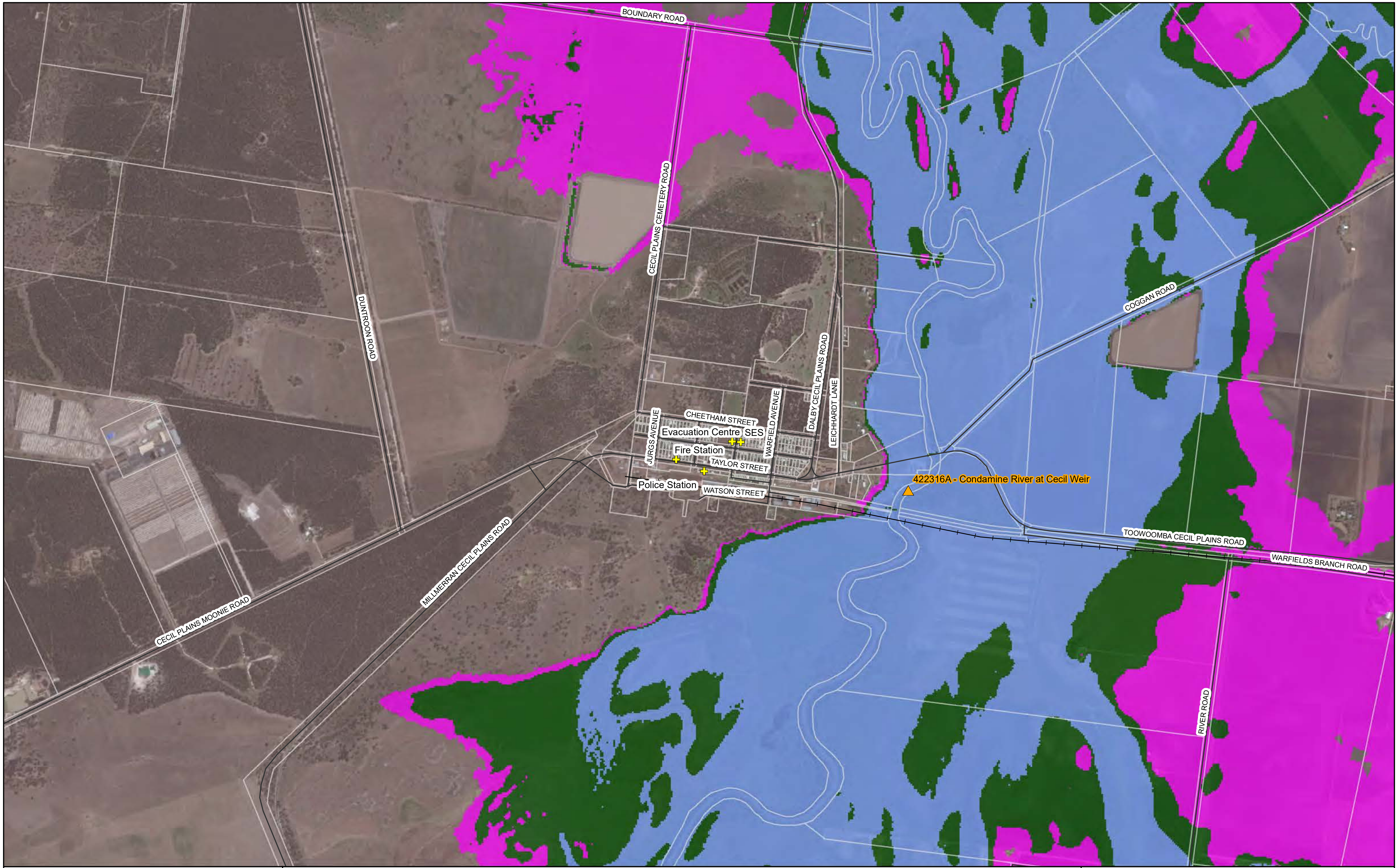
Hazard Category

- 🟦 Low
- 🟩 Significant
- 🟨 High
- 🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
20 Year ARI Event Peak Hazard

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\CEC_Map03_FloodHazard_Q020.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

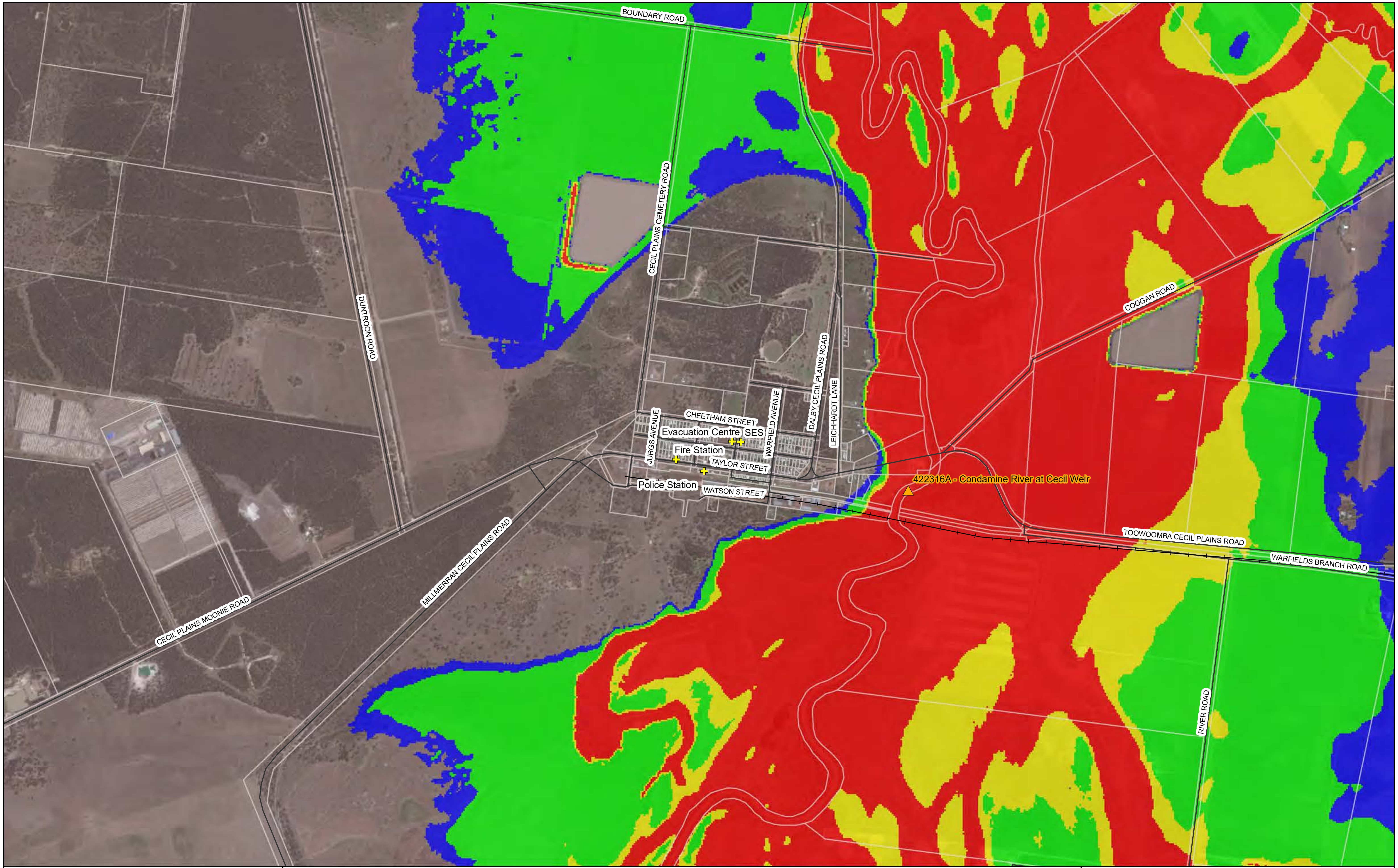
✚ Emergency Locations
—— Roads
—+— Rail
△ BoM Gauges
▭ Cadastre
▲ DNRM Gauges

Hydraulic Category
🟩 Flood Storage
🟪 Flood Fringe
🟦 Floodway

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
20 Year ARI Event Hydraulic Category

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\CEC_Map04_HydraulicCategory_Q020.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

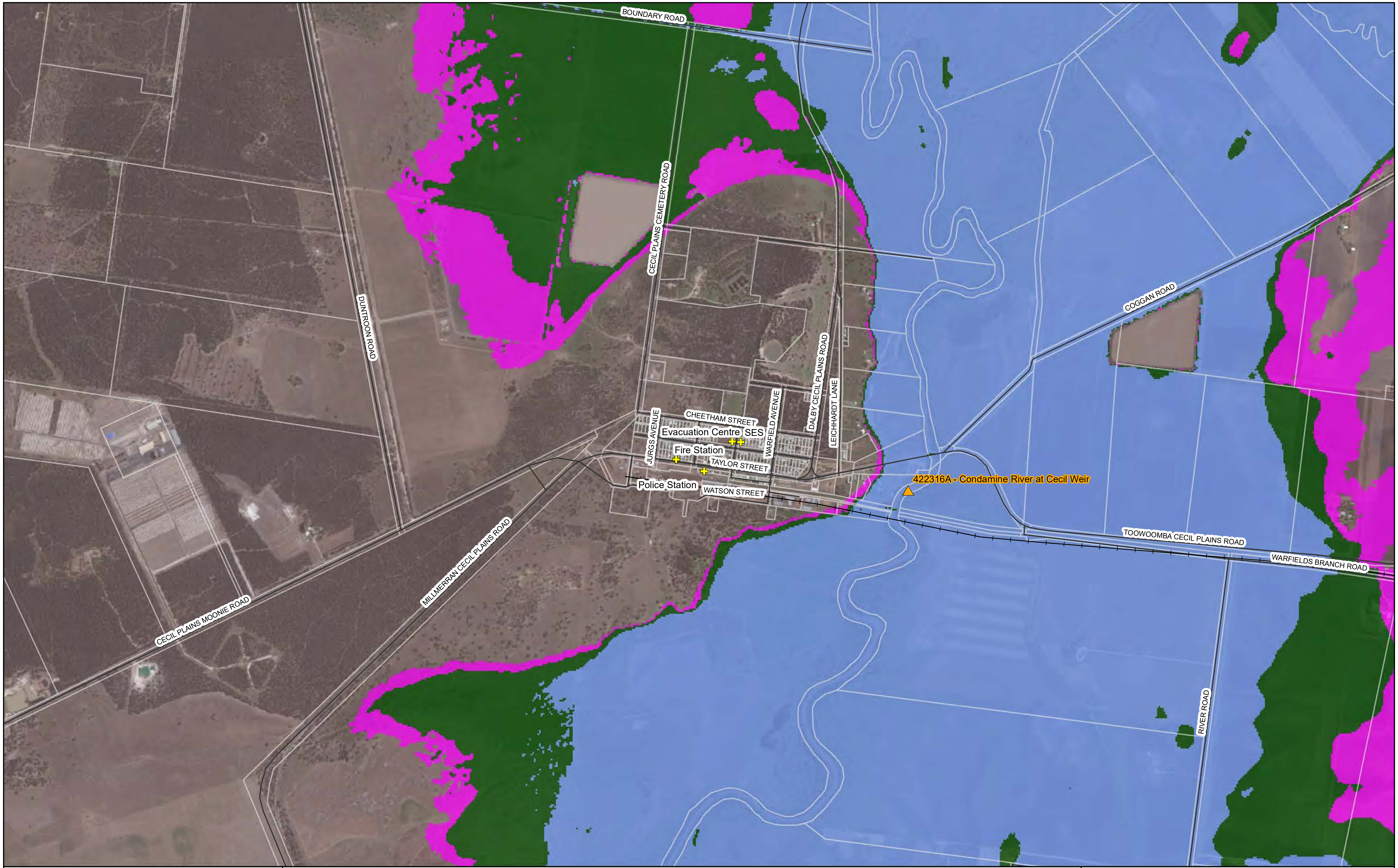
Legend

✚ Emergency Locations	— Roads	Hazard Category	🟨 High
—+— Rail	△ BoM Gauges	🟦 Low	🟥 Extreme
☐ Cadastre	△ DNRM Gauges	🟩 Significant	

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
100 Year ARI Event Peak Hazard

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\CEC_Map03_FloodHazard_Q100.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

Legend

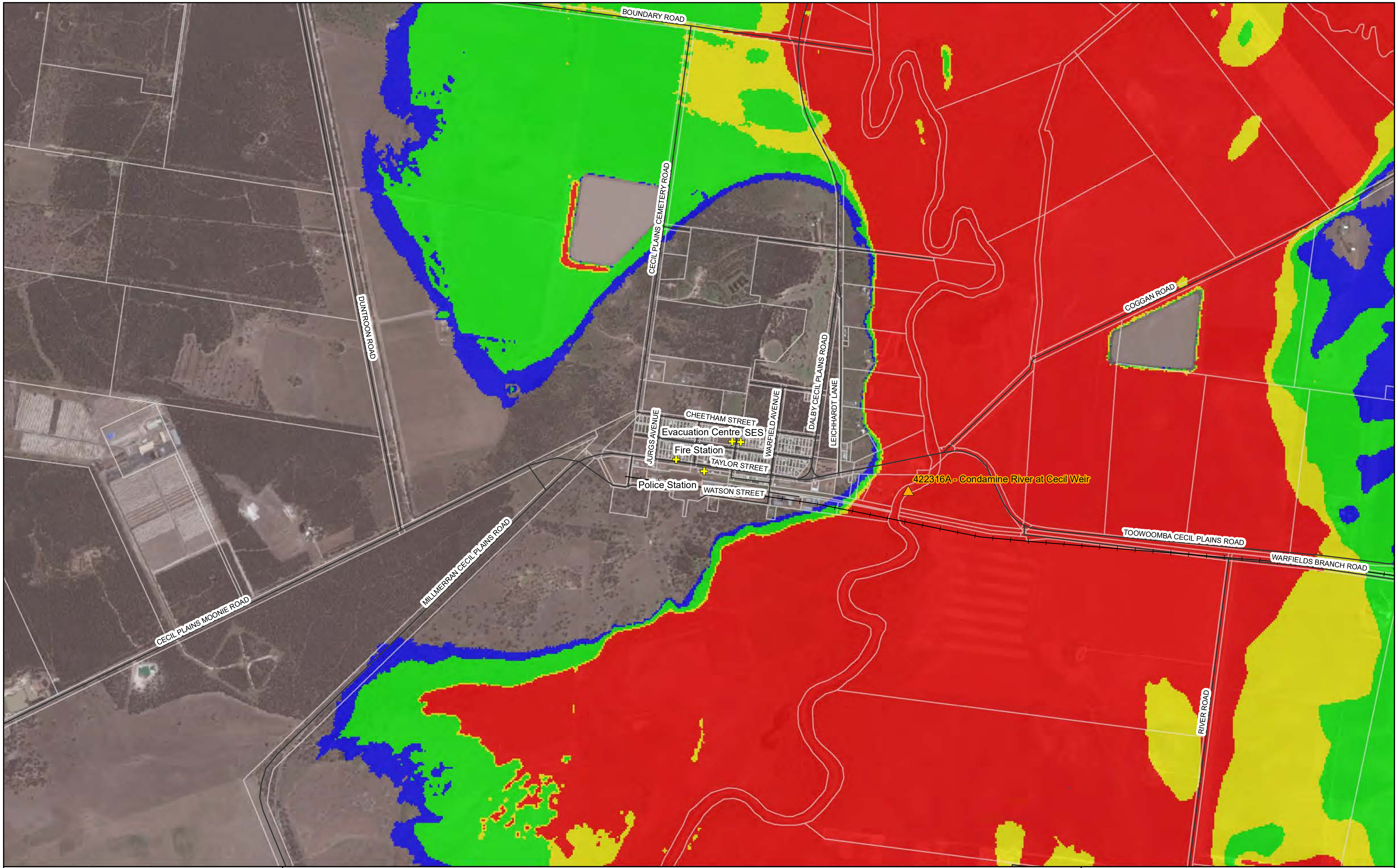
✚ Emergency Locations	— Roads	Hydraulic Category
—+— Rail	△ BoM Gauges	🟪 Flood Fringe
☐ Cadastre	△ DNRM Gauges	

🟩 Flood Storage
🟦 Floodway

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
100 Year ARI Event Hydraulic Category

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\CEC_Map04_HydraulicCategory_Q100.mxd
Date Saved: 8/11/2015



TOOWOOMBA
REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

Legend

✚ Emergency Locations	— Roads	Hazard Category	🟨 High
┼ Rail	△ BoM Gauges	🟦 Low	🟥 Extreme
☐ Cadastre	△ DNRM Gauges	🟩 Significant	

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
500 Year ARI Event Peak Hazard

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\CEC_Map03_FloodHazard_Q500.mxd
Date Saved: 8/11/2015

TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

Legend

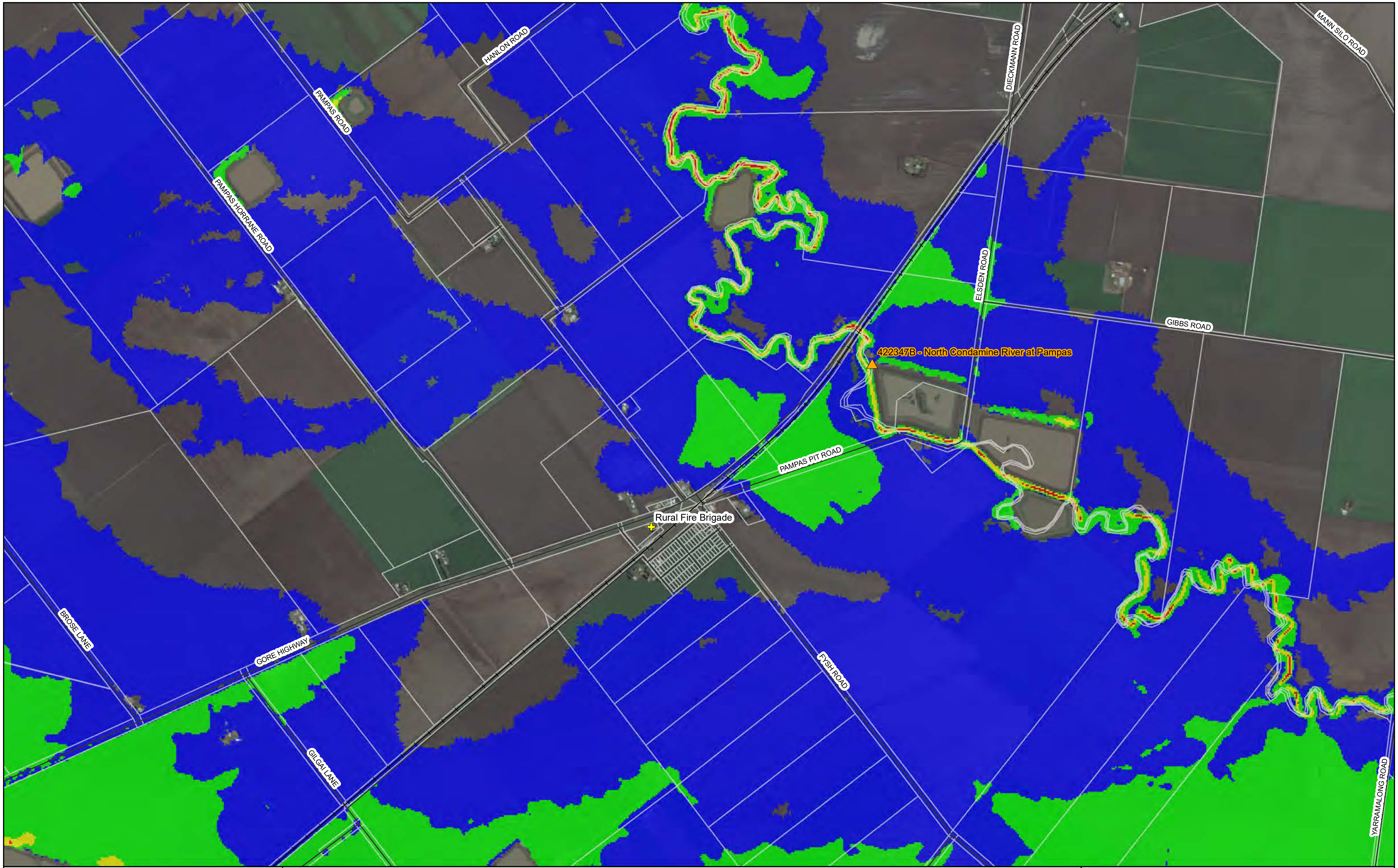
- ✚ Emergency Locations
- ┼ Rail
- ☐ Cadastre
- — Roads
- △ BoM Gauges
- ▲ DNRM Gauges

Hydraulic Category

- 🟪 Flood Fringe
- 🟩 Flood Storage
- 🟦 Floodway

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
500 Year ARI Event Hydraulic Category

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\CEC_Map04_HydraulicCategory_Q500.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)
0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

Legend

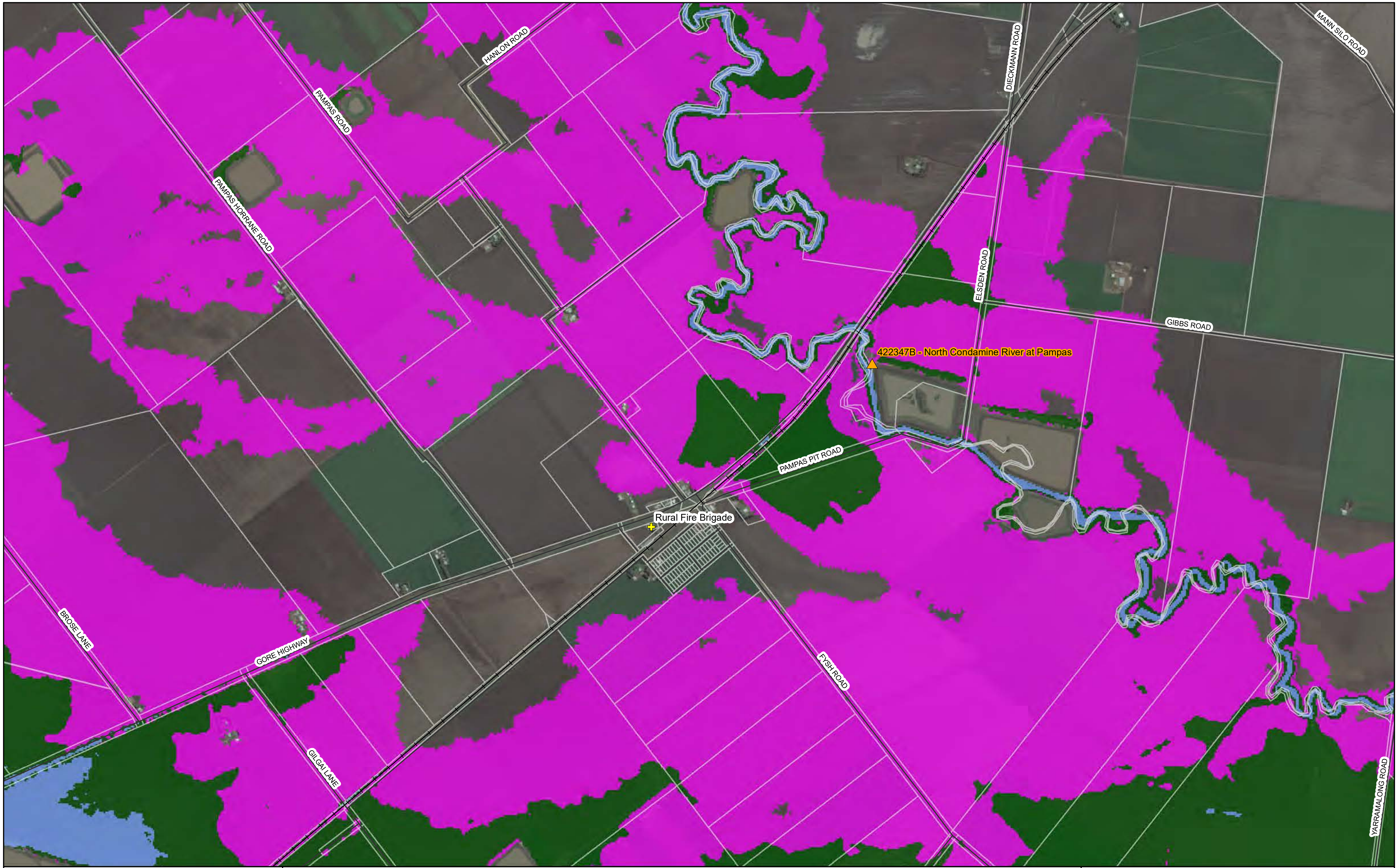
- ✚ Emergency Locations
- Rail
- Cadastre
- Roads
- △ BoM Gauges
- ▲ DNRM Gauges

Hazard Category
- 🟦 Low
- 🟩 Significant
- 🟨 High
- 🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
10 Year ARI Event Peak Hazard

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\PAM_Map03_FloodHazard_Q010.mxd
Date Saved: 8/11/2015



TOOWOOMBA
REGION

1:20,000 (at A3)

0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

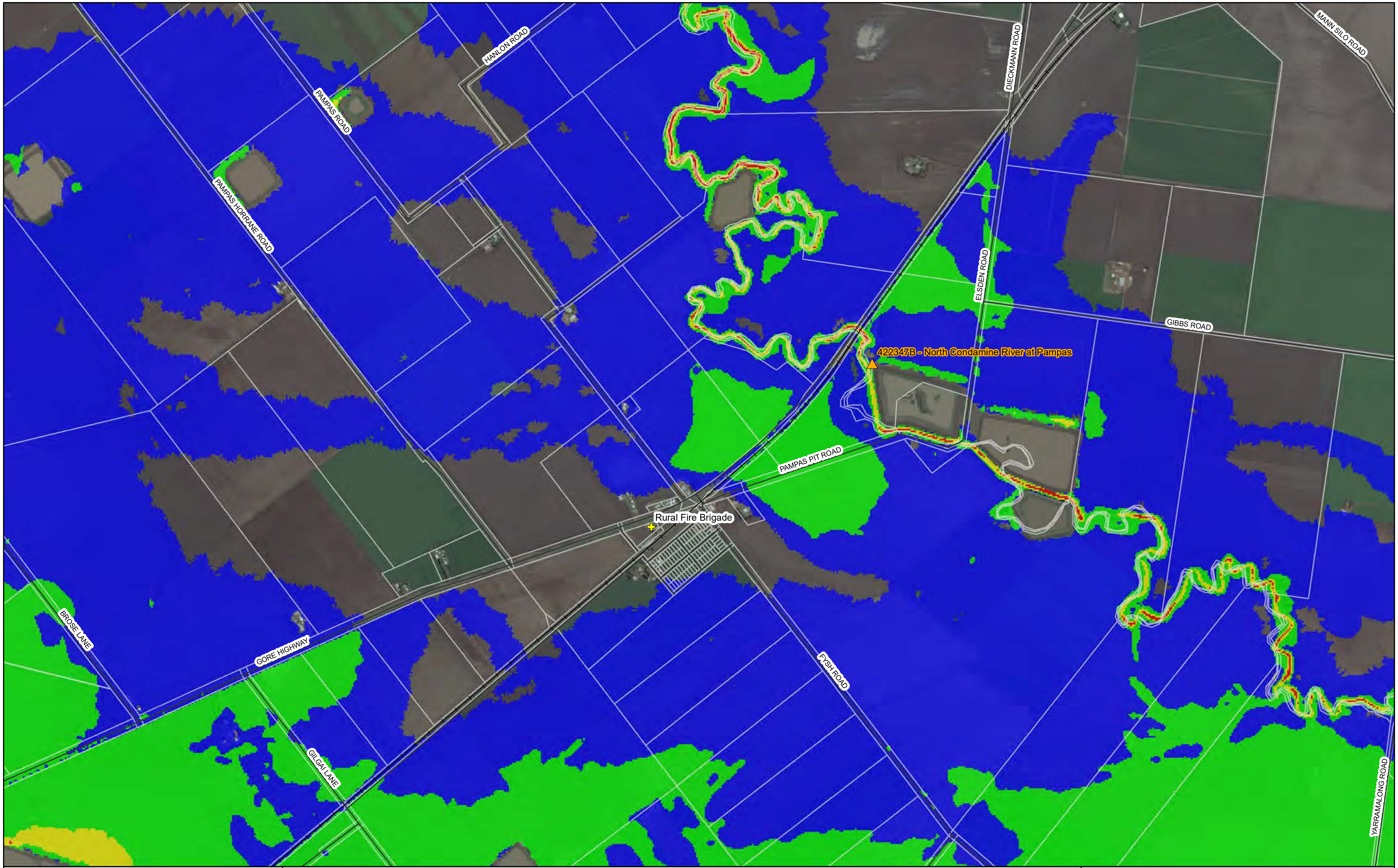
Legend

✚ Emergency Locations	— Roads	Hydraulic Category	🟩 Flood Storage
┼ Rail	△ BoM Gauges	🟪 Flood Fringe	🟦 Floodway
☐ Cadastre	▲ DNRM Gauges		

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
10 Year ARI Event Hydraulic Category

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\PAM_Map04_HydraulicCategory_Q010.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

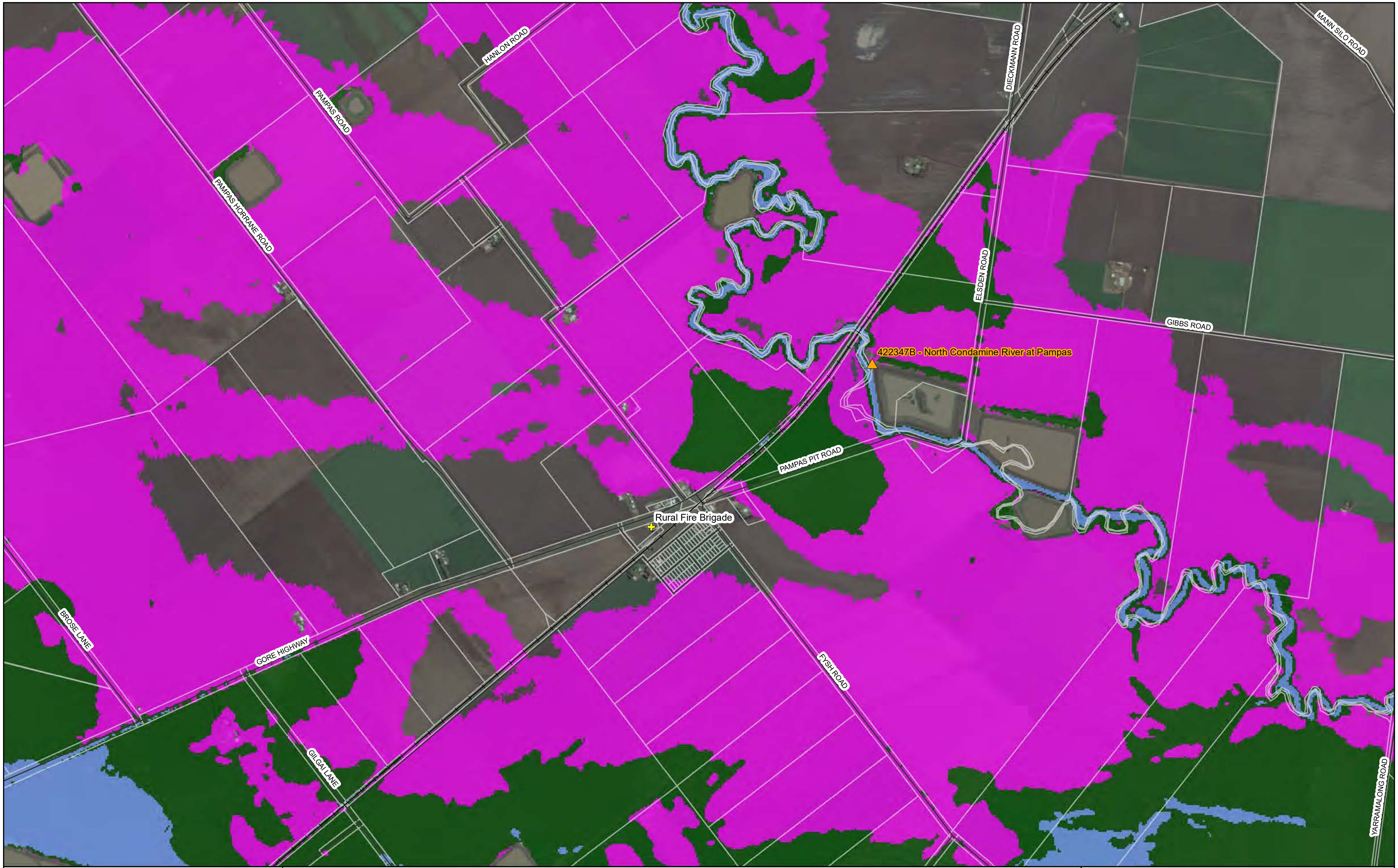
Legend

✚ Emergency Locations	— Roads	Hazard Category
—+— Rail	△ BoM Gauges	🟦 Low
☐ Cadastre	△ DNRM Gauges	🟩 Significant
		🟨 High
		🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
20 Year ARI Event Peak Hazard

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\PAM_Map03_FloodHazard_Q020.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

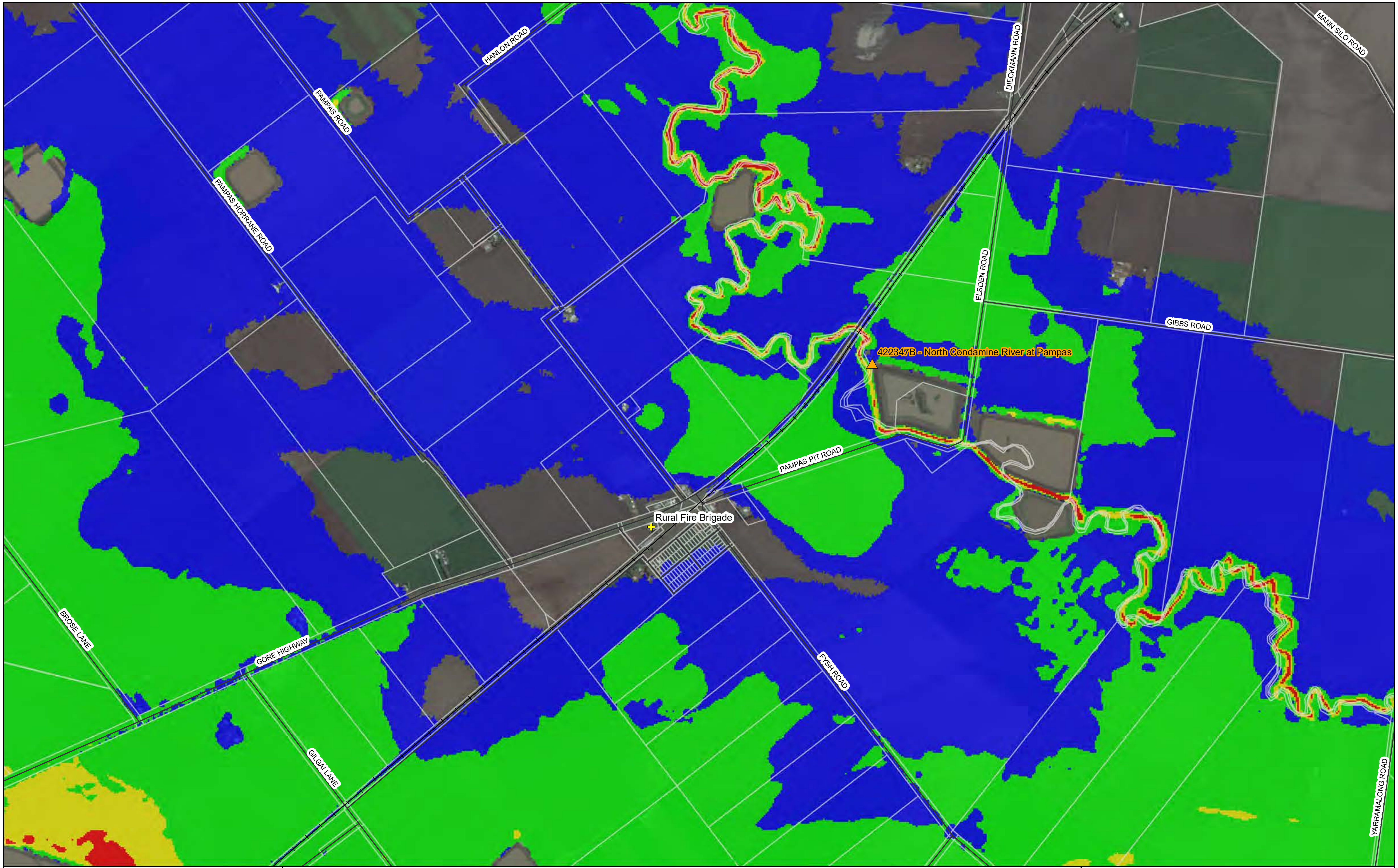
Legend

✚ Emergency Locations	— Roads	Hydraulic Category	🟩 Flood Storage
┼ Rail	△ BoM Gauges	🟪 Flood Fringe	🟦 Floodway
☐ Cadastre	▲ DNRM Gauges		

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
20 Year ARI Event Hydraulic Category

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\PAM_Map04_HydraulicCategory_Q020.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

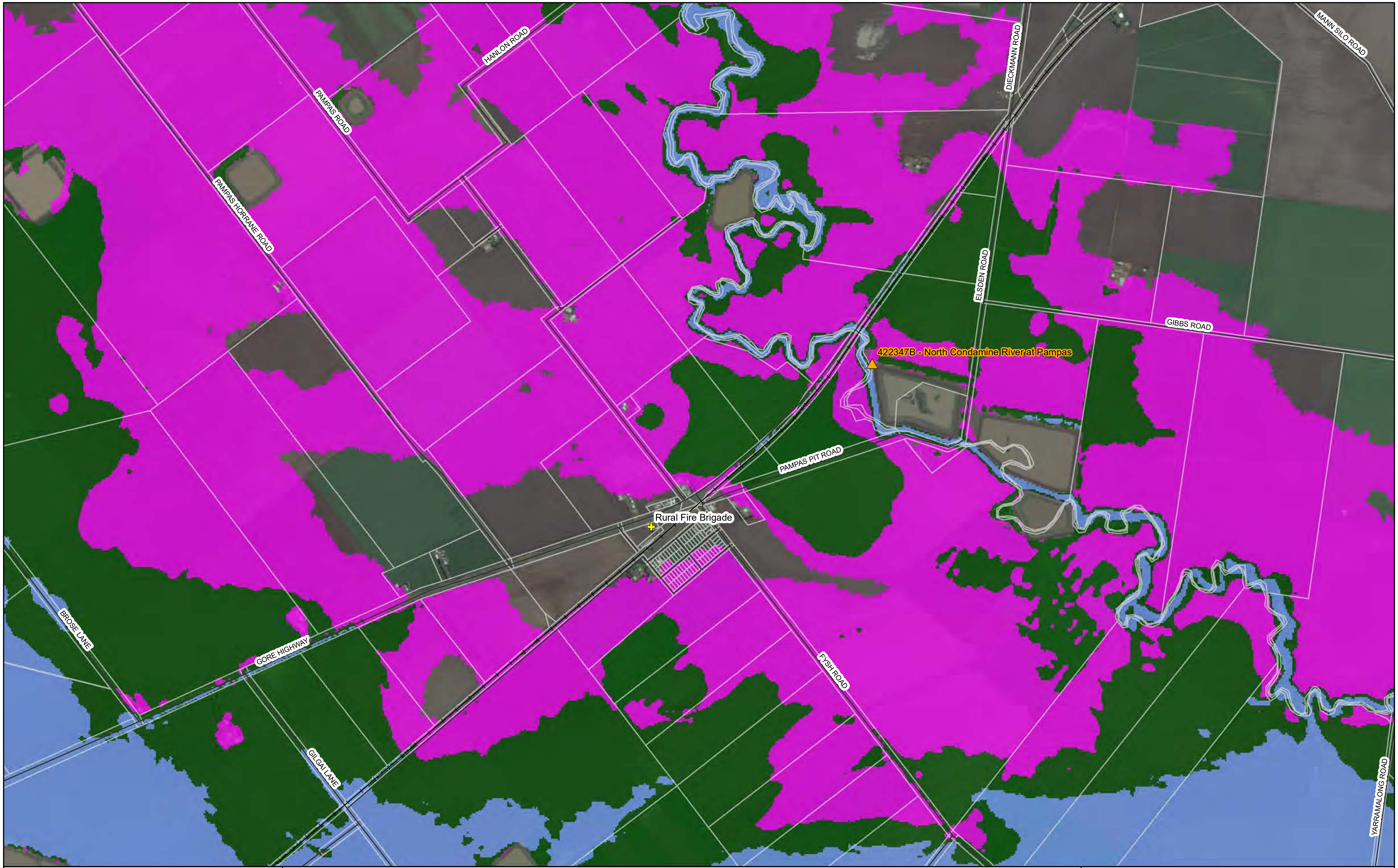
Legend

✚ Emergency Locations	— Roads	Hazard Category	🟨 High
—+— Rail	△ BoM Gauges	🟦 Low	🟥 Extreme
☐ Cadastre	▲ DNRM Gauges	🟩 Significant	

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
100 Year ARI Event Peak Hazard

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\PAM_Map03_FloodHazard_Q100.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

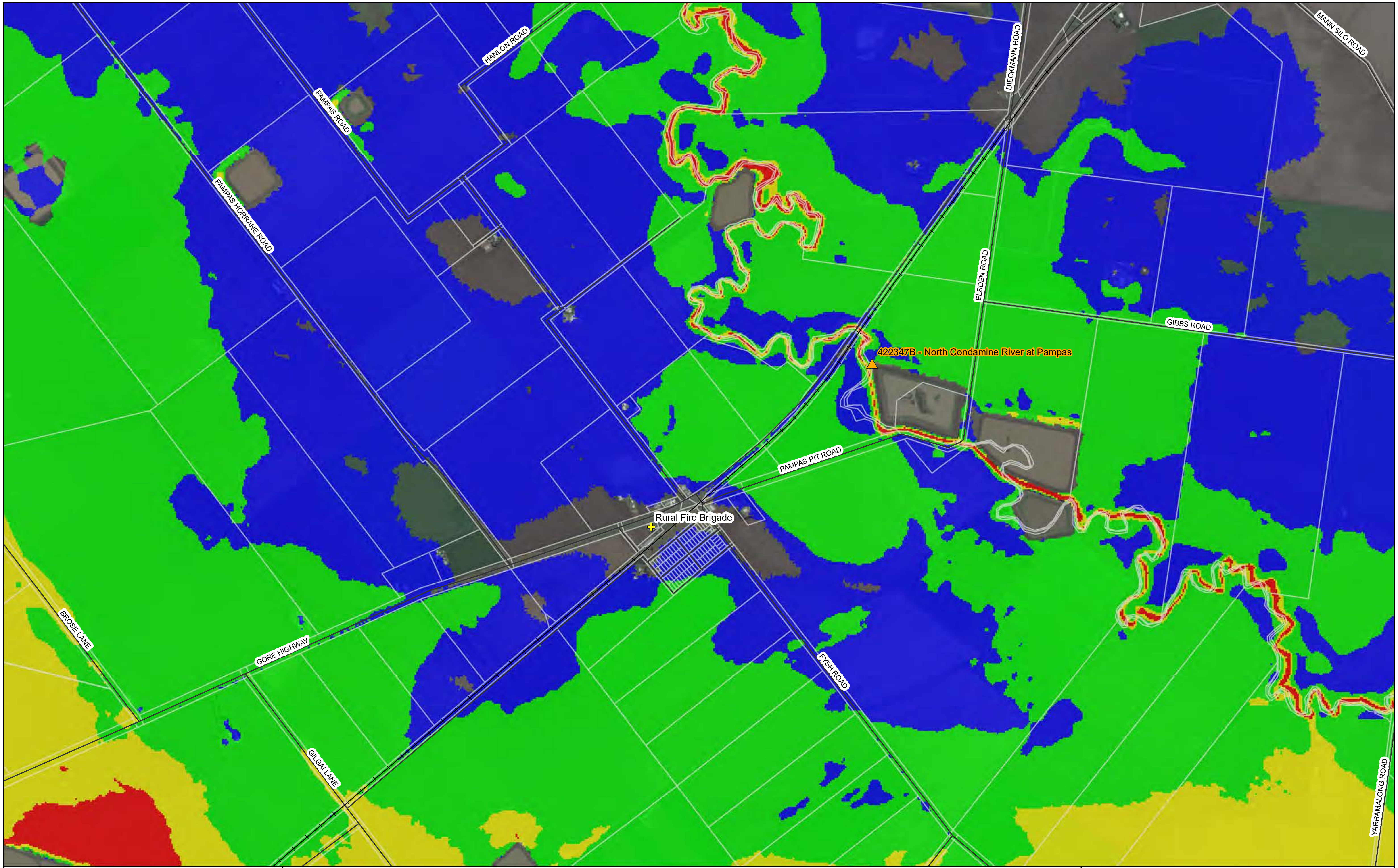
- ✚ Emergency Locations
- Rail
- Cadastre
- Roads
- △ BoM Gauges
- ▲ DNRM Gauges

Hydraulic Category
- 🟪 Flood Fringe
- 🟩 Flood Storage
- 🟦 Floodway

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
100 Year ARI Event Hydraulic Category

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\PAM_Map04_HydraulicCategory_Q100.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

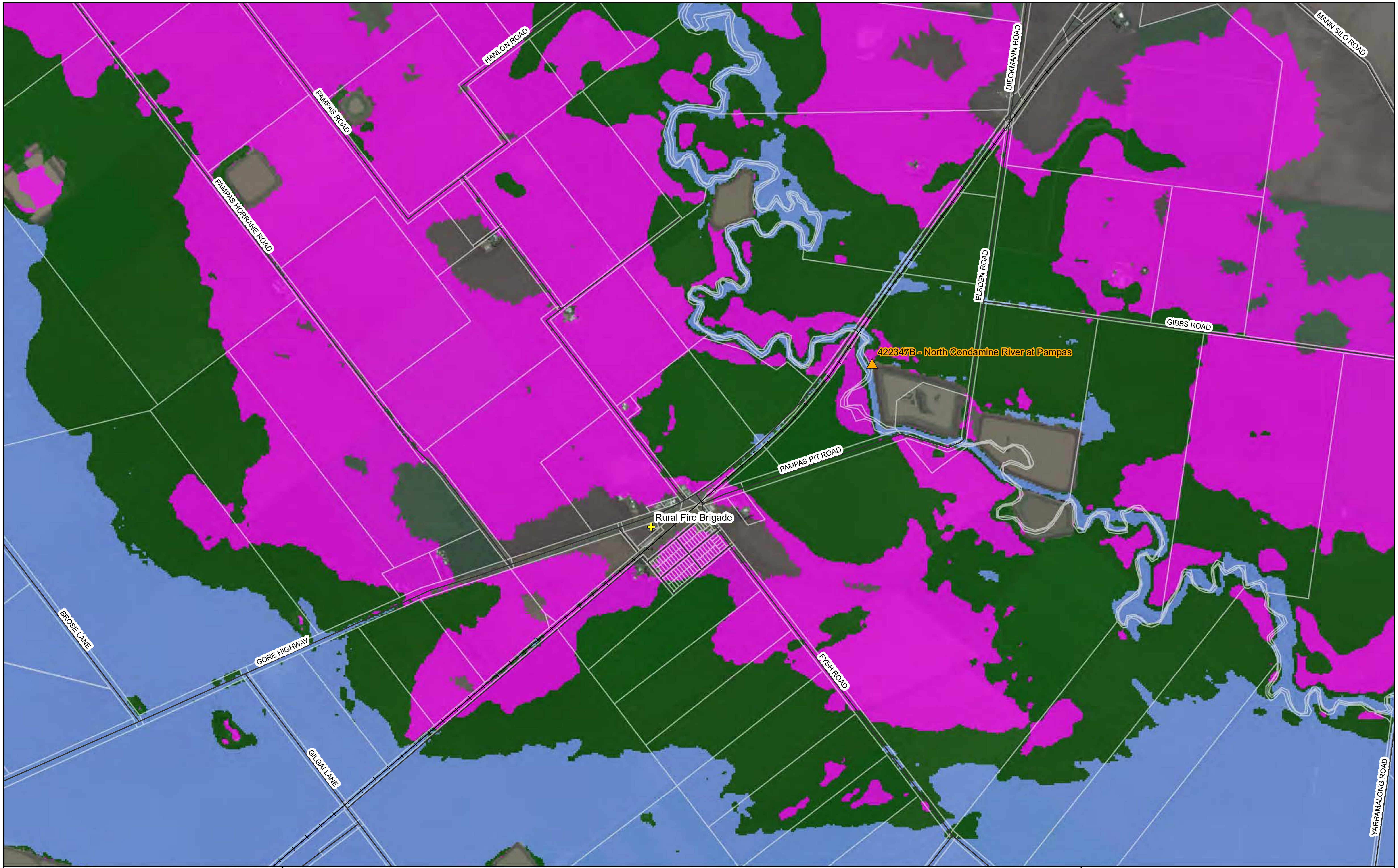
N

Legend

✚ Emergency Locations	— Roads	Hazard Category	🟨 High
┼ Rail	△ BoM Gauges	🟦 Low	🟥 Extreme
▭ Cadastre	△ DNRM Gauges	🟩 Significant	

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
500 Year ARI Event Peak Hazard

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\PAM_Map03_FloodHazard_Q500.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

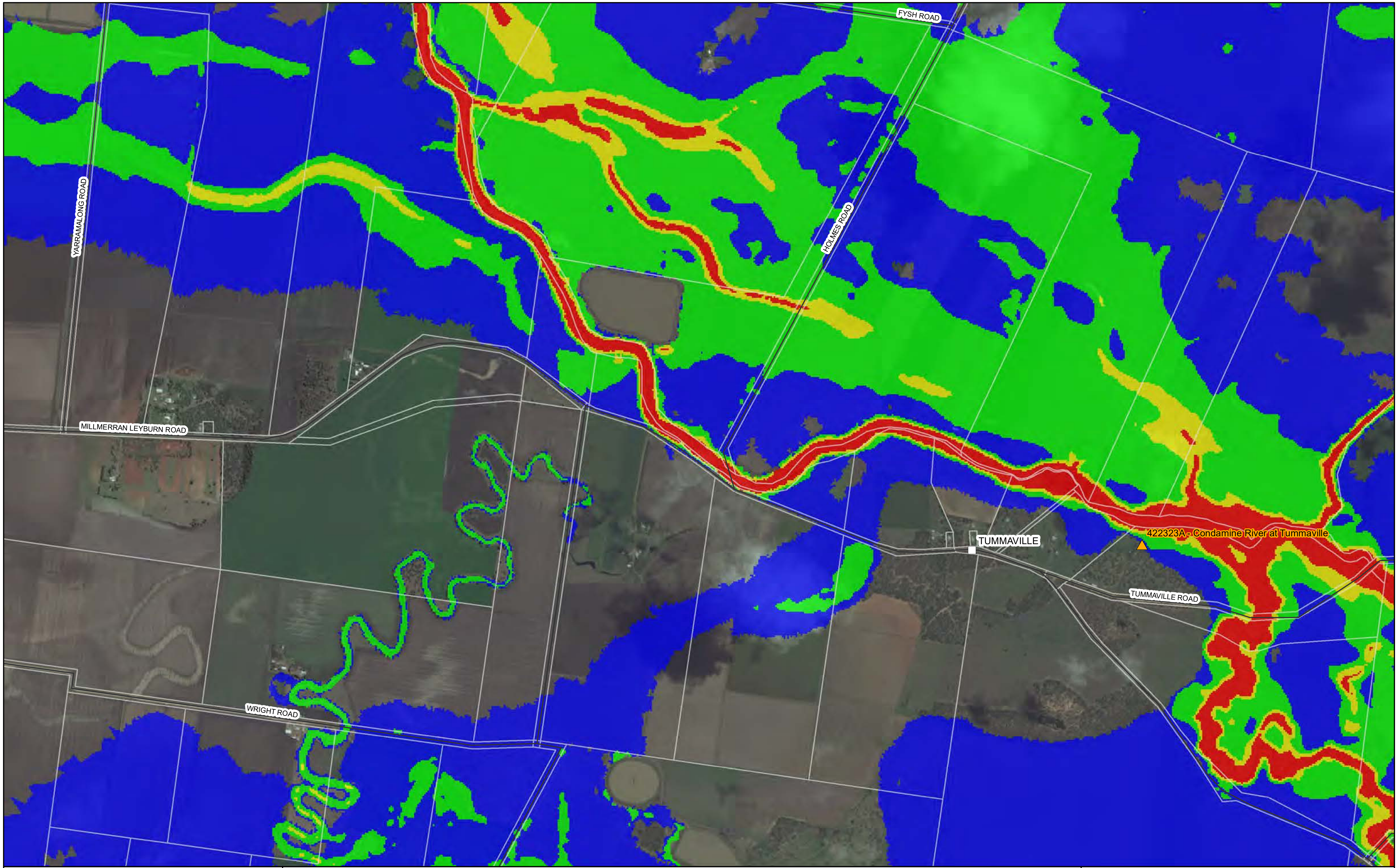
Legend

✚ Emergency Locations	— Roads	Hydraulic Category	🟩 Flood Storage
—+— Rail	△ BoM Gauges	▨ Flood Fringe	▨ Floodway
☐ Cadastre	▲ DNRM Gauges		

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
500 Year ARI Event Hydraulic Category

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\PAM_Map04_HydraulicCategory_Q500.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

GDA 1994 MGA Zone 56

Legend

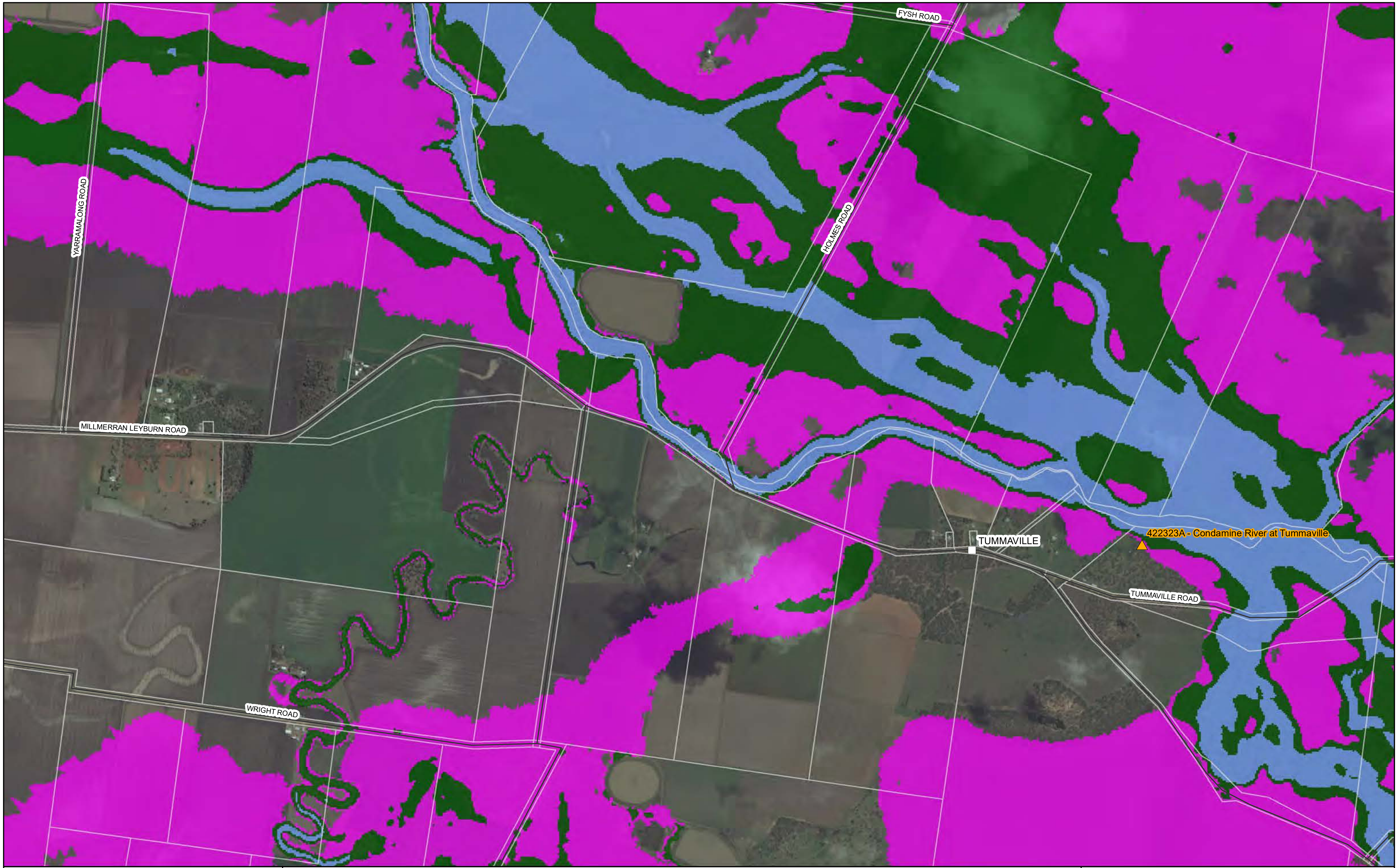
- ✚ Emergency Locations
- —+— Rail
- ☐ Cadastre
- ☐ Towns
- — Roads
- △ BoM Gauges
- △ DNRM Gauges

Hazard Category

- 🟦 Low
- 🟩 Significant
- 🟨 High
- 🟥 Extreme

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
10 Year ARI Event Peak Hazard

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\TUM_Map03_FloodHazard_Q010.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

Legend

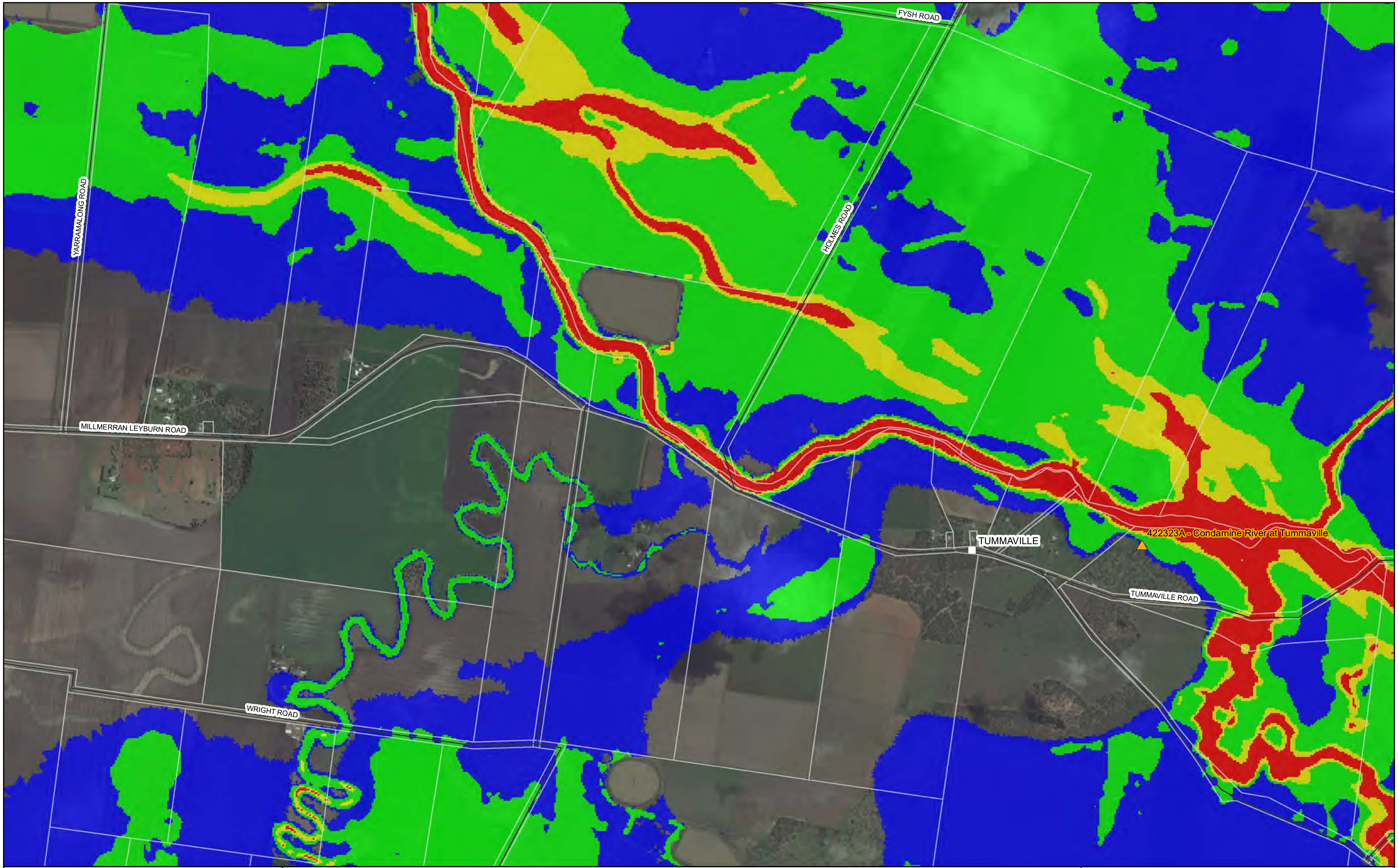
- ✚ Emergency Locations
- ┼ Rail
- ☐ Cadastre
- □ Towns
- — Roads
- △ BoM Gauges
- ▲ DNRM Gauges

Hydraulic Category

- 🟪 Flood Fringe
- 🟩 Flood Storage
- 🟦 Floodway

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
10 Year ARI Event Hydraulic Category

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\TUM_Map04_HydraulicCategory_Q010.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

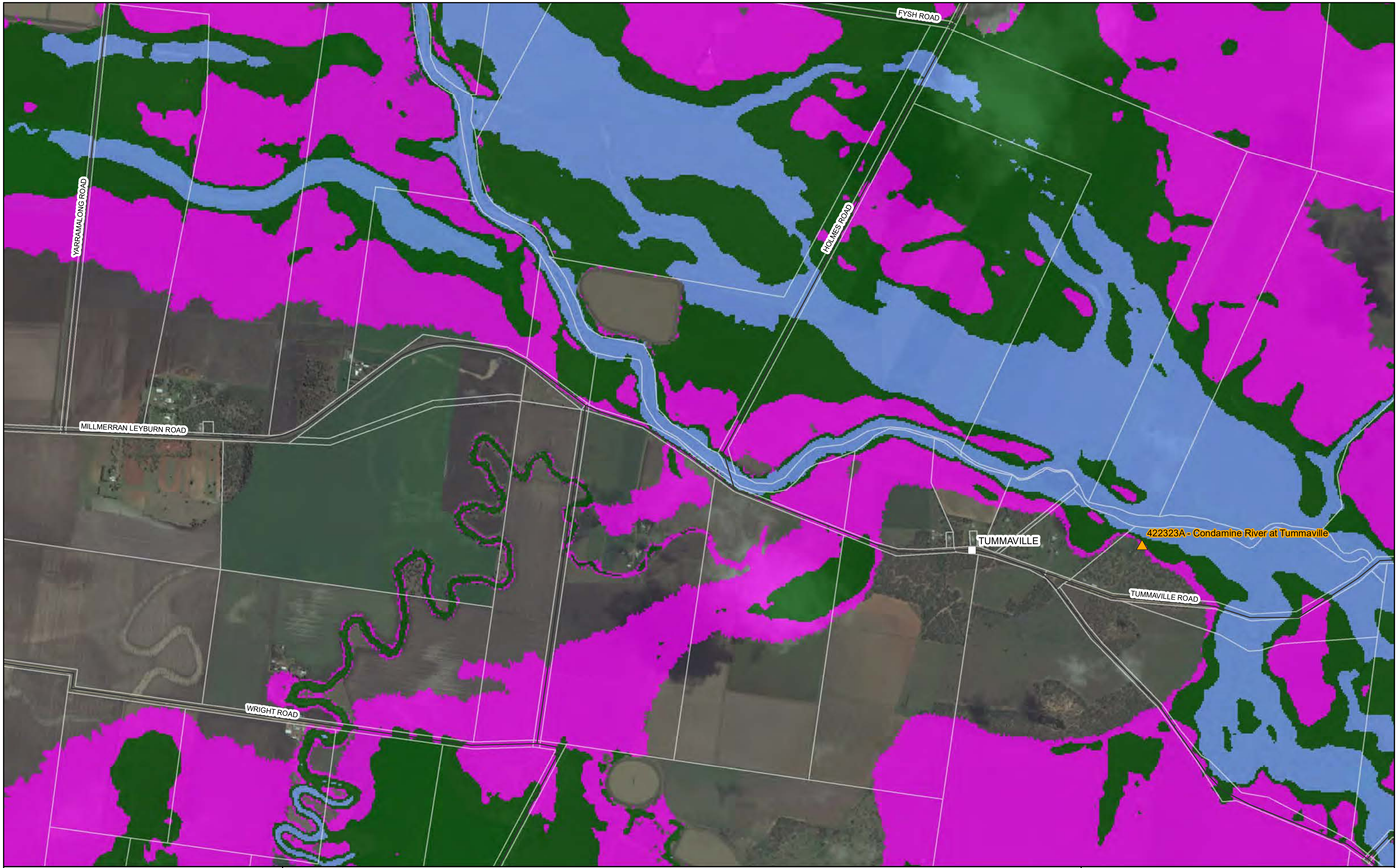
Legend

✚ Emergency Locations	Roads	Hazard Category	🟨 High
Rail	△ BoM Gauges	🟦 Low	🟥 Extreme
☐ Cadastre	△ DNRM Gauges	🟩 Significant	
☐ Towns			

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
20 Year ARI Event Peak Hazard

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\TUM_Map03_FloodHazard_Q020.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

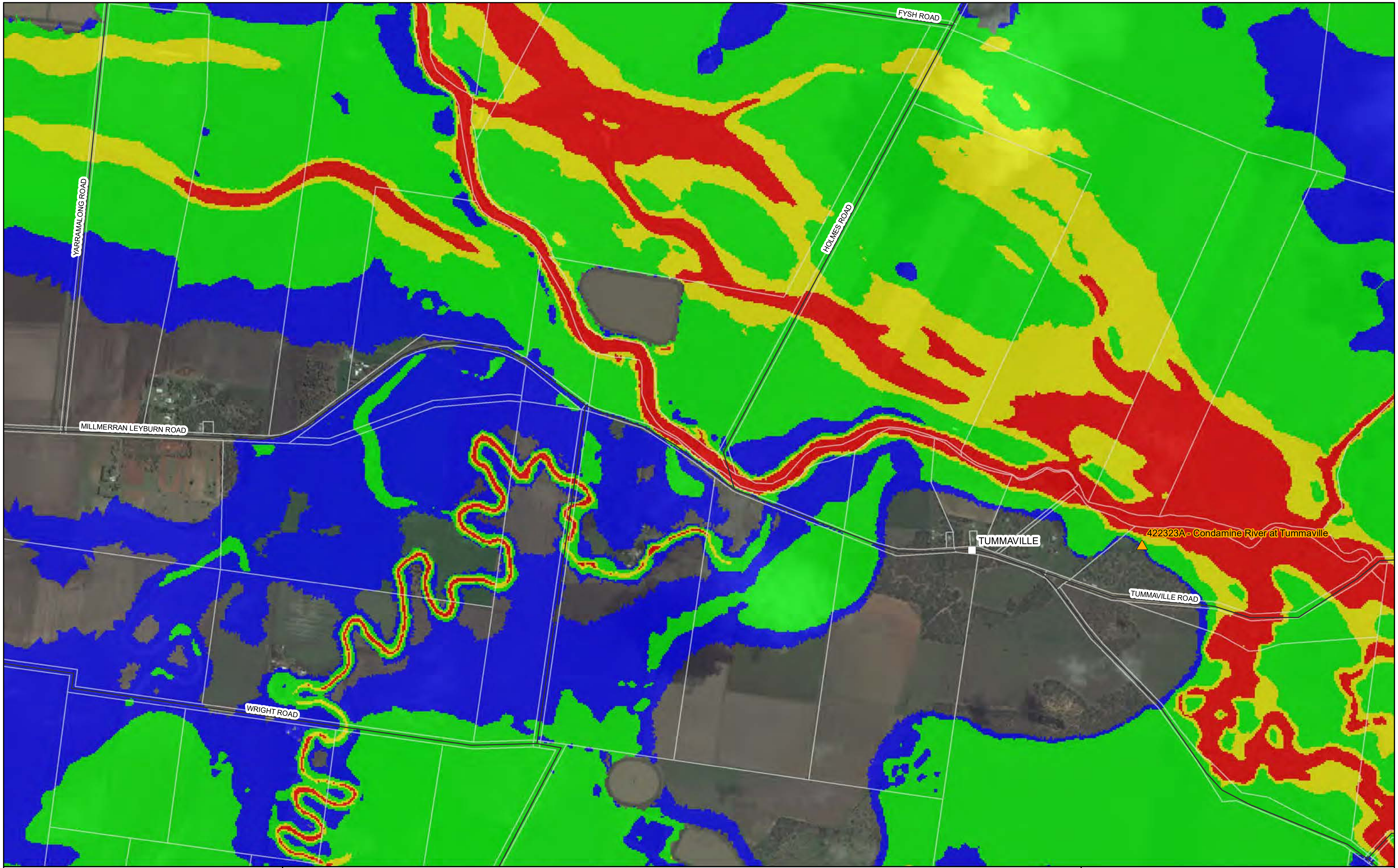
- ✚ Emergency Locations
- ─ Rail
- ☐ Cadastre
- ☐ Towns
- ─ Roads
- △ BoM Gauges
- △ DNRM Gauges

Hydraulic Category
- 🟪 Flood Fringe
- 🟩 Flood Storage
- 🟦 Floodway

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
20 Year ARI Event Hydraulic Category

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\TUM_Map04_HydraulicCategory_Q020.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

- ✚ Emergency Locations
- ─┼─ Rail
- ☐ Cadastre
- ☐ Towns
- ─── Roads
- △ BoM Gauges
- ▲ DNRM Gauges

Hazard Category

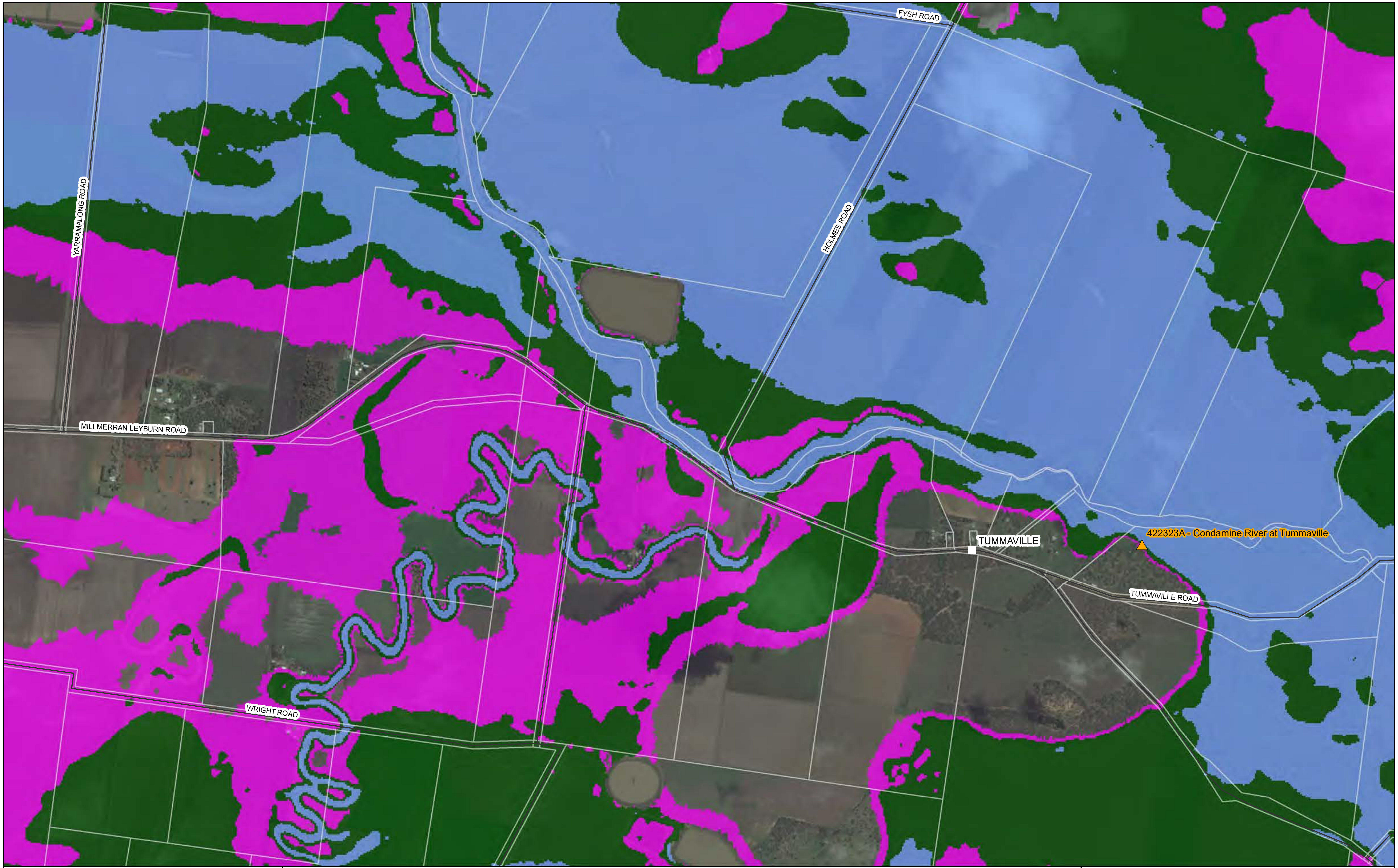
- 🟦 Low
- 🟩 Significant
- 🟨 High
- 🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
100 Year ARI Event Peak Hazard

Disclaimer: Whilst all due care has been taken in the preparation of the plan and all information (the Plan and all information is referred to as “Plan information”), the accuracy of the Plan Information cannot be guaranteed. The Plan Information is provided as a guide and should not be relied upon in anyway whatsoever. Toowoomba Regional Council takes no responsibility for inaccuracies in the Plan Information and is not liable under any circumstances for any loss or damage whatsoever or howsoever caused arising directly or indirectly in connection with its use. The recipient must verify the Plan Information on site. Please refer any discrepancies to Toowoomba Regional Council - Information, Communications & Technology. No part of the Plan Information should be reproduced without the permission of the Coordinator GIS - ICT Branch, or other delegated representative of Council (131872).

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\TUM_Map03_FloodHazard_Q100.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

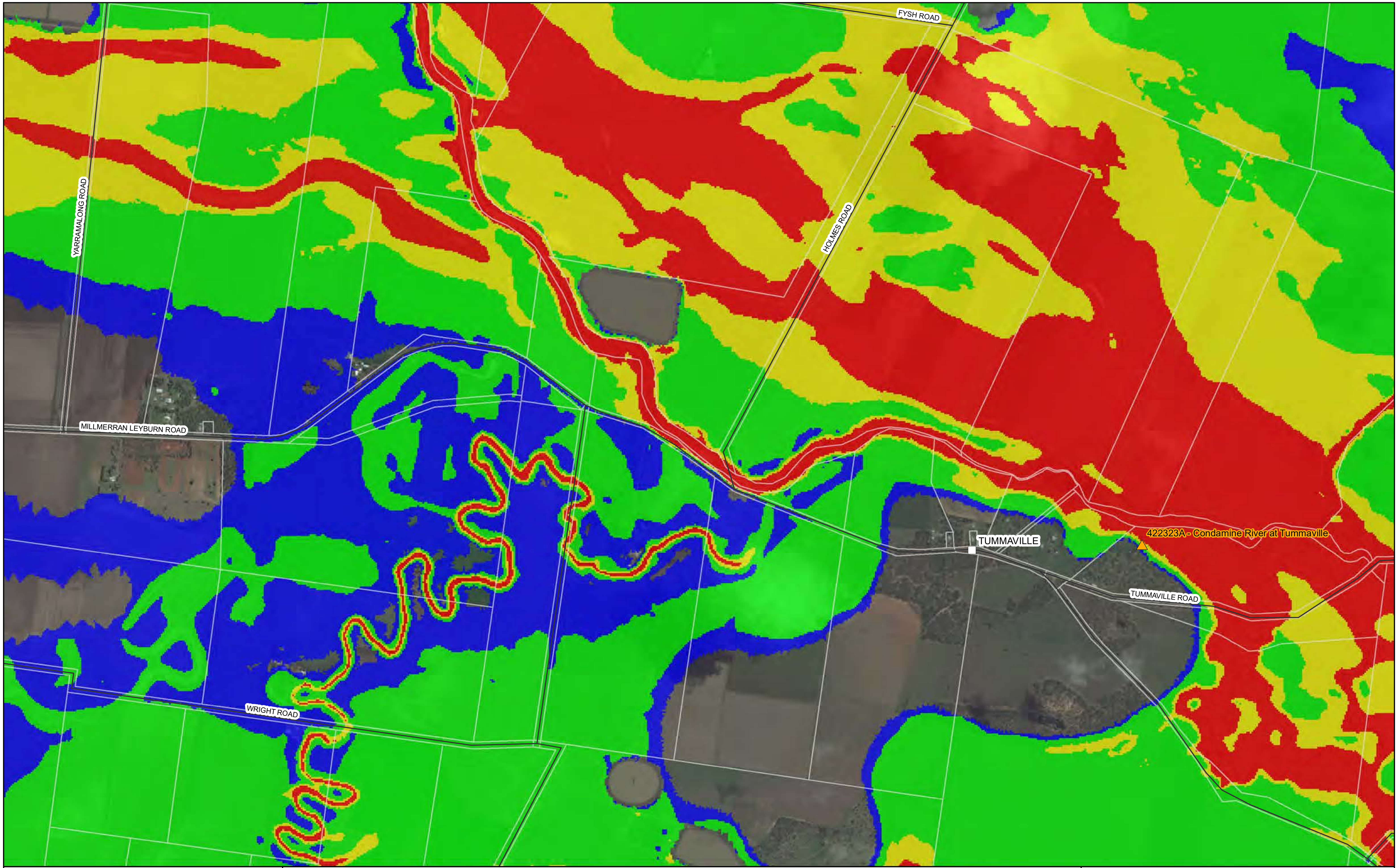
Legend

✚ Emergency Locations	— Roads	Hydraulic Category	🟩 Flood Storage
⊢ Rail	△ BoM Gauges	🟪 Flood Fringe	🟦 Floodway
☐ Cadastre	△ DNRM Gauges		
□ Towns			

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
100 Year ARI Event Hydraulic Category

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\TUM_Map04_HydraulicCategory_Q100.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

Legend

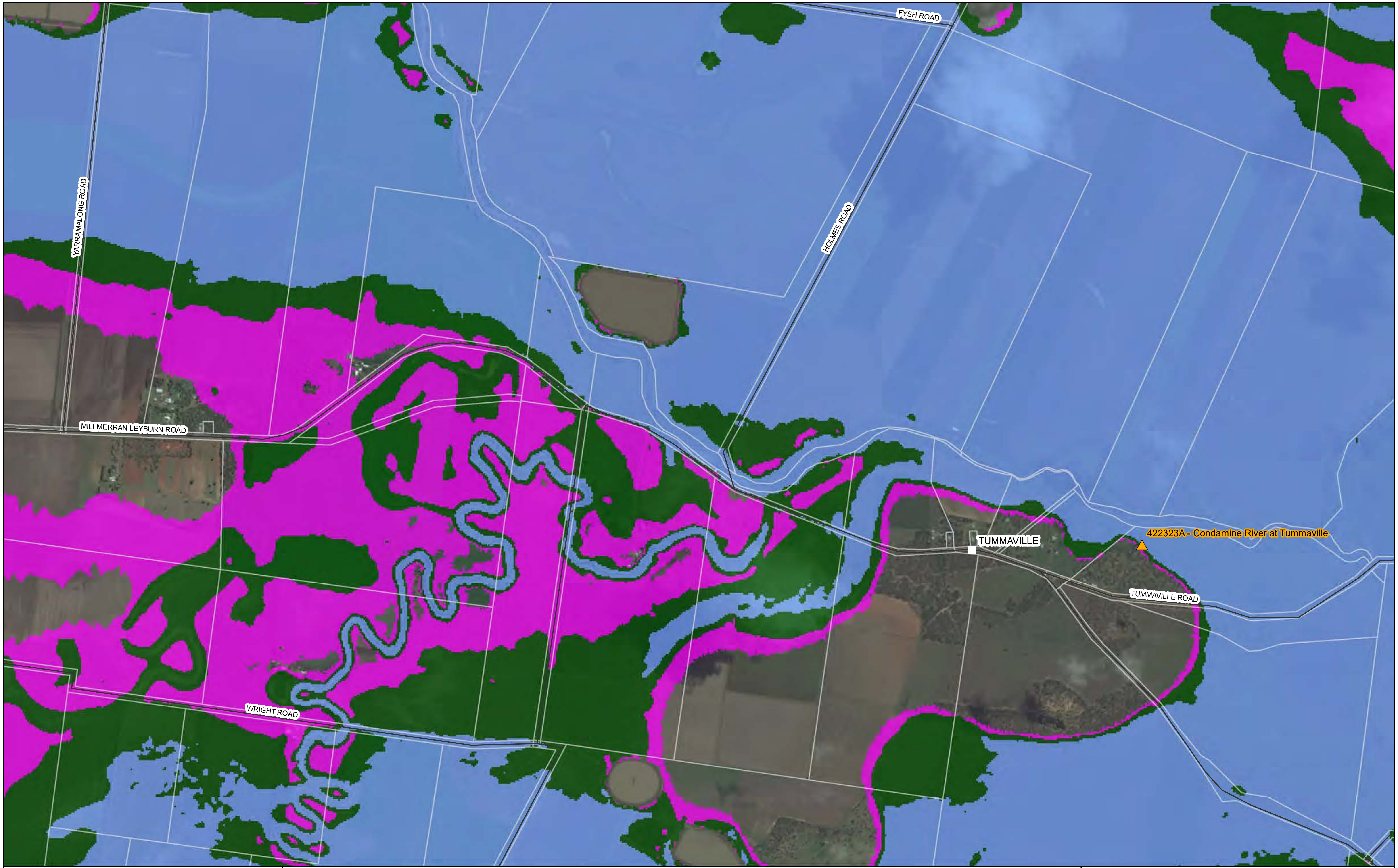
✚ Emergency Locations
—+— Rail
☐ Cadastre
☐ Towns
— Roads
△ BoM Gauges
▲ DNRM Gauges

Hazard Category
🟦 Low
🟩 Significant
🟨 High
🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
500 Year ARI Event Peak Hazard

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\TUM_Map03_FloodHazard_Q500.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

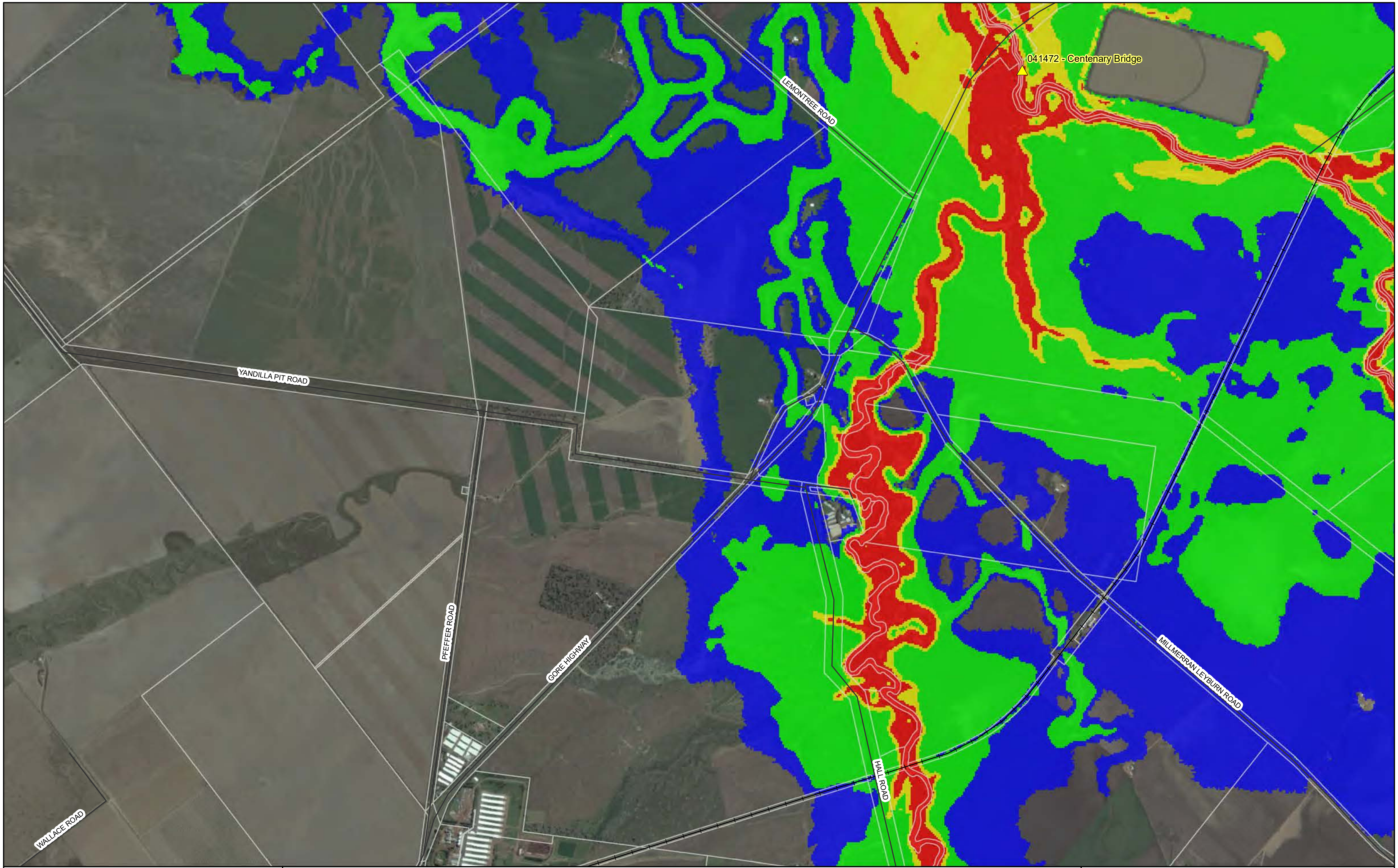
Legend

- ✚ Emergency Locations
- ─┼─ Rail
- ☐ Cadastre
- □ Towns
- ── Roads
- △ BoM Gauges
- ▲ DNRM Gauges

Hydraulic Category
- 🟪 Flood Fringe
- 🟩 Flood Storage
- 🟦 Floodway

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
500 Year ARI Event Hydraulic Category

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\TUM_Map04_HydraulicCategory_Q500.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

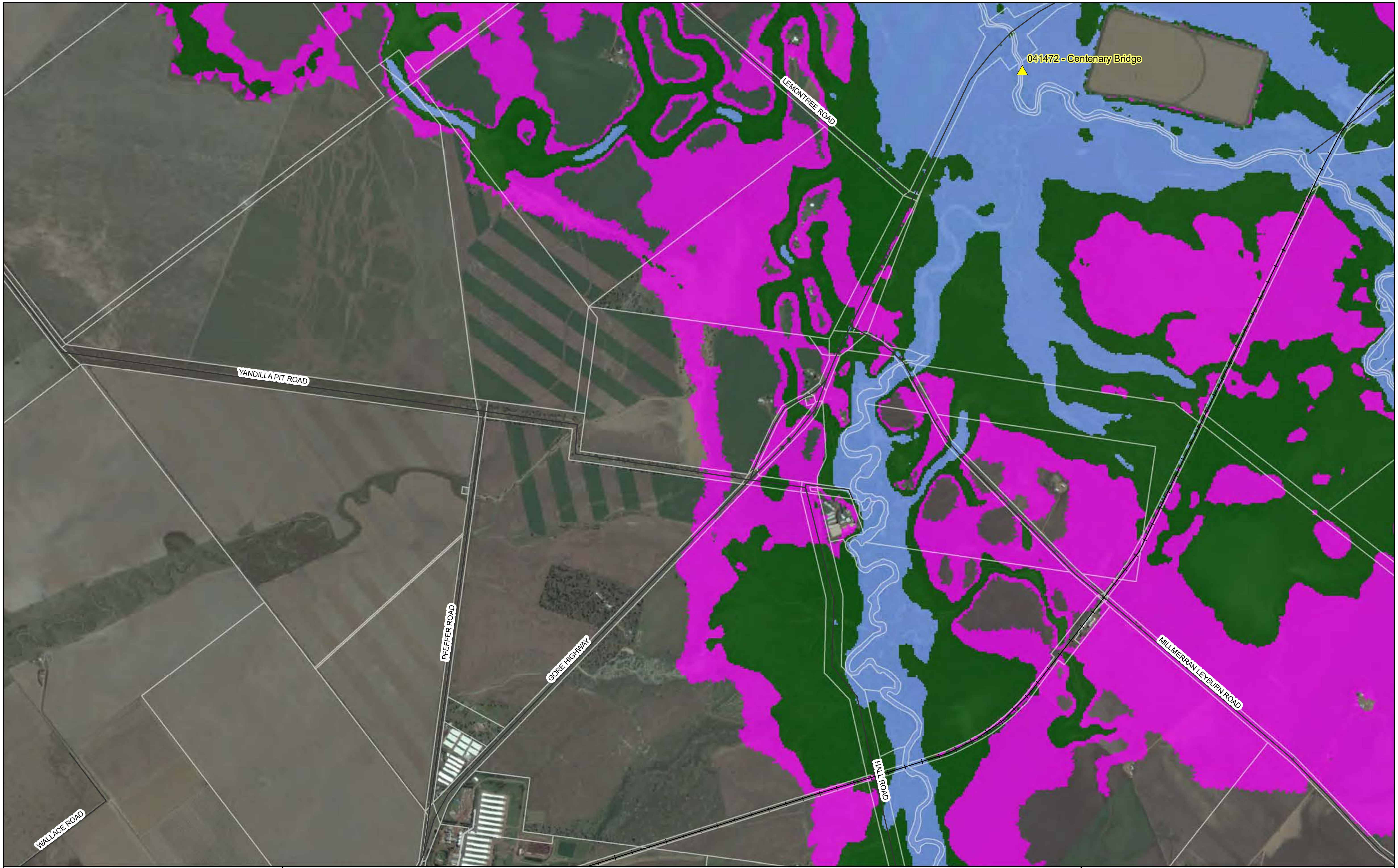
1:20,000 (at A3)
0 100 200 400
Metres
GDA 1994 MGA Zone 56
N

Legend

✚ Emergency Locations	Roads	Hazard Category	🟨 High
Rail	△ BoM Gauges	🟦 Low	🟥 Extreme
☐ Cadastre	△ DNRM Gauges	🟩 Significant	

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
10 Year ARI Event Peak Hazard



TOOWOOMBA REGION

1:20,000 (at A3)
0 100 200 400
Metres
GDA 1994 MGA Zone 56
N

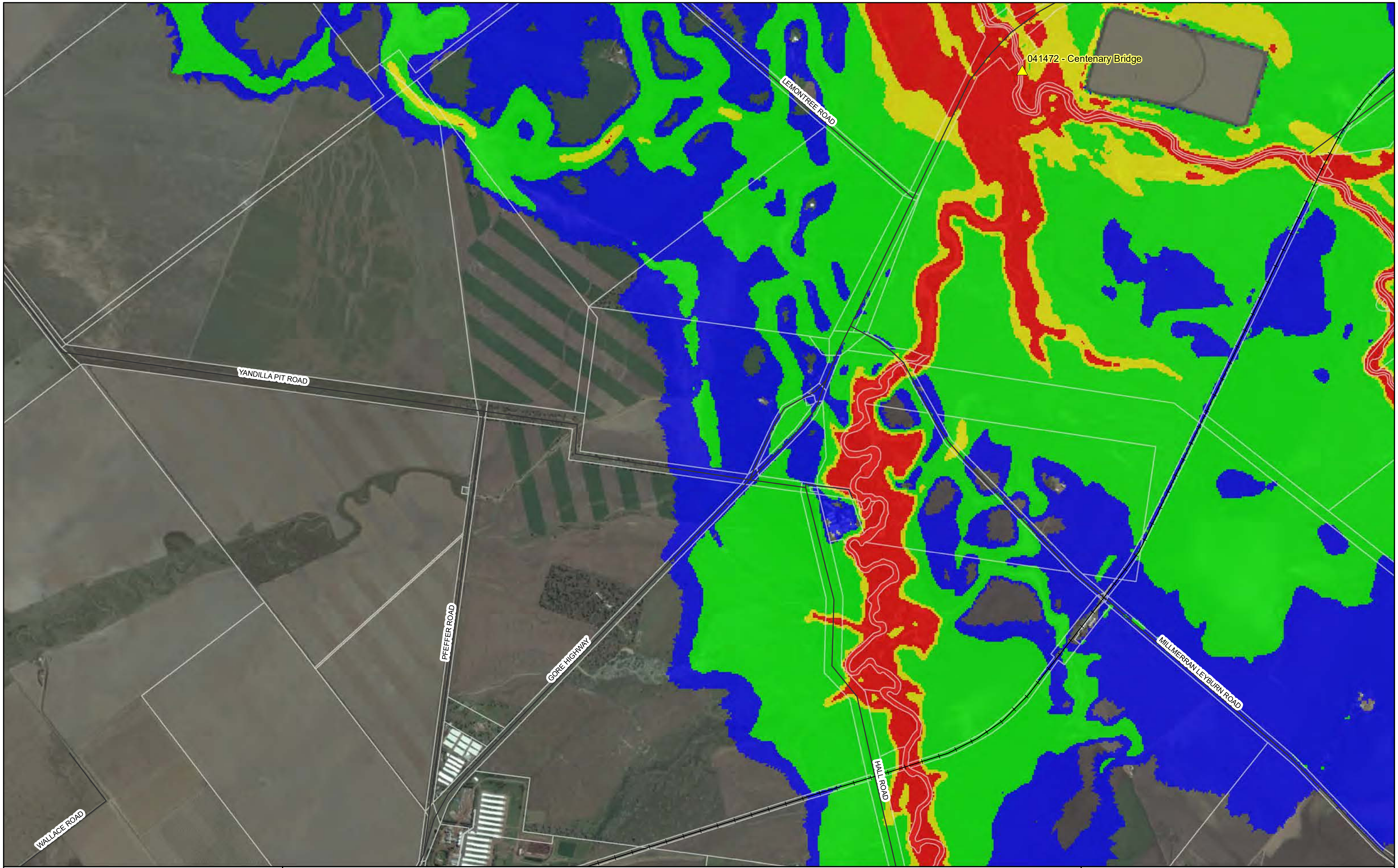
Legend

✚ Emergency Locations	— Roads	Hydraulic Category
—+— Rail	△ BoM Gauges	🟪 Flood Fringe
▭ Cadastre	△ DNRM Gauges	🟩 Flood Storage
		🟦 Floodway

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
10 Year ARI Event Hydraulic Category

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\YAN_Map04_HydraulicCategory_Q010.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

GDA 1994 MGA Zone 56

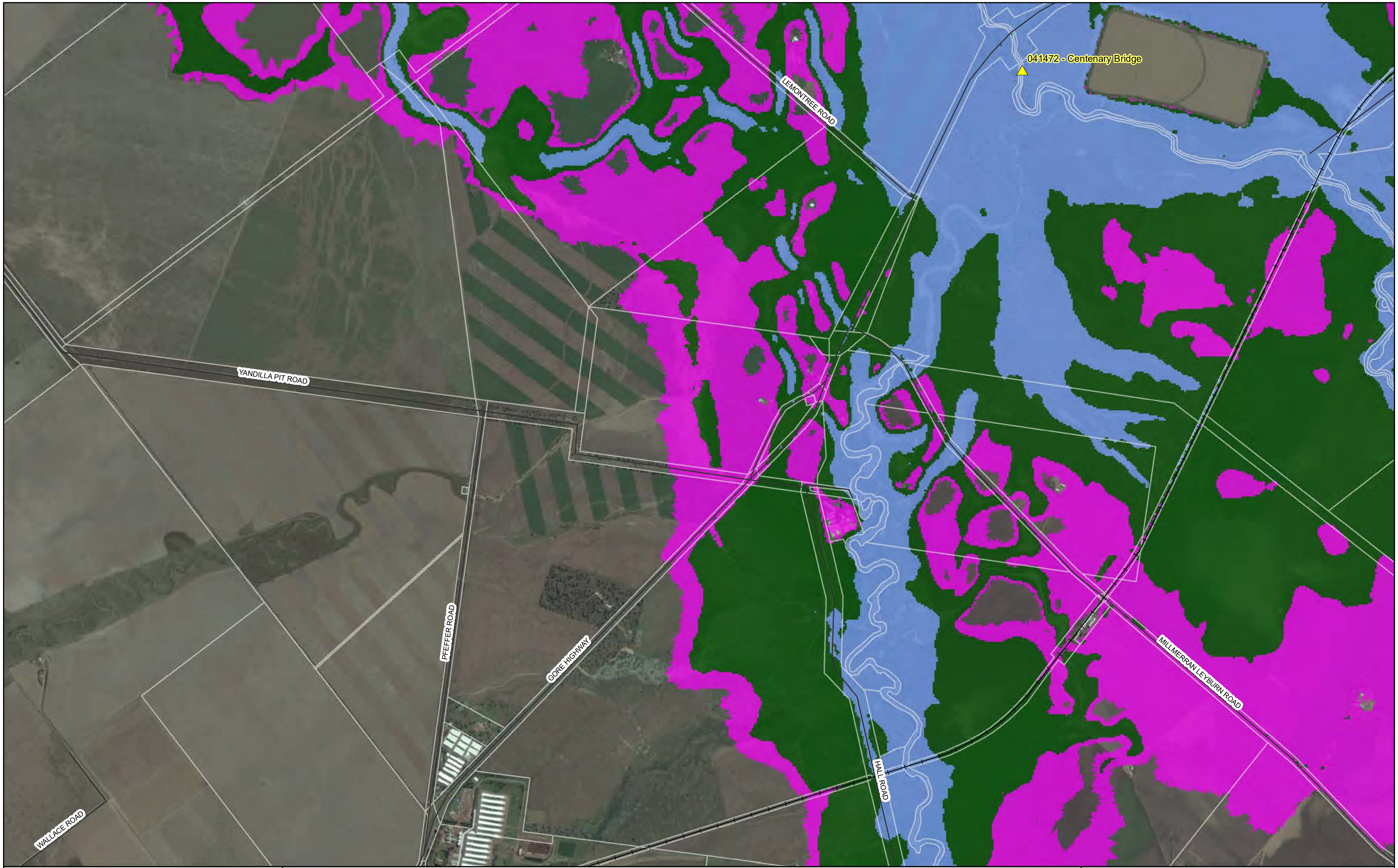
Legend

✚ Emergency Locations	Roads	Hazard Category	🟨 High
Rail	△ BoM Gauges	🟦 Low	🟥 Extreme
☐ Cadastre	△ DNRM Gauges	🟩 Significant	

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
20 Year ARI Event Peak Hazard

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\YAN_Map03_FloodHazard_Q020.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

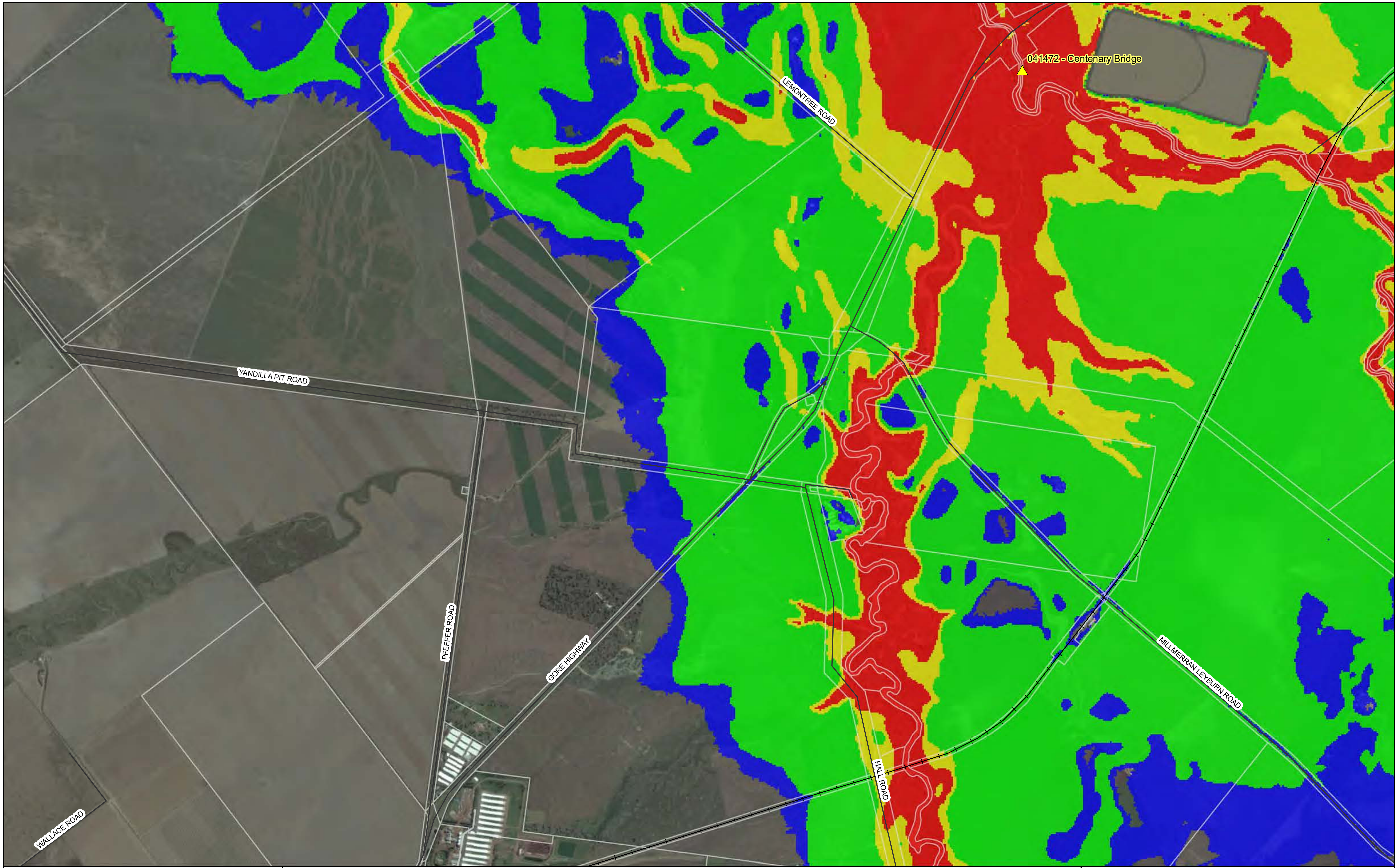
Legend

✚ Emergency Locations	— Roads	Hydraulic Category	🟩 Flood Storage
—+— Rail	△ BoM Gauges	🟪 Flood Fringe	🟦 Floodway
☐ Cadastre	△ DNRM Gauges		

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
20 Year ARI Event Hydraulic Category

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\YAN_Map04_HydraulicCategory_Q020.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

GDA 1994 MGA Zone 56

Legend

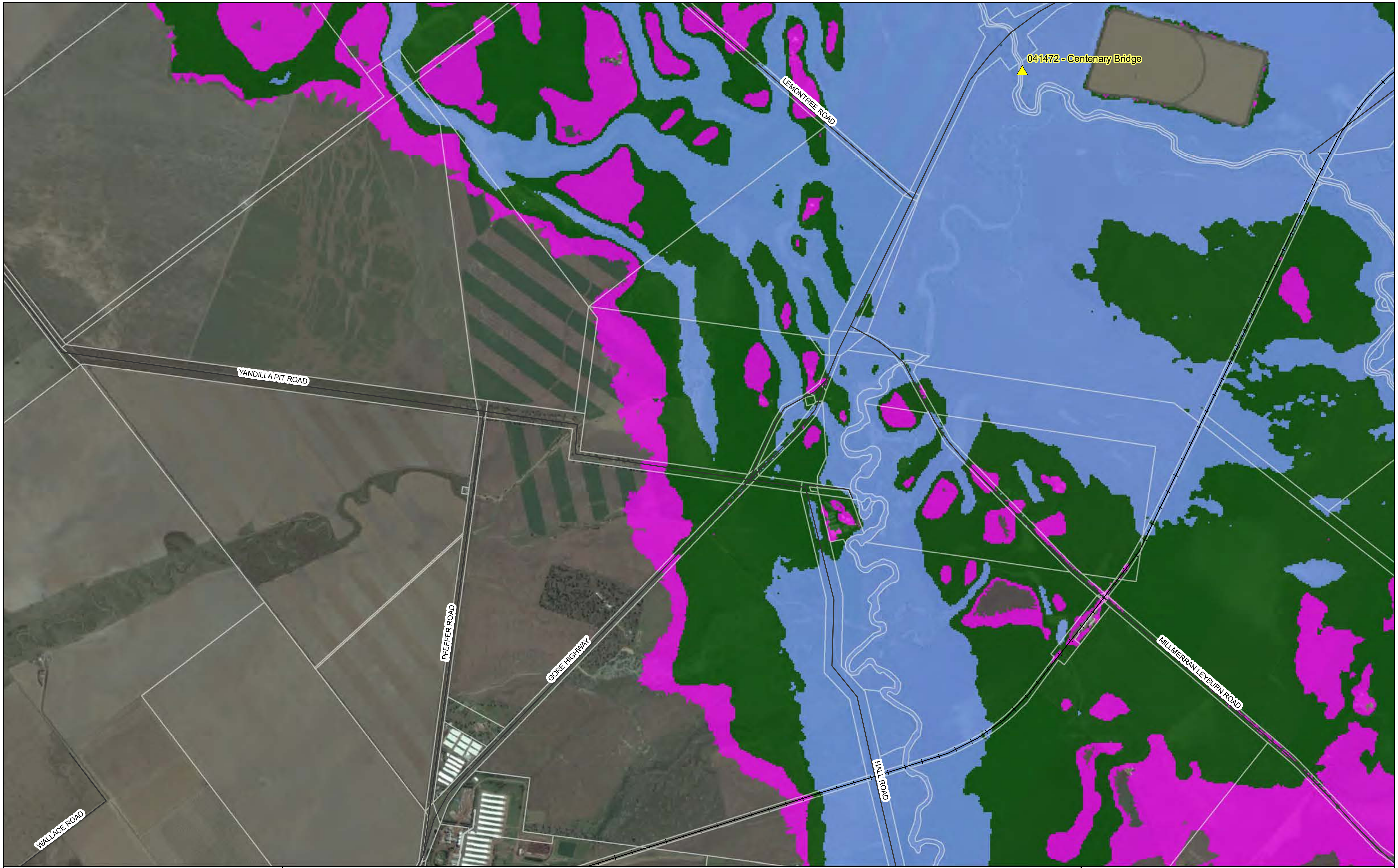
✚ Emergency Locations
—+— Rail
▭ Cadastre
— Roads
△ BoM Gauges
△ DNRM Gauges

Hazard Category
🟦 Low
🟩 Significant
🟨 High
🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
100 Year ARI Event Peak Hazard

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\YAN_Map03_FloodHazard_Q100.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

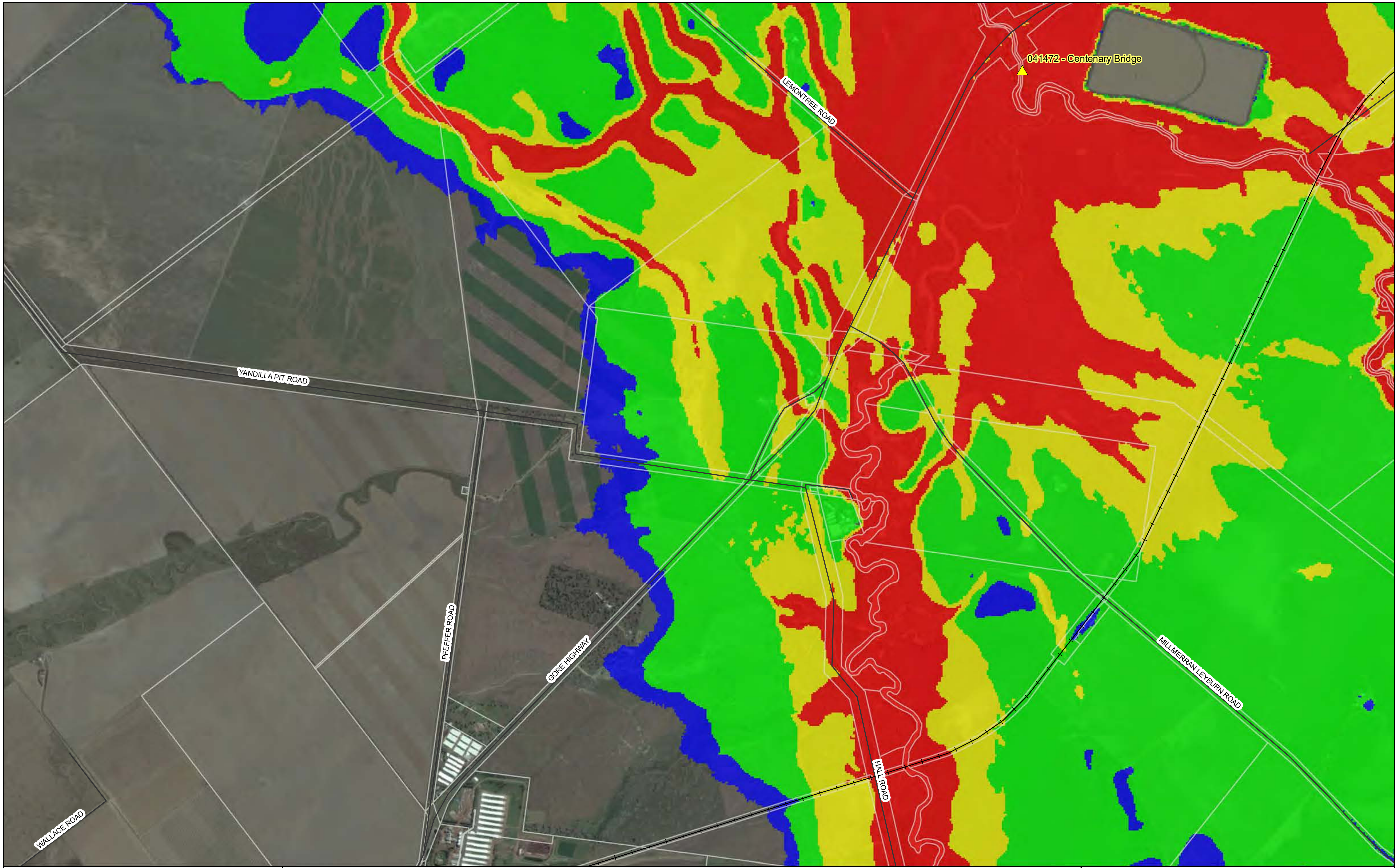
Legend

✚ Emergency Locations	— Roads	Hydraulic Category	🟩 Flood Storage
─┼─ Rail	△ BoM Gauges	🟪 Flood Fringe	🟦 Floodway
☐ Cadastre	△ DNRM Gauges		

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
100 Year ARI Event Hydraulic Category

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\YAN_Map04_HydraulicCategory_Q100.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

Legend

- ✚ Emergency Locations
- —— Roads
- —+— Rail
- ▭ Cadastre
- ▲ BoM Gauges
- ▲ DNRM Gauges

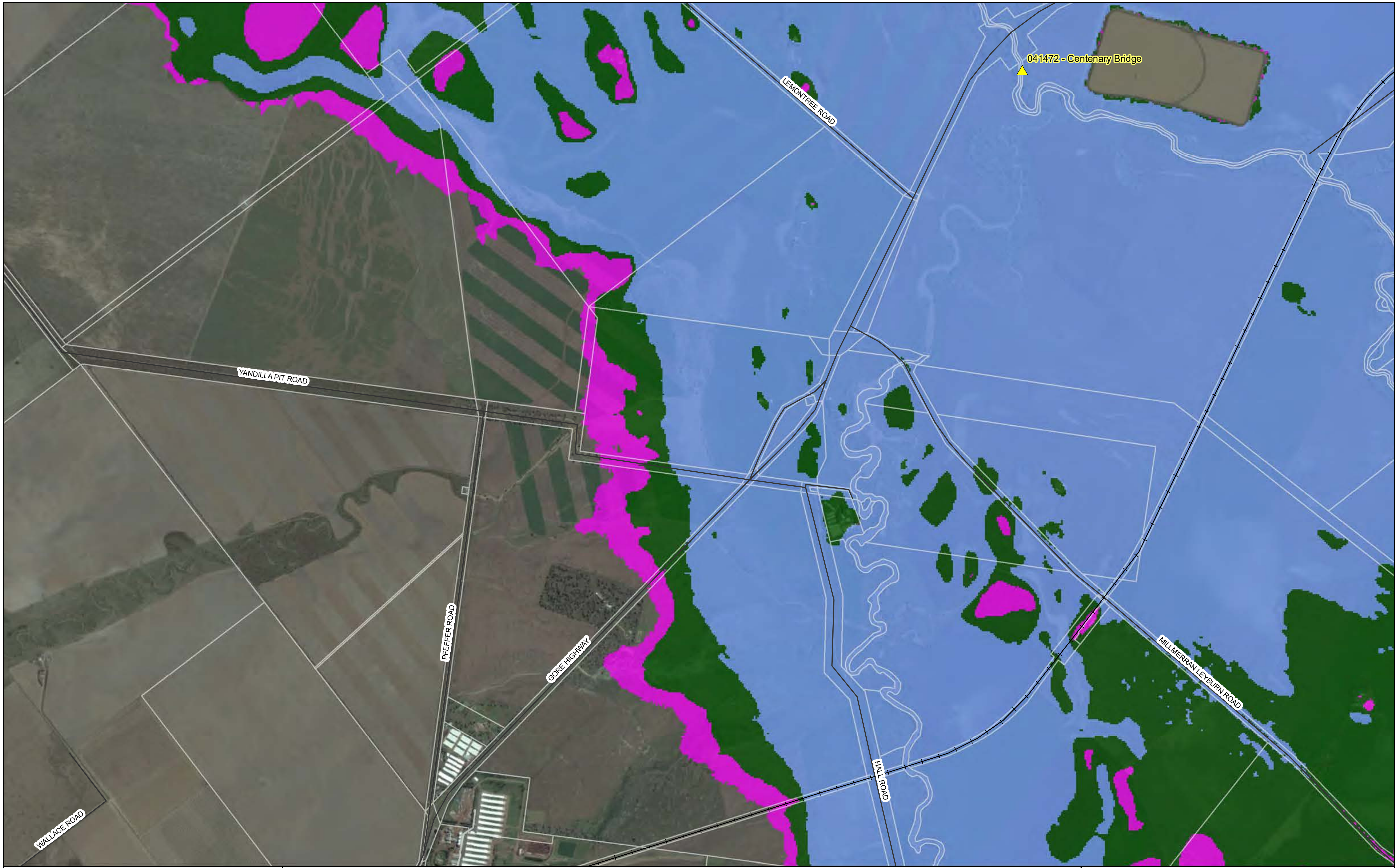
Hazard Category

- 🟦 Low
- 🟩 Significant
- 🟨 High
- 🟥 Extreme

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
500 Year ARI Event Peak Hazard

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\YAN_Map03_FloodHazard_Q500.mxd
Date Saved: 8/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres
GDA 1994 MGA Zone 56

N

Legend

✚ Emergency Locations	— Roads	Hydraulic Category
—+— Rail	△ BoM Gauges	🟪 Flood Fringe
☐ Cadastre	△ DNRM Gauges	

🟩 Flood Storage
🟦 Floodway

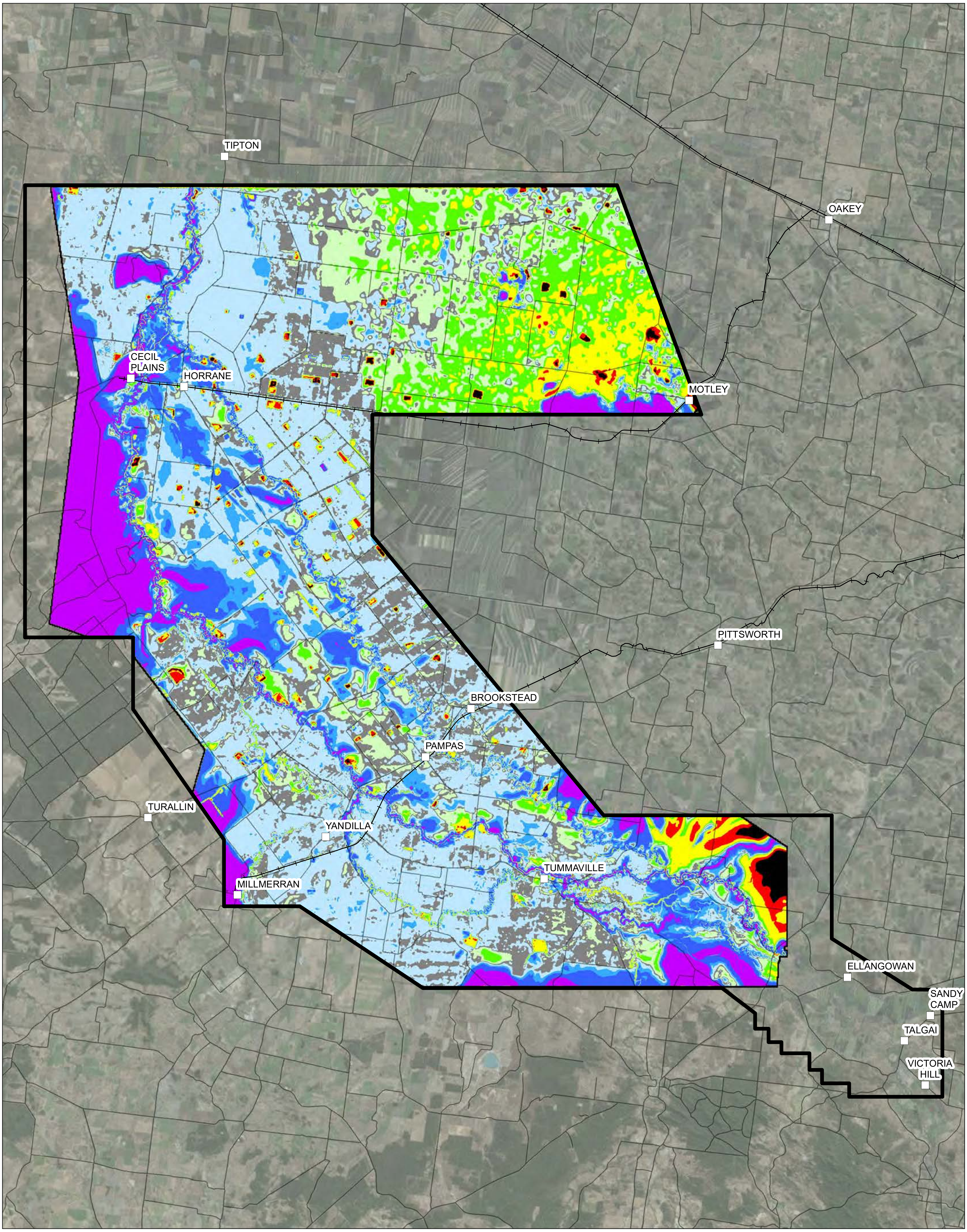
Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
500 Year ARI Event Hydraulic Category

C:\Users\Monika\Desktop\CONDAMINE\GIS\Mapping\Design\YAN_Map04_HydraulicCategory_Q500.mxd
Date Saved: 8/11/2015

APPENDIX F

Comparison of V01 and V02 Modelling Results



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

N

Legend

Model Extent

☐ Towns

Roads

Rail

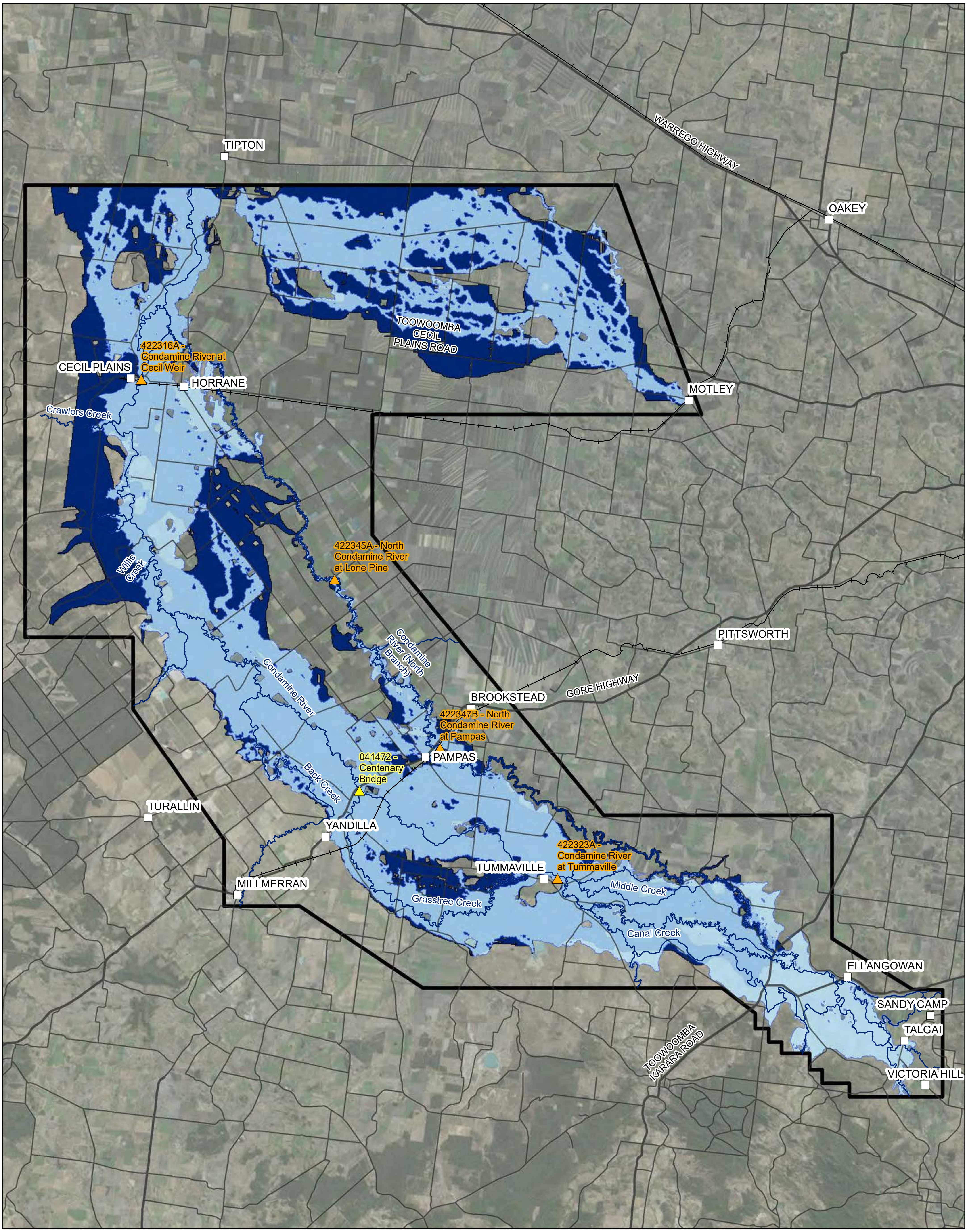
DEM Difference [m]

- ■ <-5.0
- 🟥 -5.0 to -3.0
- 🟨 -3.0 to -1.0
- 🟩 -1.0 to -0.5
- ☐ -0.5 to -0.1
- ■ -0.1 to 0.1
- ☐ 0.1 to 0.5
- 🟦 0.5 to 1.0
- 🟦 1.0 to 3.0
- 🟪 >3.0

SP051 Flood Studies
Work Package 7 Addendum 1
DEM Difference
V02 - V01 (Interpolated)

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

Disclaimer: Whilst all due care has been taken in the preparation of the plan and all information (the Plan and all information is referred to as “Plan information”), the accuracy of the Plan Information cannot be guaranteed. The Plan Information is provided as a guide and should not be relied upon in anyway whatsoever. Toowoomba Regional Council takes no responsibility for inaccuracies in the Plan Information and is not liable under any circumstances for any loss or damage whatsoever or howsoever caused arising directly or indirectly in connection with its use. The recipient must verify the Plan Information on site. Please refer any discrepancies to Toowoomba Regional Council - Information, Communications & Technology. No part of the Plan Information should be reproduced without the permission of the Coordinator GIS - ICT Branch, or other delegated representative of Council (131872).



TOOWOOMBA REGION

1:250,000 (at A3)
0 2 4 6
Kilometers
GDA 1994 MGA Zone 56

N

Legend

▭	Model Extent	—	Waterways	■	V01 Flood Extent (SRTM)
△	BoM Gauges	-+-	Rail	□	V02 Flood Extent (FM LiDAR)
▲	DNRM Gauges	—	Minor Roads		
□	Towns	—	Major Roads		

SP051 Flood Studies
Work Package 7 - Addendum 1
Dec 2010 / Jan 2011 Event
Flood Extent Comparison

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400

Metres

GDA 1994 MGA Zone 56

N

Legend

✚	Emergency Locations
—+—	Rail
☐	Cadastre
—	Roads
△	BoM Gauges
▲	DNRM Gauges
■	V01 Flood Extent (LiDAR)
□	V02 Flood Extent (FM LiDAR)

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Cecil Plains
Dec 2010 / Jan 2011 Event
Flood Extent Comparison

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Model_Comparison\CEC_Comparison_2011.mxd
Date Saved: 14/11/2015

TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

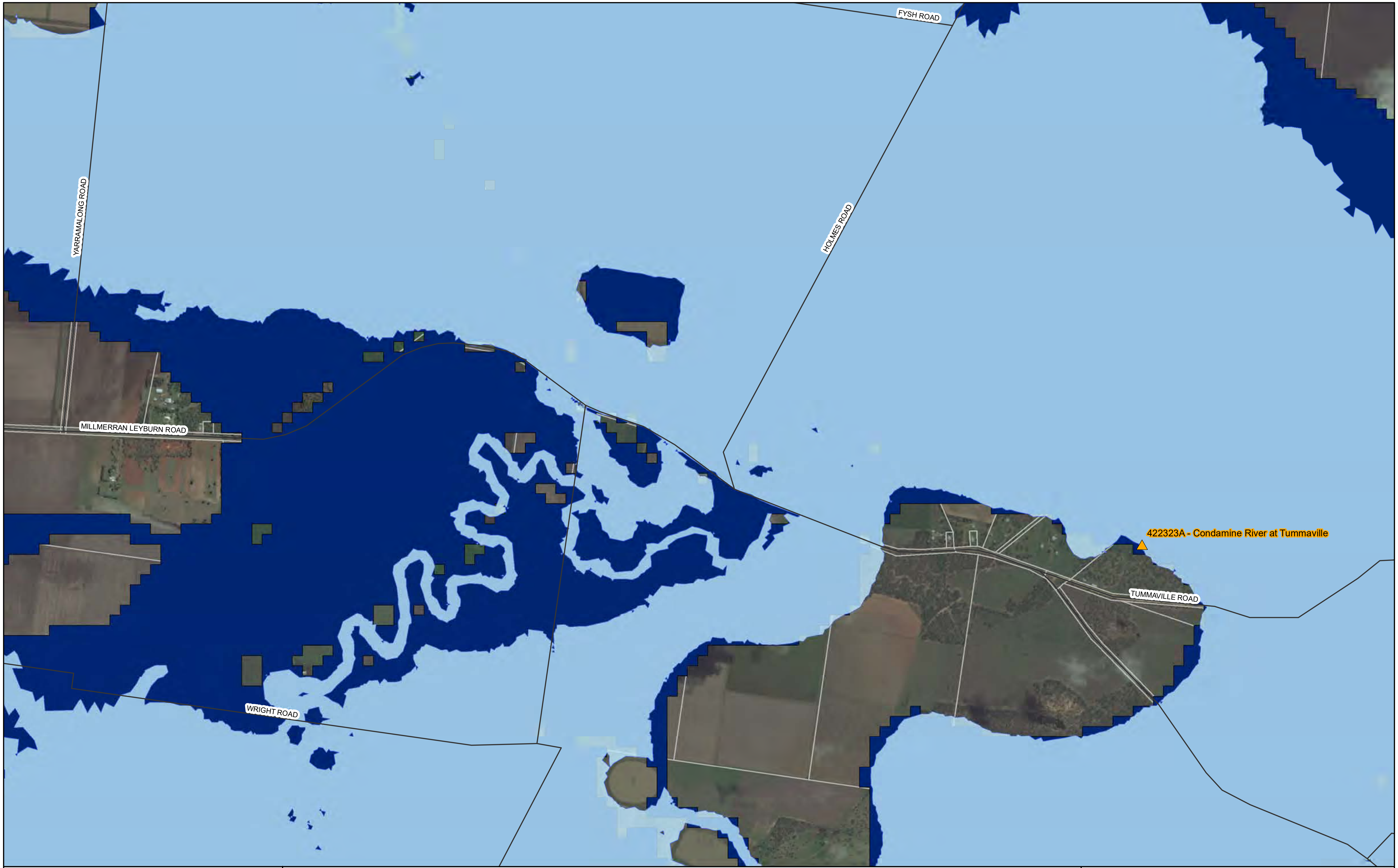
Legend

✚ Emergency Locations
—+— Rail
☐ Cadastre
— Roads
△ BoM Gauges
▲ DNRM Gauges
■ V01 Flood Extent (SRTM)
☐ V02 Flood Extent (FM LiDAR)

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Pampas
Dec 2010 / Jan 2011 Event
Flood Extent Comparison

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Model_Comparison\PAM_Comparison_2011.mxd
Date Saved: 14/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

GDA 1994 MGA Zone 56

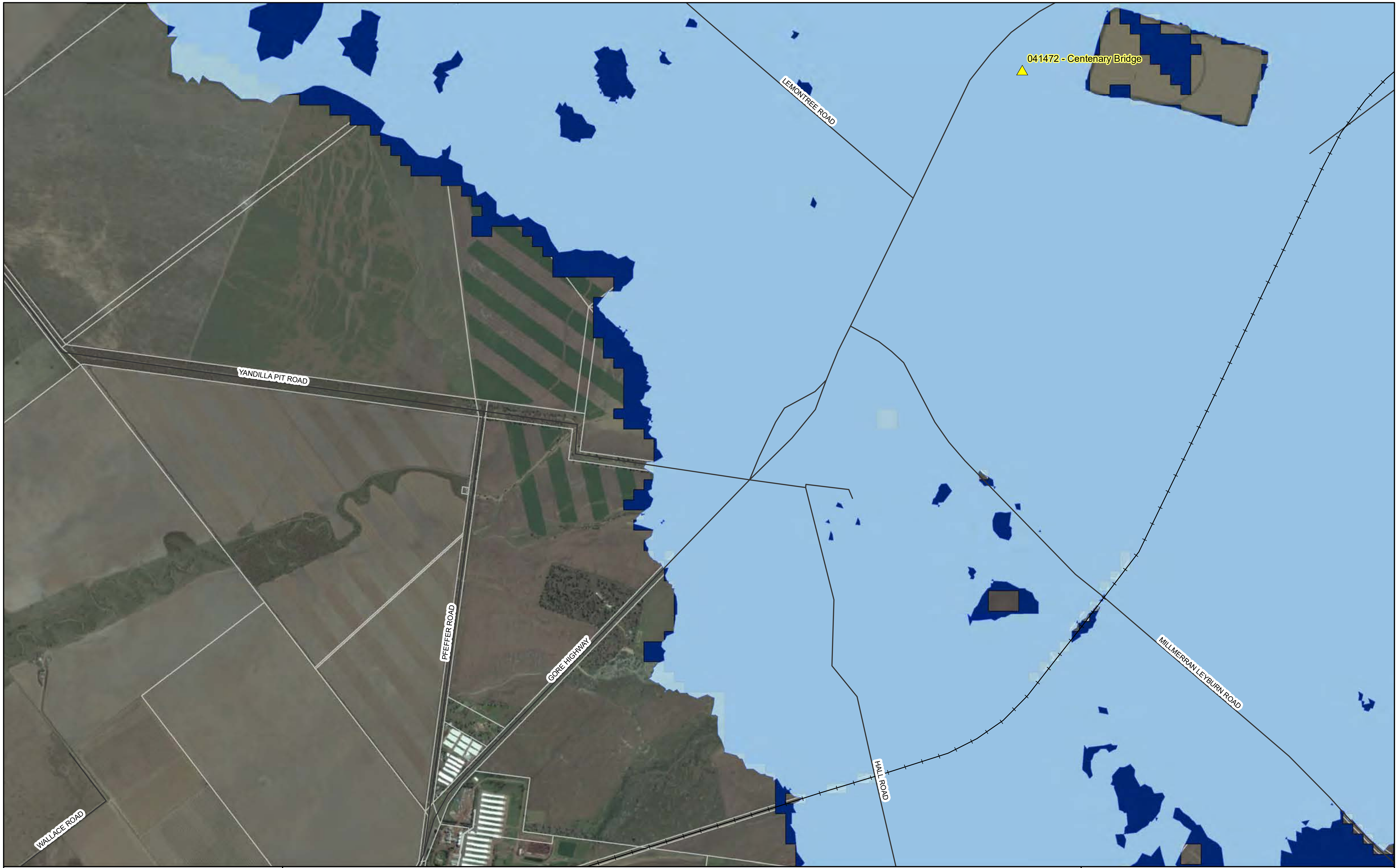
Legend

✚	Emergency Locations
—+—	Rail
☐	Cadastre
—	Roads
△	BoM Gauges
▲	DNRM Gauges
■	V01 Flood Extent (SRTM)
▭	V02 Flood Extent (FM LiDAR)

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Tummaville
Dec 2010 / Jan 2011 Event
Flood Extent Comparison

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Model_Comparison\TUM_Comparison_2011.mxd
Date Saved: 14/11/2015



TOOWOOMBA REGION

1:20,000 (at A3)

0 100 200 400
Metres

GDA 1994 MGA Zone 56

N

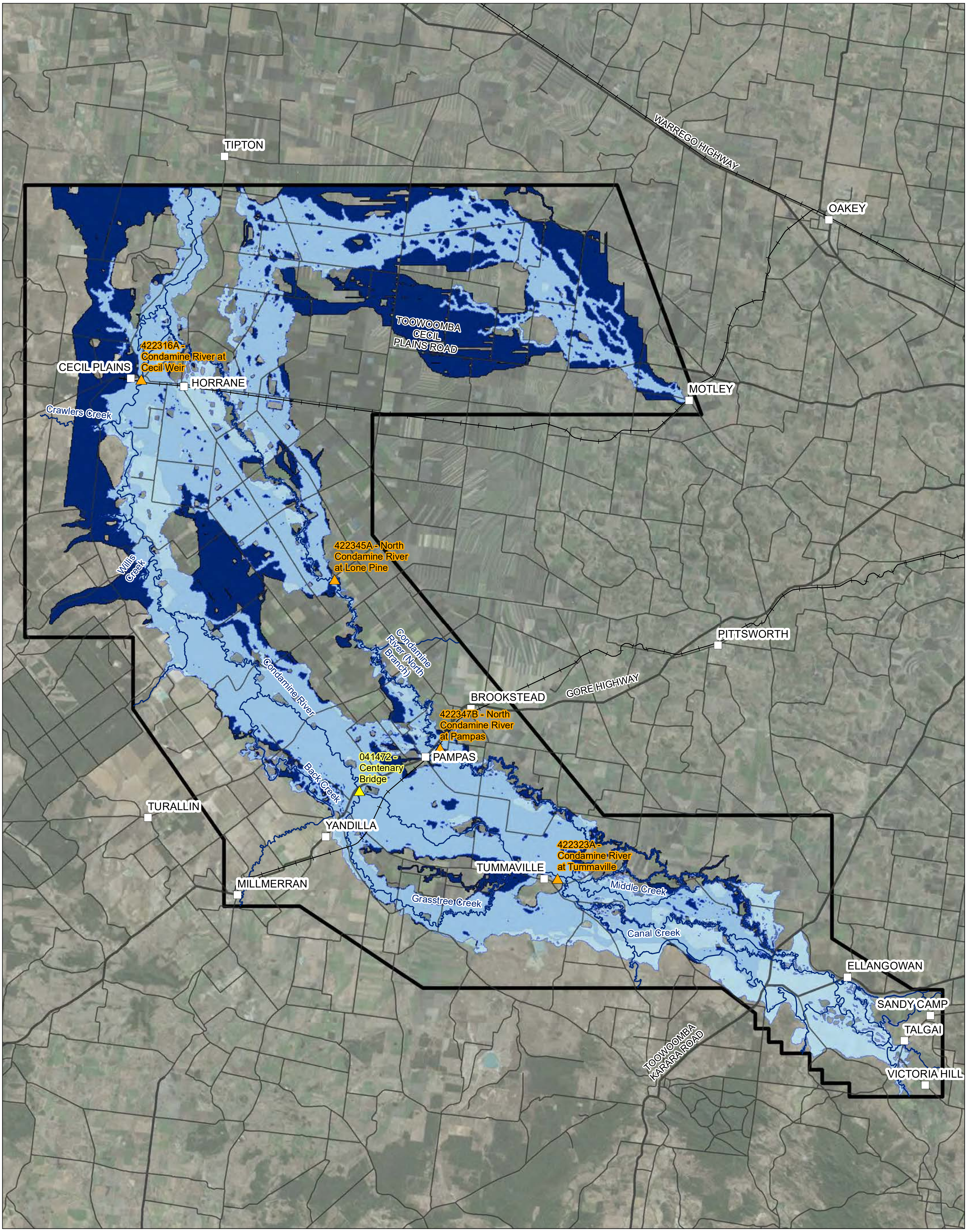
Legend

✚ Emergency Locations
—— Roads
▨ V01 Flood Extent (SRTM)
—+— Rail
△ BoM Gauges
▢ V02 Flood Extent (FM LiDAR)
▢ Cadastre
△ DNRM Gauges

Disclaimer: The flood information contained in the maps is based on debris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

SP051 Flood Studies
Work Package 7 Addendum 1
Yandilla
Dec 2010 / Jan 2011 Event
Flood Extent Comparison

\\wms05\1-WMS\1-Projects\10026-Condamine Hydraulic Modelling\GIS\Mapping\Model_Comparison\YAN_Comparison_2011.mxd
Date Saved: 14/11/2015



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

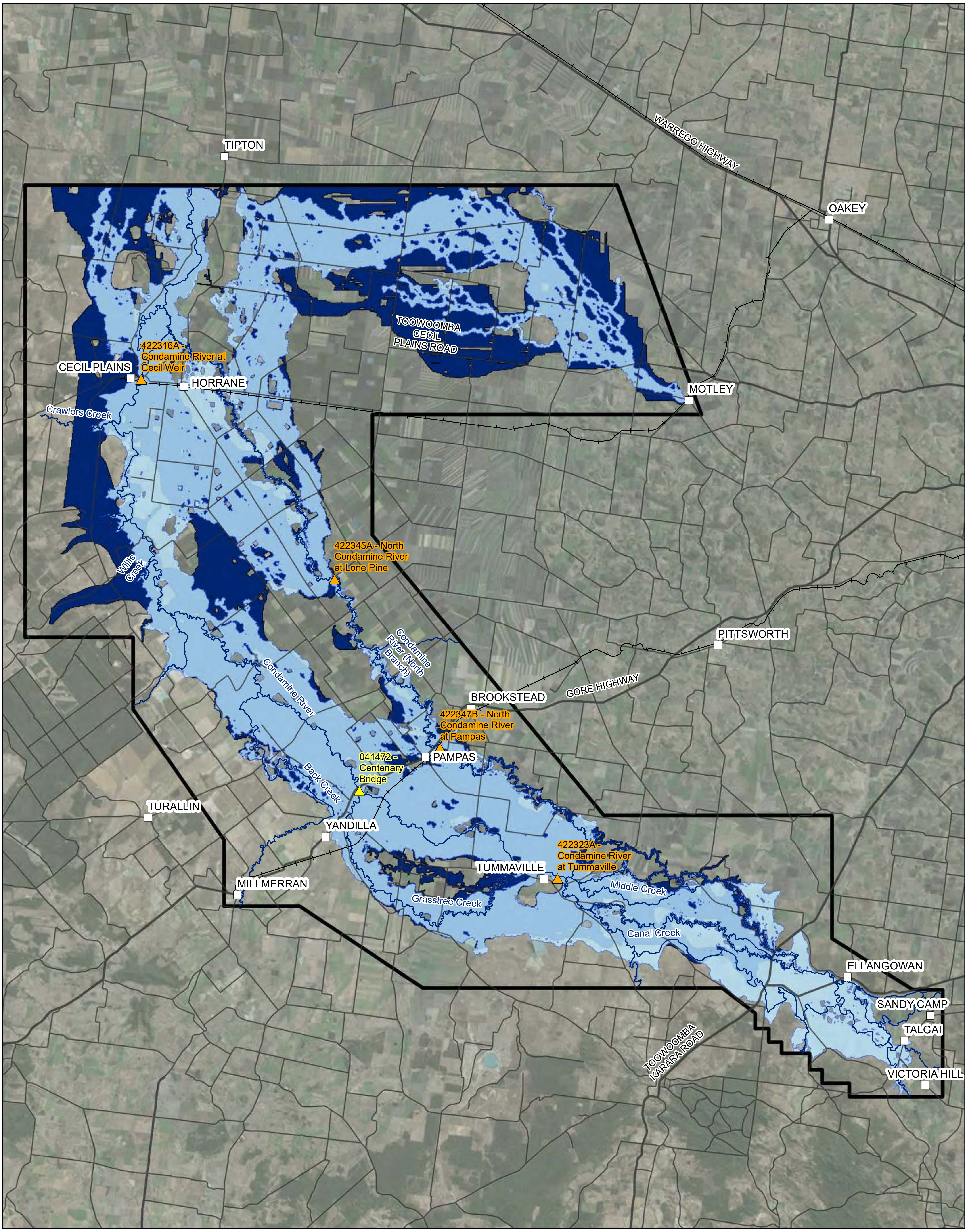
N

Legend

▭	Model Extent	—	Waterways	■	V01 Flood Extent (SRTM)
△	BoM Gauges	┼	Rail	□	V02 Flood Extent (FM LiDAR)
▲	DNRM Gauges	—	Minor Roads		
□	Towns	━	Major Roads		

SP051 Flood Studies
Work Package 7 - Addendum 1
10 Year ARI Event
Flood Extent Comparison

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

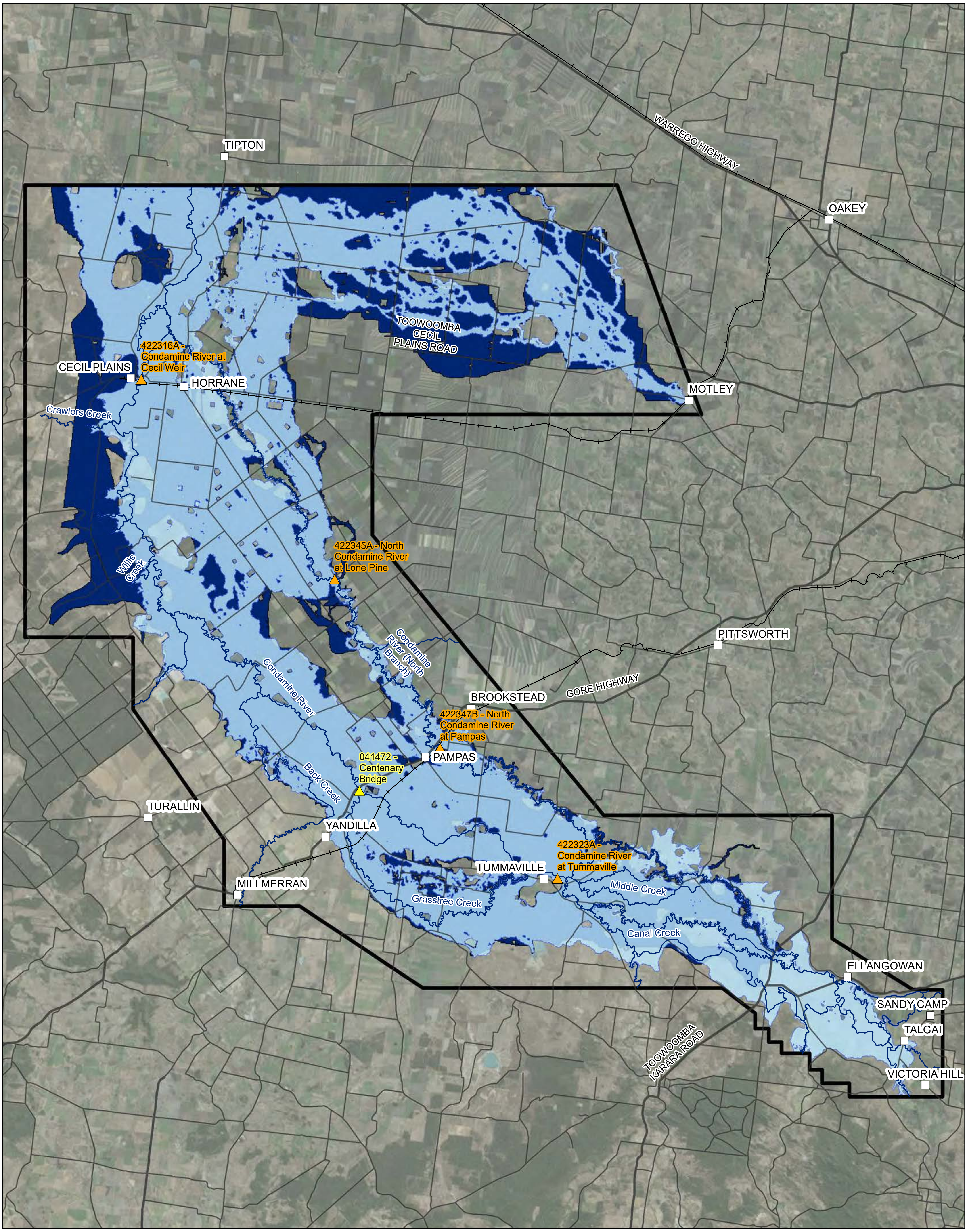
N

Legend

- ▭ Model Extent
- △ BoM Gauges
- △ DNRM Gauges
- ☐ Towns
- Waterways
- Rail
- Minor Roads
- Major Roads
- ■ V01 Flood Extent (SRTM)
- ☐ V02 Flood Extent (FM LiDAR)

SP051 Flood Studies
Work Package 7 - Addendum 1
20 Year ARI Event
Flood Extent Comparison

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

N

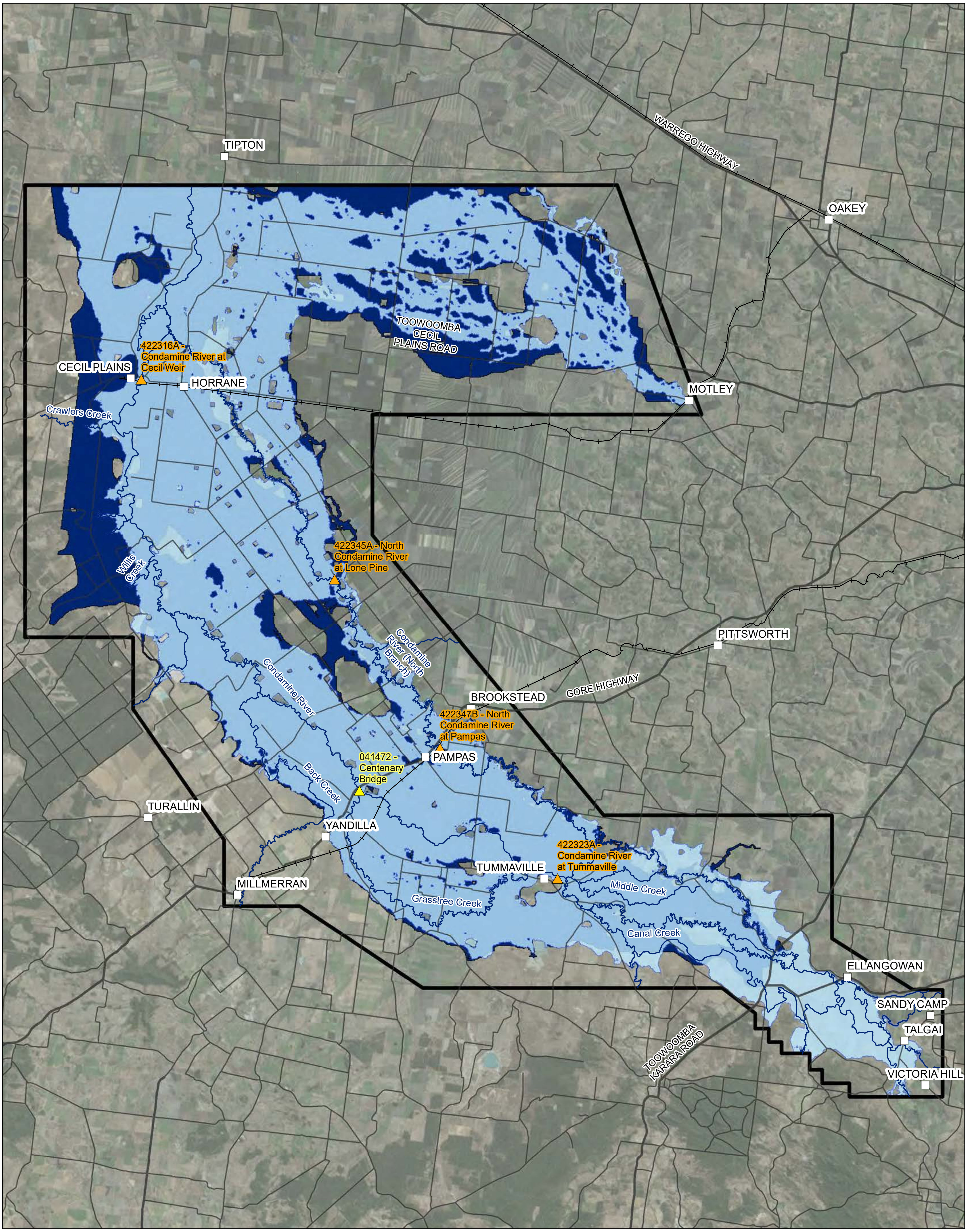
Legend

▭ Model Extent	— Waterways	■ V01 Flood Extent (SRTM)
△ BoM Gauges	┼ Rail	□ V02 Flood Extent (FM LiDAR)
▲ DNRM Gauges	— Minor Roads	
□ Towns	— Major Roads	

SP051 Flood Studies
Work Package 7 - Addendum 1
100 Year ARI Event
Flood Extent Comparison

Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

Disclaimer: Whilst all due care has been taken in the preparation of the plan and all information (the Plan and all information is referred to as “Plan information”), the accuracy of the Plan Information cannot be guaranteed. The Plan Information is provided as a guide and should not be relied upon in anyway whatsoever. Toowoomba Regional Council takes no responsibility for inaccuracies in the Plan Information and is not liable under any circumstances for any loss or damage whatsoever or howsoever caused arising directly or indirectly in connection with its use. The recipient must verify the Plan Information on site. Please refer any discrepancies to Toowoomba Regional Council - Information, Communications & Technology. No part of the Plan Information should be reproduced without the permission of the Coordinator GIS - ICT Branch, or other delegated representative of Council (131872).



TOOWOOMBA REGION

1:250,000 (at A3)

0 2 4 6

Kilometers

GDA 1994 MGA Zone 56

N

Legend

▭ Model Extent	— Waterways	■ V01 Flood Extent (SRTM)
△ BoM Gauges	┼ Rail	□ V02 Flood Extent (FM LiDAR)
△ DNRM Gauges	— Minor Roads	
□ Towns	— Major Roads	

SP051 Flood Studies
Work Package 7 - Addendum 1
500 Year ARI Event
Flood Extent Comparison

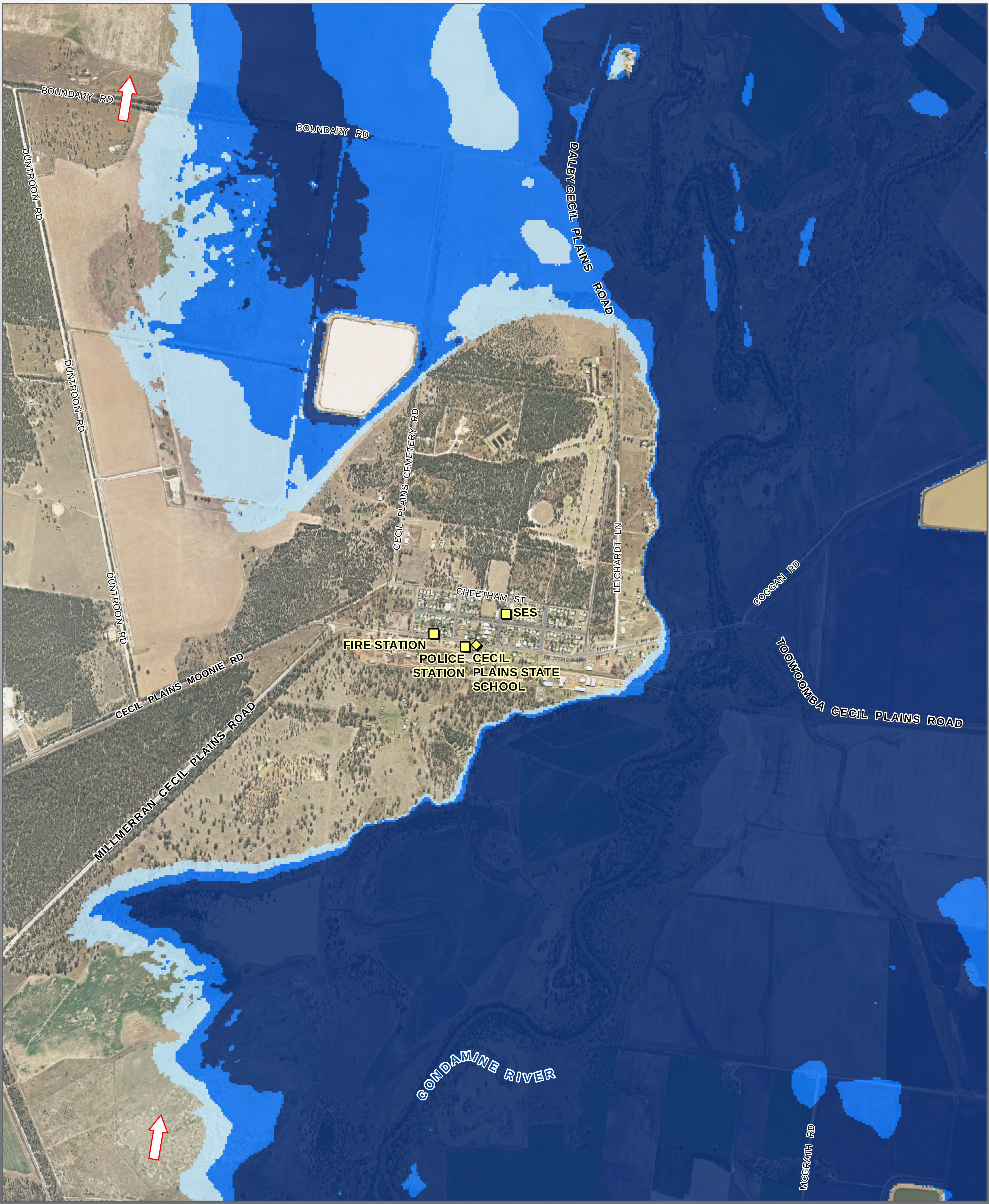
Disclaimer:The flood information contained in the maps is based ondebris lines and marks that were visible and accessible at the time of recording after the January 2011 flood extent and may not be accurate or complete and reliance should not be placed on it. Toowoomba Regional Council makes no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability whether in contract, negligence or otherwise for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred in any way and for any reason as a result of the flood information contained in the maps being inaccurate or incomplete.

TOOWOOMBA
REGION

131 872 | info@tr.qld.gov.au | www.tr.qld.gov.au
PO Box 3021 Toowoomba QLD 4350 | Toowoomba Regional Council

yoursay.toowoombaRC.qld.gov.au/flood-resilience

CECIL PLAINS



TOOWOOMBA REGION

1:18,500 (at A3)

0 150 300 450 600

Metres

N

1% AEP FLOOD DEPTH RIVERINE

Water Depth (m)

▭	0 - 0.5
▭	0.5 - 1
▭	1+

⇦	Direction Flow
□	Emergency Services
◇	School

U:\Projects\Spatial Services\Incident Management\143270\143270_CEC_D_AEP1_A3.mxd Author/Date: purvesa 22/01/2016

A safer, stronger, more resilient region

Financially, socially and environmentally sustainable

TOOWOOMBA REGION
Rich traditions. Bold ambitions.

Cecil Plains & Surrounds Flood Studies Information Sheet

WHY UNDERTAKE FLOOD STUDIES?

Following extensive flooding across the Toowoomba region, we commissioned a number of flood studies to better understand how flooding can impact our communities. These studies are now complete and available on our website.

The flood studies found that flood behaviour can be complex and vary between locations, depending on landscape, infrastructure and rainfall pattern.

SOME BASIC FLOOD TERMS

1. **Overland flow** – short duration flooding of backyards, drainage paths, streets and rural properties caused by stormwater as it makes its way into the creek/river system;
2. **Creek flooding** – short to medium duration flooding caused by creeks rising and breaking their banks, which can then flood nearby homes, businesses and rural properties;
3. **River flooding** – longer duration flooding caused by significant rises in a river which can break its banks in the same way as smaller creeks.

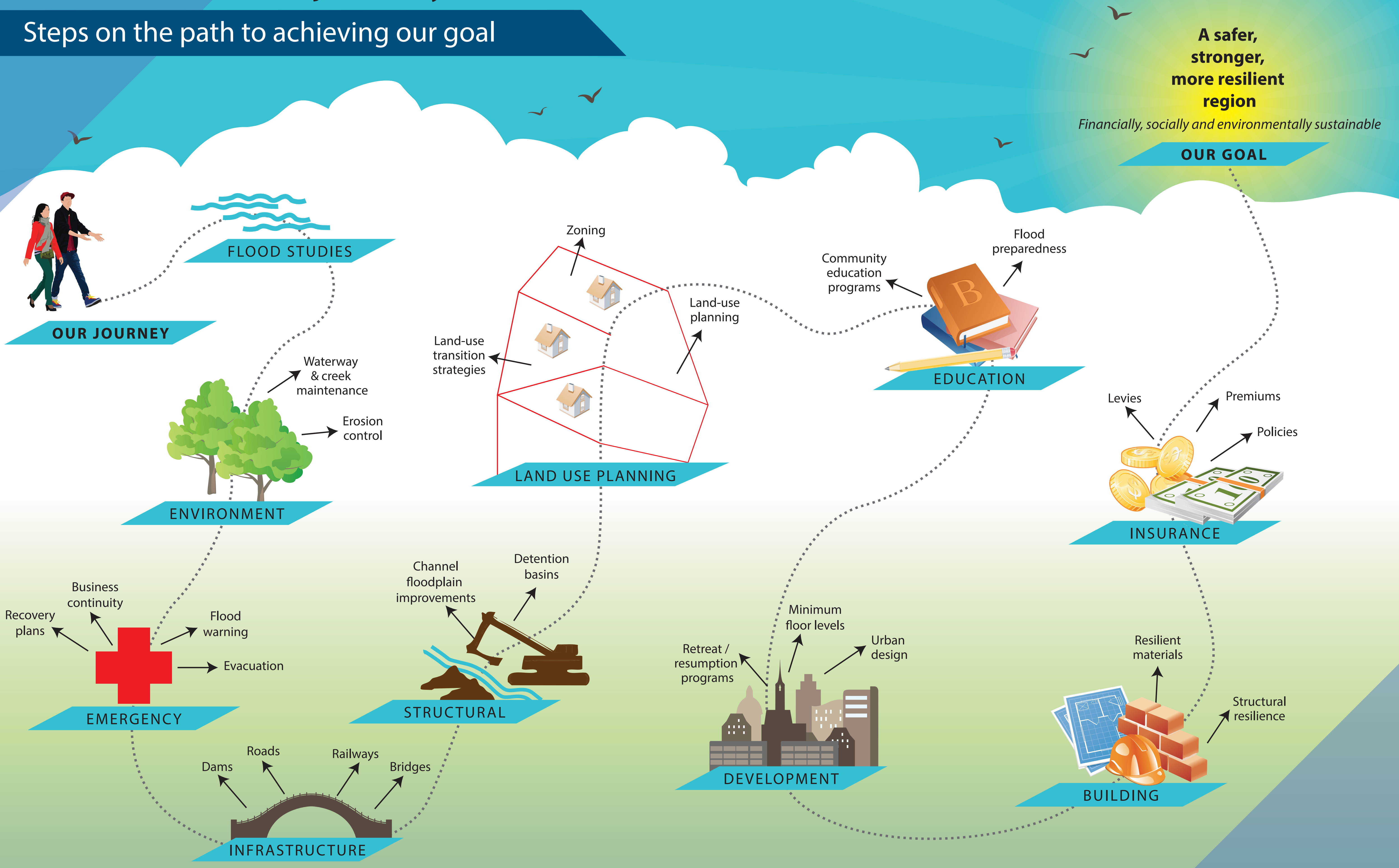
Most of the studies undertaken or commissioned by Council relate to the first two types of flooding – overland flow and creek flooding. It's important to note that these types of flooding can occur separately or together.

KEY MESSAGES

1. Council has a legislative requirement to undertake flood management and the whole community needs to be involved.
2. Flood studies are a foundation and an essential step towards our goal of a safer, stronger, more resilient region.
3. Flood studies have been undertaken by specialist engineers and incorporate the latest data, modelling techniques and community input.
4. Community consultation enables two-way information sharing about the project to increase community awareness, enhance decision making and help achieve our goal of a safer, stronger, more resilient region.

Flood + us - our journey

Steps on the path to achieving our goal



A safer,
stronger,
more resilient
region

Financially, socially and environmentally sustainable

OUR GOAL

OUR JOURNEY

FLOOD STUDIES

ENVIRONMENT
- Waterway & creek maintenance
- Erosion control

EMERGENCY
- Recovery plans
- Business continuity
- Flood warning
- Evacuation

INFRASTRUCTURE
- Dams
- Roads
- Railways
- Bridges

STRUCTURAL
- Channel floodplain improvements
- Detention basins

LAND USE PLANNING
- Zoning
- Land-use transition strategies
- Land-use planning

EDUCATION
- Community education programs
- Flood preparedness

DEVELOPMENT
- Retreat / resumption programs
- Minimum floor levels
- Urban design

BUILDING
- Resilient materials
- Structural resilience

INSURANCE
- Levies
- Premiums
- Policies

Cecil Plains & Surrounds Flood Studies Information Sheet

CECIL PLAINS & SURROUNDS FLOOD STORY

The flood study and maps for Cecil Plains and the Condamine River floodplain were updated using flood information received from the community during consultation held in early 2015. These updated versions are now available to residents. The study across the floodplain includes the localities of Pampas, Yandilla, Tummaville and Ellangowan.

The primary source of flooding for the area is river flooding.

Given the elevation of Cecil Plains above the surrounding floodplain, the township was not significantly affected by flood waters in the 2010/2011 floods. However, flood waters did inundate some rural residential lots adjoining the river on the eastern side of town. Cecil Plains was isolated when Toowoomba-Cecil Plains and Dalby-Cecil Plains roads were cut off.

Given the nature and width of the floodplain, the flood extent on the western bank does not significantly differ between moderate to large and rare flood events. The flood hazard of the deeper, faster waters is generally contained within the Condamine River channel across a range of flood events.

It is estimated that the 2010/2011 flood is approximately a 5% Annual Exceedance Probability event – meaning there is a 5%chance in any year to see this size flood event or larger.

Annual Exceedance Probability (AEP) means the chance of a flood of a given size or larger size occurring in any one year, usually expressed as a percentage.

COMMUNITY INVOLVEMENT

Improving the way we prepare for and respond to flooding as a community is very important to us. Many residents in our region contributed information to build and validate our flood knowledge during the region-wide consultation sessions and other flood studies engagement opportunities.

Community involvement with this project continues to help our region become safer, stronger and more resilient. We encourage you to access the flood study information online and stay up to date with the project by visiting the web address below.

GET INFORMED

You can access our region's current flood studies and maps by heading to
http://yoursay.toowoombarc.qld.gov.au/flood-resilience
For more information, please contact the project team by phone, email or post.

Phone: 131 872

Email: info@tr.qld.gov.au

Post: Strategic Planning & Economic Development,
Toowoomba Regional Council, PO Box 3021, Toowoomba Q 4350.

TOOWOOMBA
REGION