# Appendix D
# Modelling Quality Report

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**Project:** Regional Floodplain Database Model Quality Report Pumicestone Passage (PUM)

**Reference:** 211090

**Prepared for:** Moreton Bay Regional Council

**Revision:** 1

**14 June 2012**

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# Regional Floodplain Database Model Quality Report Pumicestone Passage (PUM)

Date | 14 June 2012
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# 1 Introduction

## 1.1 Study objective

Moreton Bay Regional Council (MBRC) is delivering a Regional Floodplain Database (RFD) in support of their flood risk management, considering emergency response, development control, strategic landuse and infrastructure planning. The MBRC was recently formed under local government amalgamations and is responsible for Caboolture, Pine Rivers, Redcliffe and Bribie Island. The RFD project focuses on the northern sector as a key growth area for South-East Queensland.

The project is being funded by MBRC, Emergency Management Queensland (EMQ) and Emergency Management Australia (EMA) as part of the Disaster Resilience Program and will provide:

- A comprehensive and consistent description of flood behaviour across the region
- Strategies for management of any flooding problems identified
- A system/process to store and manage this information and keep it up-to-date

***Stage 1*** of the project was completed in July 2010 and involved a number of sub-projects. These projects delivered consistent processes and protocols for the detailed hydrologic and hydraulic model development. A key sub-project involved the development of broadscale hydrodynamic models for each minor basin to provide general understanding of flooding mechanisms and allow prioritisation of data capture.

***Stage 2*** (current stage) of the project involves the development of detailed hydrologic and hydraulic models for each minor basin.

***Stage 3*** will build on the detailed models and “add value” through assessment of flood damages and community resilience measures.

## 1.2 Objective of model quality report

This report describes the model setup process adopted for the detailed 10 m grid and 5 m grid TUFLOW models of the Pumicestone Passage (PUM) minor basin, including all the changes made to the broadscale model. It also describes the model quality and model issues for the hydrologic and hydraulic models.

# 2 TUFLOW model setup process

## 2.1 Code boundary

The code boundary was modified as per the following:

- Higher areas which floods are not likely to reach were removed from the model to try and reduce run times
- Total inflow locations were removed from the model. In the areas where these were applied to the broadscale model the code boundary was extended to capture part of every sub-catchment

In Figure 1 below, the red line shows the adopted code boundary and the blue line shows the broadscale model code boundary.

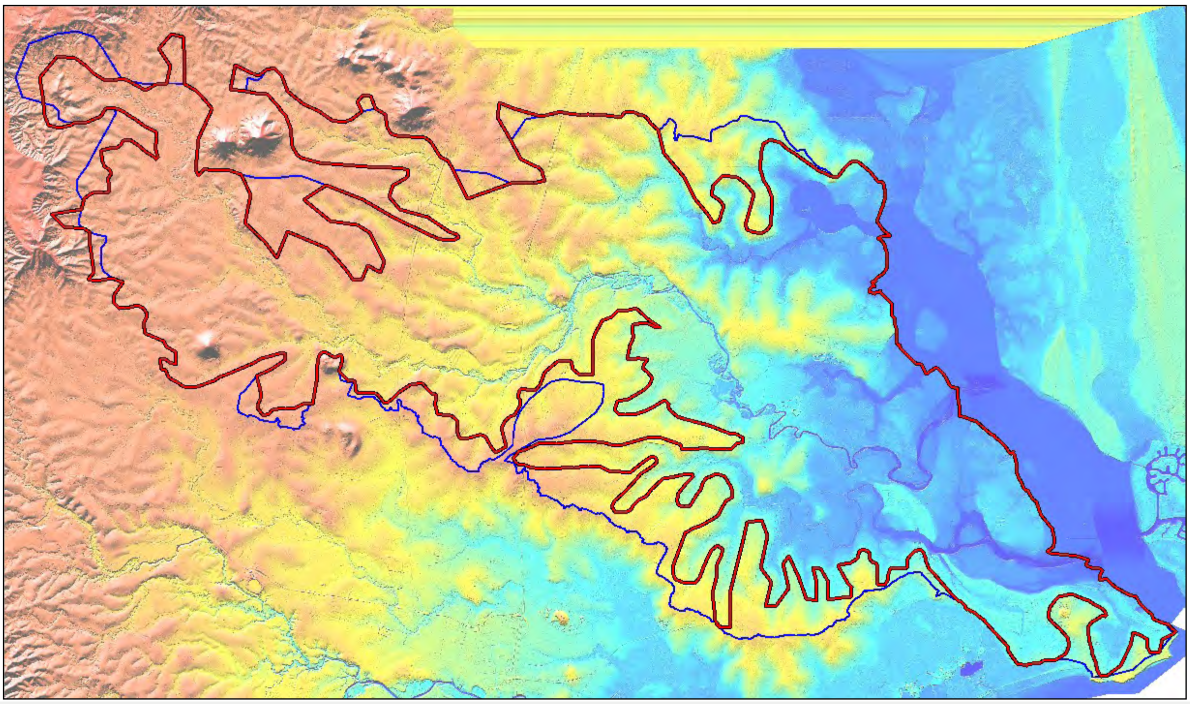

Figure 1 | Code boundary

## 2.2 Inflows and SA boundaries

SA boundaries were adopted based upon the final hydrography minor catchments layer provided to Aurecon on 24 February 2011. The following changes were made to this layer:

- Near the downstream boundary, the SA boundaries were modified so the most downstream catchment was not applied in the ocean
- At structures the SA boundaries were modified so they crossed the top of the structure and inflows were then applied upstream of the structure

Figure 2 below shows an example of how the SA boundaries were modified at structures. The black line represents the adopted SA boundary and the grey line represents the minor catchment definition. In this image, flow is from the left of the page towards the right of the page.

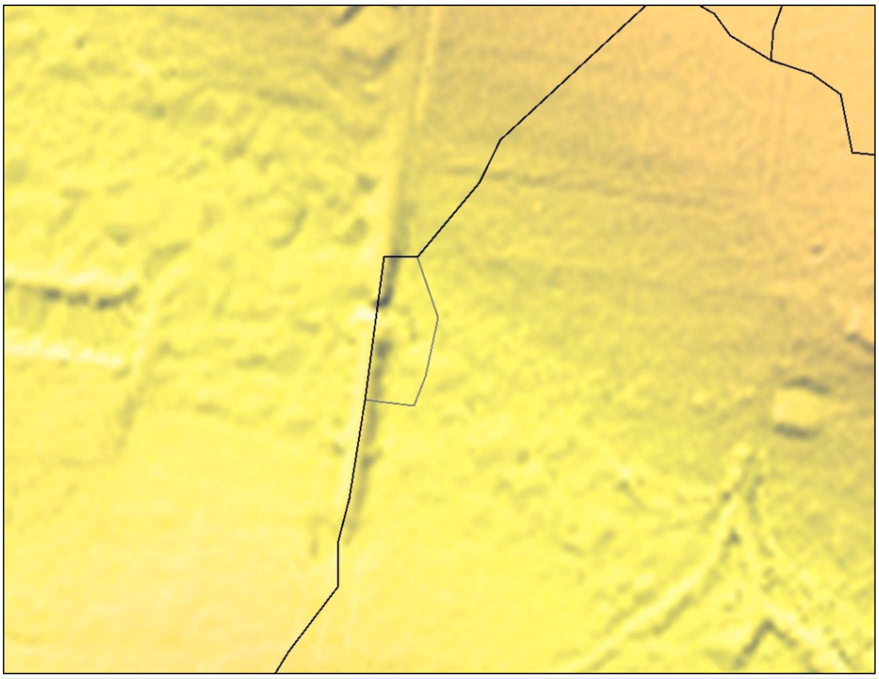

Figure 2 | SA Boundaries

### 2.2.1 Downstream boundaries

The downstream boundary location was modified to match the code boundary location.

Mean High Water Springs was adopted as the downstream boundary conditions. The values applied to the downstream boundaries were determined based upon the Maritime Safety Queensland Tidal Plane data. The following values were adopted:

- At Donnybrook MHWS = 1.88 m and AHD = 1.12 m, therefore a MHWS value of 0.76 m AHD was adopted at the downstream boundary condition for the north east model boundary (ie the outlet of Glass Mountain Creek and Elimbah Creek)
- At Toorbul MHWS = 1.95 m and AHD=1.10 m, therefore a MHWS value of 0.85 m AHD was adopted at the downstream boundary condition for the south east model boundary (ie the outlet of Ningi Creek)

### 2.2.2 Survey, topography and Zpoints

The Zpoints provided by WorleyParsons were used as the base Zpoints for the model. The following changes were made to the Zpoints:

- In locations where the lowest point within a SA boundary was a culvert inlet, a Zc upstream of the culvert was lowered such that this would become the initial location for SA inflow application
- Where required for model stability, Zlines and Zshapes have been used to lower the cells in the vicinity of culvert inlets and outlets

## 2.3 Materials

Materials files provided by MBRC at the outset of the project were reviewed and changes were made to these files as per Aurecon's memo to Council on 1 March 2011. Within the Pumicestone Passage model extents, these changes included:

- Extension of the digitised layers to cover the SCRC portion of the catchment
- Removal of dirt roads from the digitised roads layer
- Large buildings within the rural areas were digitised
- Some additional definition was included in the vegetation layer

The Manning's n values associated with the materials files were also updated. The new values were those adopted during the model calibration process undertaken on a number of the other catchments within the MBRC region.

## 2.4 Structures

Hydraulic structures, including bridges, footbridges, culverts and trunk drains, were incorporated into the model. Appendix A presents details of all modelled structures and all other structures identified in the Data Assessment Report. Comments regarding specific structures are included in this table.

# 3 Quality assessment process

## 3.1 Hydrologic model quality

The hydrologic model quality was reviewed using the following process:

- For the 100yr 3hr and EDS runs, the peak outflow volumes and discharges and the time of peak discharge were mapped across the catchment. A visual inspection of these values was undertaken to ensure that peaks were sensible as flows moved through the system
- For the 100yr 3hr and EDS runs, a graphical review of the hydrographs throughout the system was undertaken to check that timing and volume was sensible as flows moved through the system
- It was assumed that if the 100yr 3hr and EDS runs were sensible, then the model would perform adequately for the remainder of the runs

## 3.2 Hydraulic model quality

The model quality was assessed using the following process:

- Review of model log to determine:
  - Whether the run was completed or unstable
  - Number of negative depths in the run
  - Whether final and peak cumulative mass error values were less than 1%
- Review of culvert discharges to determine:
  - Whether culverts were stable during the peak of the run
  - Extent of instabilities in low flows
  - Whether run duration was long enough to capture peak at all structures
- Review of water levels to determine:
  - Whether instabilities were evident (ie whether any “blow ups” existed)
  - Whether the water surface gradients were sensible throughout the system
- Where required, modifications to the models were made to reduce instabilities and the above process was repeated
  - For the culverts, it was not possible to get all culverts stable for all runs, therefore the focus was upon obtaining stability in the peak of the critical events

# 4 Quality assessment results

## 4.1 Hydrologic model quality

The hydrologic model was found to be performing well. The following Figure 3 and Figure 4 show examples of the model hydrographs within the Ningi Creek part of the model. These figures show that:

- Hydrograph shape and timing increase as discharges move through the system as would be expected
- When side tributaries enter the system the proportional discharges from these tributaries is sensible
- The shape of the resultant hydrograph downstream of tributaries adequately accounts for and includes the discharges and shape of the upstream inflow hydrographs (eg in the image below NIN_01_04195 and NIN_24_00000 combine and are routed further downstream to NIN_01_02695)

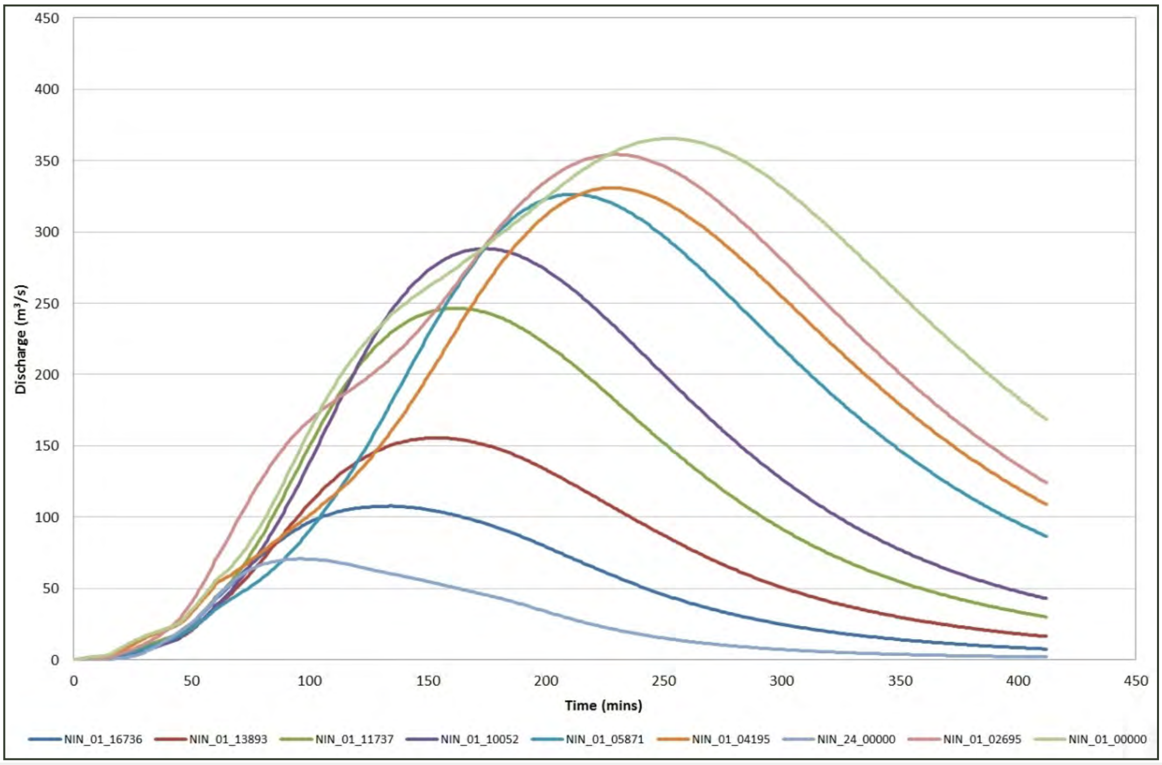


Figure 3 | WBNM 0180m Event Discharges – Ningi Creek

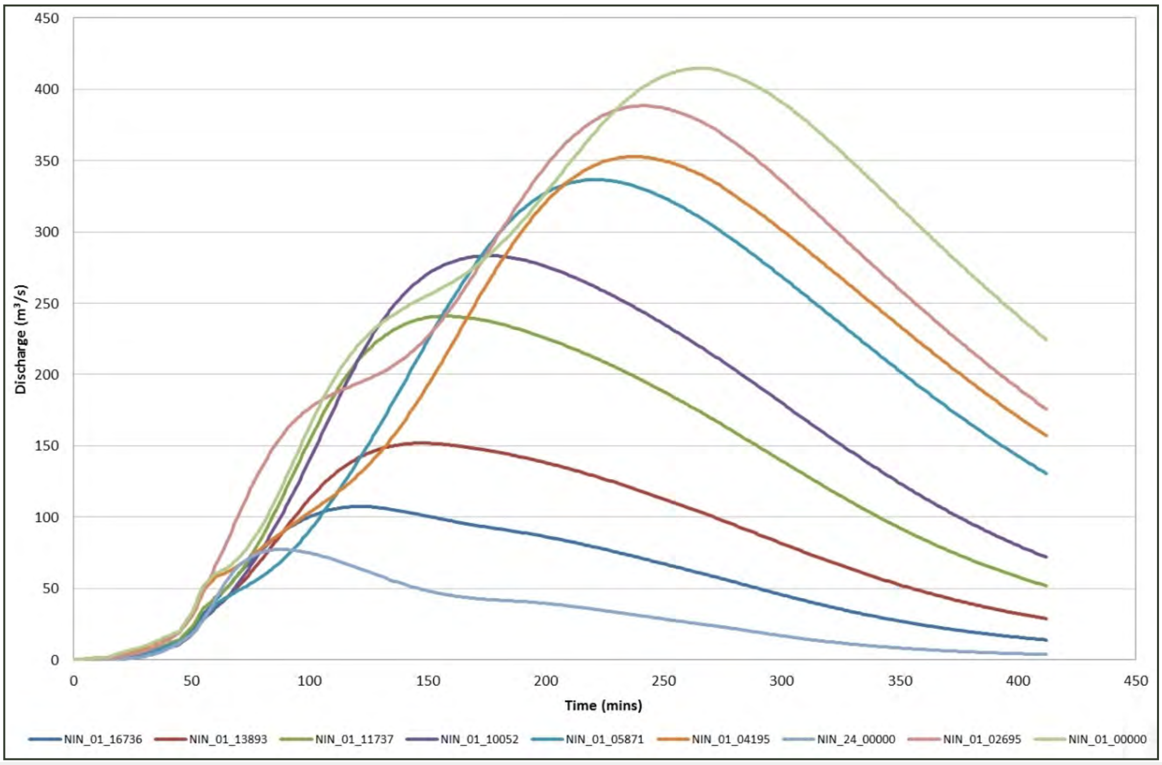


Figure 4 | WBNM EDS Event Discharges – Ningi Creek

A similar process to that described in this report for Ningi Creek was undertaken across the entire model area and for more frequent locations within each creek. No significant issues were found with model consistency, therefore the WBNM models were considered to be performing well.

## 4.2 Hydraulic model quality

Figure 5 shows areas where there are either concerns with the model results or in which future investigations and development to the models may improve the model outcomes. These are discussed further in the following sections.

### 4.2.1 Overall stability

The parameters which were used to assess the overall stability results are provided in the table in Appendix B. These results show that:

- No 1D negative depths occur in any of the runs
- Typically there are 0-4 2D negative depths occurring in the 10 m model
- In the 5 m model, 2D negative depths are model prevalent, with 6 runs having more than 30 negative depths. The 50 year 0180 m event has 530 negative depths which occur at two locations within the model
- Volume error is within ±0.2% for all events up to the 2000 year ARI event. Volume errors for the PMF events reach up to 1.1%
- Final and peak cumulative mass errors are generally within ±0.2% except for the PMF events where errors up to -1.09% occur

The above parameters are well within acceptable ranges, except for some of the PMF error ranges, and indicate that the model is generally performing well. Whilst the error ranges for the PMF events are slightly outside the acceptable norm, it was not considered that rerunning these models was required, as the PMF event is of such large magnitude and volume that these errors are likely to only have very minor impacts on the overall model predictions. Similarly, it was not considered critical that the 50 year ARI 0180 m event be rerun to fix the stability issue, as it is not likely to have a significant effect on the overall model predictions.

### 4.2.2 Structure stability

Stability of model structures was problematic and many configurations of inlet/outlet boundaries and topography were tested. The adopted configuration proved to be the most stable. There are a number of culverts in which stability was not able to be achieved for all runs and for the entire duration of the run. Throughout this process, the two most unstable 1D structures were converted to 2D structures to improve stability. The small channels that these structures are located within may be better represented using 1D branches. Stability issues were also common where there are multiple culverts in series, particularly near Rose Creek Road, Beerburrum Road and the North Coast Rail Line.

The culvert discharge results for the EDS run are presented in Appendix C. A summary of the culvert results is as follows:

- Stability is generally increased with increased discharge, ie stability issues tend to occur with low flows
- There are a number of problematic culverts, however they are not problematic throughout all runs
- A number of culverts are unstable in low flow conditions but perform stably throughout the peak of the event
- Generally the culvert discharge and velocity instabilities have very little impact upon water levels both upstream and downstream of the culvert

### 4.2.3 Sensitivity run inundation extents

The use of SA boundaries for the application of rainfall to the model has impacted upon the location in which inflows are applied in some of the sensitivity runs. For this reason some of the runs show a reduction in flood levels and inundation extents in areas where this would not be expected to occur. To remedy this it would be necessary to rerun all the models and this was not considered prudent given that it was only discovered at a very late stage of the project. Results in these areas should be treated with caution.

### 4.2.4 Iterated models for stability improvement

In the PUM basin, minor changes were made to the following two model runs to improve the stability:

- For the 5 m grid 100y 0720 m event the model became unstable at the Zshape on Steve Irwin Way. This model was iterated to run 04 and the Zshape was modified
- For the dynamic storm tide model, the downstream boundary was modified to include the following changes:
  - It was uniformly moved closer to the land by approximately 15 m
  - At the outlet to branches GMC_22 and GMC_24 the boundary was extended further into Pumicestone Passage to prevent circulations
  - At the outlet to Ningi Creek it was made orthogonal to the flow to prevent circulations

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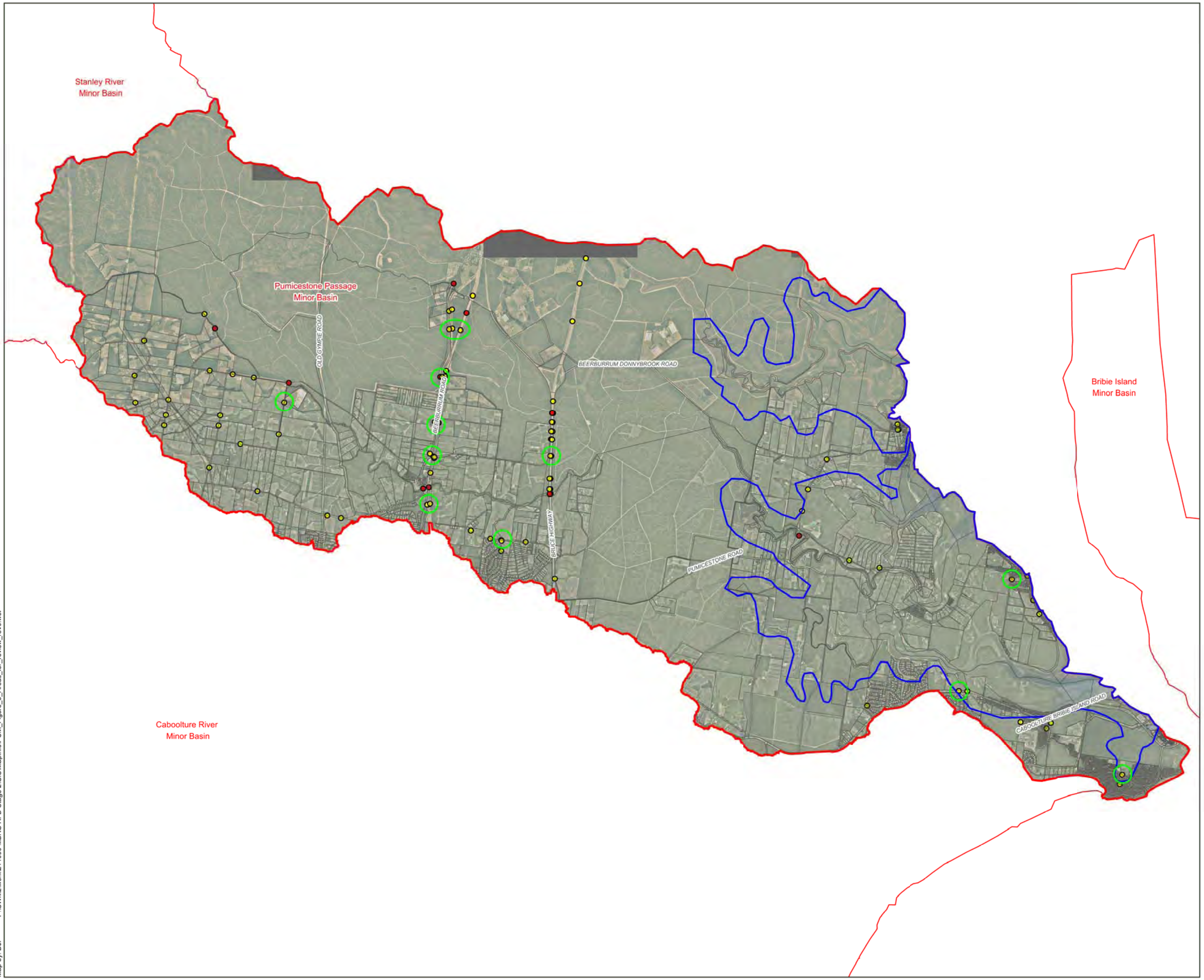



Map by: DJF    P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\PUM_Figure_5_Areas_for_review_rev0.wor

## Legend

- Cadastre
- Minor Basin Boundaries
- Culvert
- Bridge
- Structure Stability
- SA Boundary Application

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

**Date: 31/05/2012**    **Version: 0**

A3 scale 1:100,000

0    2,500 m    5,000 m

Projection: MGA Zone 56

**RFD Detailed Modelling (PUM)**

**Figure 5: Areas of Concern for Future TUFLOW Model Review/Upgrades**

# 5 Conclusions

The Pumicestone Passage detailed modelling has upgraded the 10 m grid broadscale model to both a 10 m grid and a 5 m grid detailed model. This model upgrade has followed the general model setup of the Burpengary Creek (BUR) detailed model.

Changes to the model include:

- Revision of boundary conditions and their locations
- Inclusion of updated Zpoints and some minor modifications to these
- Inclusion of materials layers and some minor modifications to these
- Inclusion of structures and associated boundary conditions

The model quality has been assessed through review of the model results for both the hydrologic and hydraulic model. Key findings of the quality assessment are:

- The hydrologic model is performing well
- The hydraulic model is generally performing well, with the following issues being of note
  - Model errors in a number of the PMF events are slightly outside the acceptable norm
  - Structure stability – the stability of the structures has been problematic and whilst stability has been significantly improved, instabilities are still occurring at some structures, particularly in low flow conditions
  - In the sensitivity runs, water levels and inundation extents are shown to reduce in some areas as a result of SA boundaries redistributing flows across the catchments. Results in these areas should be treated with caution

# Appendices

# Appendix A
# Modelled Structures

| Structure ID | Waterway ID | Structure Type | Crossing Name | Priority* | Is Structure Modelled? | Data Availability/Source & Comments |
|---|---|---|---|---|---|---|
| BEE_01_01652 | BEE_01_01652 | Bridge | Bruce Highway | A | Yes | Aurecon survey and TMR plans |
| BEE_01_01675 | BEE_01_01675 | Bridge | Bruce Highway | A | Yes | TMR plans |
| BEE_01_06768 | BEE_01_06768 | Bridge | Railway | A | Yes | Aurecon survey and QR plans |
| BEE_01_07828 | BEE_01_07828 | Bridge | Beerburrum Road | A | Yes | TMR Plans |
| BEE_10_01778 | BEE_10_01778 | Bridge | Railway | A | Yes | Aurecon survey and QR plans |
| BEE_18_01376 | BEE_18_01376 | Bridge | Bruce Highway | A | Yes | Aurecon survey and TMR plans |
| ELI_01_10536 | ELI_01_10536 | Bridge | Donnybrook Road | A | Yes | MBRC Plans |
| SMC_01_13518 | SMC_01_13518 | Bridge | Twin View Road | A | Yes | MBRC Plans |
| SMC_01_02645 | SMC_01_02645 | Bridge | Bruce Highway | A | Yes | TMR Plans |
| SMC_01_02671 | SMC_01_02671 | Bridge | Bruce Highway | A | Yes | TMR Plans |
| SMC_01_06731 | SMC_01_06731 | Bridge | Railway | A | Yes | Aurecon survey and QR plans |
| SMC_01_06873 | SMC_01_06873 | Bridge | Beerburrum Road | A | Yes | Aurecon survey and TMR plans |
| SMC_12_00384 | SMC_12_00384 | Bridge | Twin View Road | A | Yes | Aurecon survey |
| 01_06768 | BEE_01_06768 | Culvert | Railway | A | Yes | QR plans |
| N/A | BEE_01_11919 | Culvert | Old Gympie Road | B | No | No |
| 06_00000 | BEE_06_00000 | Culvert | Rose Creek Road | N/A | Yes | MBRC Survey, Survey ID = BEE_06_00530 |
| 06_00530 | BEE_06_00530 | Culvert | Railway | B | Yes | MBRC Survey |
| N/A | BEE_06_00568 | Culvert | Beerburrum Road | B | No | |
| 08_00425a | BEE_08_00425 | Culvert | Railway | A | Yes | QR plans |
| 08_00425b | BEE_08_00425 | Culvert | Rose Creek Road | A | Yes | MBRC Survey, Survey ID = BEE_08_00755 |
| 08_00755 | BEE_08_00755 | Culvert | Railway | B | Yes | MBRC Survey |
| N/A | BEE_08_00787 | Culvert | Beerburrum Road | B | No | No |
| 09_01117 | BEE_09_01117 | Culvert | Bruce Highway | A | Yes | Aurecon survey and TMR plans |

| Structure ID | Waterway ID | Structure Type | Crossing Name | Priority* | Is Structure Modelled? | Data Availability/Source & Comments |
|---|---|---|---|---|---|---|
| N/A | BEE_09_01592 | Culvert | Steve Irwin Way | B | No | No |
| 10_01633a | BEE_10_01633 | Culvert | Railway | A | Yes | MBRC Survey, Survey ID = BEE_10_01724 |
| 10_01633b | BEE_10_01633 | Culvert | Railway | A | Yes | QR plans |
| 10_01724 | BEE_10_01724 | Culvert | Railway | A | Yes | MBRC Survey |
| 12_00243 | BEE_12_00243 | Culvert | Bruce Highway | A | Yes | Aurecon survey and TMR plans |
| 12_00275 | BEE_12_00275 | Culvert | Bruce Highway | A | Yes | Aurecon survey and TMR plans |
| 14_00454 | BEE_14_00454 | Culvert | Bruce Highway | B | Yes | TMR plans |
| N/A | BEE_14_00481 | Culvert | Bruce Highway | B | No | No |
| 16_00679 | BEE_16_00679 | Culvert | Bruce Highway | B | Yes | TMR plans |
| 16_00703 | BEE_16_00703 | Culvert | Bruce Highway | B | Yes | TMR plans |
| 18_01396 | BEE_18_01396 | Culvert | Bruce Highway | A | Yes | TMR plans |
| 18_05085a | BEE_18_05085 | Culvert | Rose Creek Road | B | Yes | MBRC Survey |
| 18_05085b | BEE_18_05085 | Culvert | Railway | A | Yes | MBRC Survey, Survey ID = BEE_18_05151 |
| 18_05151 | BEE_18_05151 | Culvert | Railway | A | Yes | MBRC Survey |
| 18_05190 | BEE_18_05190 | Culvert | Beerburrum Road | B | Yes | TMR plans |
| N/A | ELI_03_01693 | Culvert | Bruce Highway | B | No | No |
| 07_00183 | ELI_07_00183 | Culvert | Meldale Road | B | Yes | MBRC Survey |
| 09_00104 | ELI_09_00104 | Culvert | Meldale Road | B | Yes | MBRC Survey |
| N/A | ELI_10_00057 | Culvert | Pumicestone Road | B | No | No |
| 11_04807 | ELI_11_04807 | Culvert | Donnybrook Road | B | Yes | MBRC Survey |
| N/A | Not on reach | Culvert | Pumicestone Road | B | Not on reach | No, 5 separate culverts |
| 13_01616 | ELI_13_01616 | Culvert | Donnybrook Road | B | Yes | MBRC Survey |
| N/A | ELI_14_00382 | Culvert | Pumicestone Road | B | No | No |

| Structure ID | Waterway ID | Structure Type | Crossing Name | Priority* | Is Structure Modelled? | Data Availability/Source & Comments |
|---|---|---|---|---|---|---|
| N/A | ELI_16_01136 | Culvert | Pumicestone Road | B | No | No |
| 18_00000a-d | ELI_18_00000 | Trunk Drain | Esplanade | A | Yes | MBRC GIS. Dimensions based on GIS. ILs based on GIS but some assumptions made |
| 20_00000 | ELI_20_00000 | Culvert | Esplanade | A | Yes | MBRC GIS |
| 20_00617 | ELI_20_00617 | Culvert | Freeman Road | A | Yes | MBRC GIS |
| 22_00038 | ELI_22_00038 | Culvert | Esplanade | A | Yes | MBRC Survey |
| 24_00122 | ELI_24_00122 | Culvert | Esplanade | A | Yes | MBRC Survey |
| 01_15669 | GMC_01_15669 | Culvert | Bruce Highway | B | Yes | TMR plans |
| 02_00459 | GMC_02_00459 | Culvert | Bruce Highway | B | Yes | TMR plans |
| 04_02236 | GMC_04_02236 | Culvert | Bruce Highway | B | Yes | TMR plans |
| 24_00212 | GMC_24_00212 | Culvert | Esplanade North | A | Yes | MBRC Survey |
| 24_00331 | GMC_24_00331 | Culvert | Amy Street | A | Yes | MBRC Survey |
| 26_00000 | GMC_26_00000 | Culvert | Amy Street | A | Yes | MBRC GIS |
| 28_02630 | GMC_28_02630 | Culvert | Donnybrook Road | B | Yes | MBRC Survey |
| N/A | Not on reach | Culvert | Pumicestone Road | B | No | No, 7 separate culverts |
| N/A | NIN_01_18391 | Culvert | Pumicestone Road | B | No | No |
| 01_23388 | NIN_01_23388 | Culvert | Rutters Road | B | Yes | MBRC Survey |
| N/A | NIN_01_23388 | Culvert | Bruce Highway | B | No | No |
| N/A | NIN_14_00567 | Culvert | Minor Road | A | No | No |
| N/A | NIN_14_01586 | Culvert | Wattle Grove Drive | A | No | No |
| 14_01586 | NIN_14_01586 | Culvert | Wrenaus Way | A | Yes | MBRC Survey |
| 22_00733 | NIN_22_00733 | Culvert | Bribie Island Road | A | Yes | Aurecon survey and TMR plans |
| 24_00716 | NIN_24_00716 | Culvert | Bribie Island Road | A | Yes | Aurecon survey and TMR plans |

| Structure ID | Waterway ID | Structure Type | Crossing Name | Priority* | Is Structure Modelled? | Data Availability/Source & Comments |
|---|---|---|---|---|---|---|
| 24_03255 | NIN_24_03255 | Culvert | Sandstone Bvd | A | Yes | No, Dimensions based on site visit |
| 28_00581 | NIN_28_00581 | Culvert | Wetland Outlet | A | Yes | No, Dimensions based on site visit |
| 28_02571 | NIN_28_02571 | Culvert | Sandheath Place | A | Yes | MBRC Survey, Modelled as a 2D structure |
| 28_02761 | NIN_28_02761 | Culvert | Redondo Street | A | Yes | MBRC Survey, Modelled as a 2D structure |
| N/A | NIN_36_00585 | Culvert | Bribie Island Road | B | No | No |
| 36_03043 | NIN_36_03043 | Culvert | Bestmann Road East | A | Yes | MBRC Survey |
| 36_03325 | NIN_36_03325 | Culvert | Carpenter Way | A | Yes | MBRC Survey |
| N/A | SMC_01_11575 | Culvert | Old Gympie Road | B | No | No |
| 04_00701 | SMC_04_00701 | Culvert | Twin View Road | N/A | Yes | MBRC Survey |
| N/A | SMC_08_00499 | Culvert | Prosser Road | B | No | No |
| 09_02090 | SMC_09_02090 | Culvert | Rose Creek Road | B | Yes | MBRC Survey |
| 09_02136 | SMC_09_02136 | Culvert | Railway | A | Yes | QR plans |
| 09_02248 | SMC_09_02248 | Culvert | Beerburrum Road | A | Yes | Aurecon survey and TMR plans |
| N/A | SMC_09_06807 | Culvert | Old Gympie Road | B | No | No |
| 12_04150 | SMC_12_04150 | Culvert | Twin View Road | N/A | Yes | MBRC Survey |
| N/A | SMC_13_00311 | Culvert | Twin View Road | B | No | No |
| N/A | SMC_14_01506 | Culvert | Woodlands Drive | B | No | No |
| 15_00438 | SMC_15_00438 | Culvert | Railway | B | Yes | QR plans |
| N/A | SMC_15_00665 | Culvert | Beerburrum Road | A | No | No |
| 17_01044 | SMC_17_01044 | Culvert | Bruce Highway | B | Yes | TMR plans |
| 17_01055 | SMC_17_01055 | Culvert | Bruce Highway | B | Yes | TMR plans |
| 18_00832 | SMC_18_00832 | Culvert | Woodlands Drive | B | Yes | MBRC Survey |
| 19_00348 | SMC_19_00348 | Culvert | Bruce Highway | B | Yes | TMR plans |

| Structure ID | Waterway ID | Structure Type | Crossing Name | Priority* | Is Structure Modelled? | Data Availability/Source & Comments |
|---|---|---|---|---|---|---|
| 19_00373 | SMC_19_00373 | Culvert | Bruce Highway | B | Yes | TMR plans |
| 20_01371 | SMC_20_01371 | Culvert | Williams Road | B | Yes | MBRC Survey |
| 20_03707 | SMC_20_03707 | Culvert | Powell Road | B | Yes | MBRC Survey |
| N/A | SMC_20_03766 | Culvert | Hoffman Road | B | No | No |
| 20_05638 | SMC_20_05638 | Culvert | Minor Road | B | Yes | MBRC Survey |
| 20_06732 | SMC_20_06732 | Culvert | Woodlands Drive | N/A | Yes | MBRC Survey |
| 22_00787 | SMC_22_00787 | Culvert | Newlands Road | B | Yes | MBRC Survey |
| 24_00261 | SMC_24_00261 | Culvert | Newlands Road | B | Yes | MBRC Survey |
| 26_00736 | SMC_26_00736 | Culvert | Powell Road | B | Yes | MBRC Survey |
| N/A | SMC_28_00908 | Culvert | Powell Road | B | No | No |
| 28_01916 | SMC_28_01916 | Culvert | Scurr Road | B | Yes | MBRC Survey |
| N/A | SMC_28_02077 | Culvert | Scurr Road | B | No | No |
| 30_00666 | SMC_30_00666 | Culvert | Scurr Road | B | Yes | MBRC Survey |
| 32_00555 | SMC_32_00555 | Culvert | Scurr Road | N/A | Yes | MBRC Survey |
| 34_03784 | SMC_34_03784 | Culvert | King Road | B | Yes | MBRC Survey |
| N/A | SMC_36_00481 | Culvert | King Road | B | No | No |
| N/A | SMC_36_01650 | Culvert | Powell Road | B | No | No |
| 40_00207 | SMC_40_00207 | Culvert | Powell Road | B | Yes | MBRC Survey |
| N/A | SMC_42_00788 | Culvert | Williams Road | B | No | No |
| 42_02276 | SMC_42_02276 | Culvert | Pates Road | B | Yes | MBRC Survey |
| 44_00868 | SMC_44_00868 | Culvert | Williams Road | B | Yes | MBRC Survey |
| N/A | SMC_46_01629 | Culvert | King Road | B | No | No |
| 48_01569 | SMC_48_01569 | Culvert | King Road | B | Yes | MBRC Survey |

| Structure ID | Waterway ID | Structure Type | Crossing Name | Priority* | Is Structure Modelled? | Data Availability/Source & Comments |
|---|---|---|---|---|---|---|
| 54_00492 | SMC_54_00492 | Culvert | King Road | N/A | Yes | MBRC Survey |
| 58_00453 | SMC_58_00453 | Culvert | Hamilton Road | B | Yes | MBRC GIS |
| 58_00504 | SMC_58_00504 | Culvert | Railway | A | Yes | QR plans |
| 58_00539 | SMC_58_00539 | Culvert | Beerburrum Road | A | Yes | Aurecon survey |
| N/A | SMC_60_00679 | Culvert | Kirrang Drive | A | No | No, No culvert exists |
| 64_01396 | SMC_64_01396 | Culvert | Mansfield Road | A | Yes | MBRC Survey |
| 66_00151 | SMC_66_00151 | Culvert | Bigmor Drive | A | Yes | MBRC Survey |
| 68_00227 | SMC_68_00227 | Culvert | Mansfield Road | A | Yes | MBRC GIS |
| 70_00654 | SMC_70_00654 | Culvert | Mansfield Road | B | Yes | MBRC GIS |
| 72_01331a | SMC_72_01331 | Culvert | Mansfield Road | B | Yes | MBRC Survey |
| 72_01331b | SMC_72_01331 | Culvert | Mansfield Road | B | Yes | MBRC Survey |

** As identified in the Data Assessment Report*

# Appendix B
# Overall Stability Results

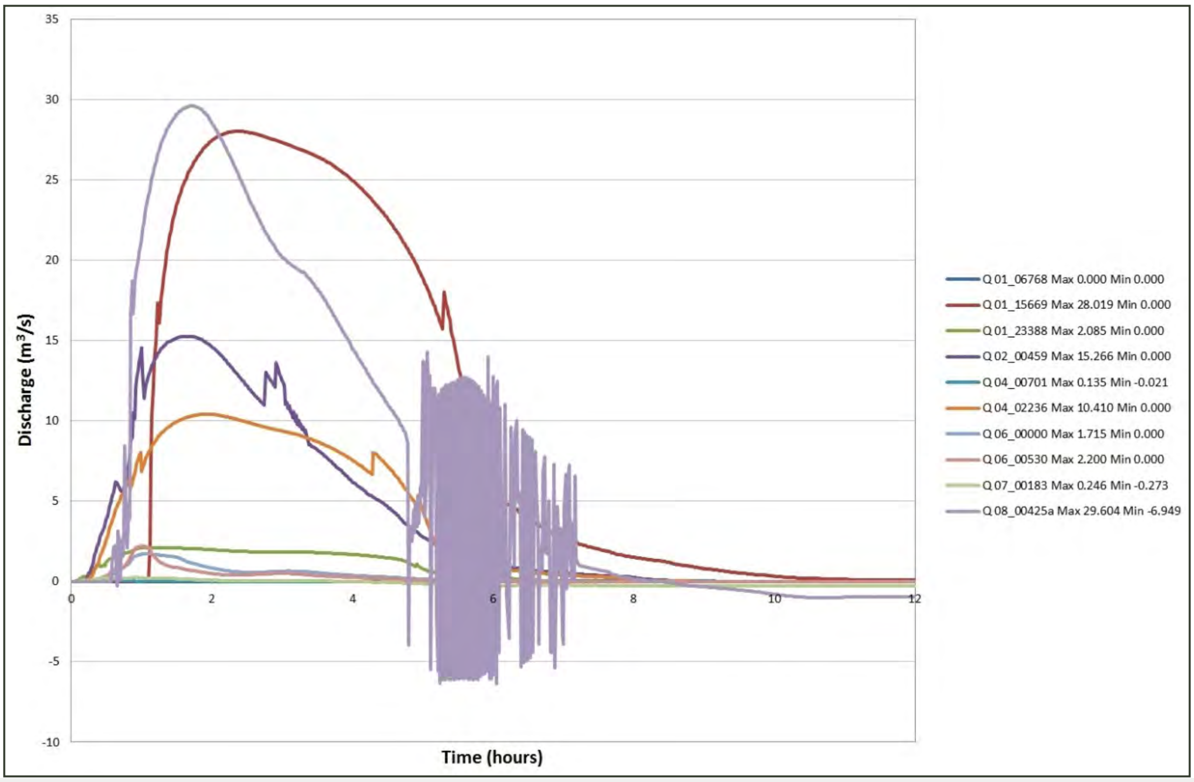
| Simulation | Total 1D Negative Depths | Total 2D Negative Depths | WARNINGs prior to simulation | WARNINGs during simulation | Volume Error (m3) | Final Cumulative ME | Whole Simulation Peak Cumulative ME |
|---|---|---|---|---|---|---|---|
| 00001Y_0180m | 0 | 15 | 15 | 15 | -8348 or 0.0% | -0.05% | -0.08% at 6.90h |
| 00001Y_0360m | 0 | 0 | 15 | 0 | -14339 or -0.1% | -0.07% | -0.10% at 9.88h |
| 00001Y_0720m | 0 | 1 | 15 | 1 | -19821 or -0.1% | -0.08% | -0.10% at 15.88h |
| 00002Y_0180m | 0 | 7 | 15 | 7 | -10115 or 0.0% | -0.04% | -0.07% at 6.89h |
| 00002Y_0360m | 0 | 1 | 15 | 1 | -18352 or -0.1% | -0.06% | -0.08% at 9.88h |
| 00002Y_0720m | 0 | 1 | 15 | 1 | -29140 or -0.1% | -0.08% | -0.09% at 15.88h |
| 00005Y_0180m | 0 | 5 | 15 | 5 | -13371 or 0.0% | -0.04% | -0.06% at 6.88h |
| 00005Y_0360m | 0 | 12 | 15 | 12 | -21218 or -0.1% | -0.05% | -0.06% at 9.88h |
| 00005Y_0720m | 0 | 5 | 15 | 5 | -40133 or -0.1% | -0.08% | -0.08% at 15.89h |
| 00010Y_0010m | 0 | 2 | 15 | 2 | -4067 or 0.0% | -0.03% | -0.05% at 4.05h |
| 00010Y_0015m | 0 | 1 | 15 | 1 | -4955 or 0.0% | -0.03% | -0.05% at 4.14h |
| 00010Y_0030m | 0 | 43 | 15 | 43 | -9057 or -0.1% | -0.05% | -0.07% at 4.38h |
| 00010Y_0045m | 0 | 10 | 15 | 10 | -10139 or -0.1% | -0.05% | -0.06% at 4.63h |
| 00010Y_0060m | 0 | 37 | 15 | 37 | -9153 or 0.0% | -0.04% | -0.06% at 4.88h |
| 00010Y_0090m | 0 | 22 | 15 | 22 | -11614 or 0.0% | -0.04% | -0.06% at 5.40h |
| 00010Y_0120m | 0 | 22 | 15 | 22 | -12262 or 0.0% | -0.04% | -0.06% at 5.88h |
| 00010Y_0180m | 0 | 1 | 15 | 1 | -13983 or 0.0% | -0.04% | -0.05% at 6.89h |
| 00010Y_0270m | 0 | 23 | 15 | 23 | -20377 or -0.1% | -0.05% | -0.06% at 8.38h |
| 00010Y_0360m | 0 | 17 | 15 | 17 | -24456 or -0.1% | -0.05% | -0.06% at 9.89h |
| 00010Y_0540m | 0 | 27 | 15 | 27 | -32992 or -0.1% | -0.06% | -0.06% at 12.88h |
| 00010Y_0720m | 0 | 5 | 15 | 5 | -55729 or -0.1% | -0.09% | -0.09% at 17.00h |
| 00010Y_1080m | 0 | 3 | 15 | 3 | -59735 or -0.1% | -0.08% | -0.08% at 22.05h |
| 00010Y_1440m | 0 | 17 | 15 | 17 | -76360 or -0.1% | -0.09% | -0.10% at 27.88h |
| 00010Y_2160m | 0 | 10 | 15 | 10 | -114166 or -0.1% | -0.11% | -0.15% at 26.10h |
| 00010Y_2880m | 0 | 42 | 15 | 42 | -147657 or -0.1% | -0.14% | -0.16% at 19.64h |
| 00010Y_4320m | 0 | 24 | 15 | 24 | -230489 or -0.2% | -0.19% | -0.21% at 72.03h |
| 00020Y_0180m | 0 | 64 | 15 | 64 | -16594 or 0.0% | -0.04% | -0.05% at 6.89h |
| 00020Y_0360m | 0 | 11 | 15 | 11 | -34678 or -0.1% | -0.06% | -0.06% at 15.00h |
| 00020Y_0720m | 0 | 4 | 15 | 4 | -86508 or -0.1% | -0.11% | -0.11% at 19.52h |
| 00050Y_0180m | 0 | 530 | 15 | 530 | -35678 or -0.1% | -0.07% | -0.08% at 6.88h |
| 00050Y_0360m | 0 | 10 | 15 | 10 | -63738 or -0.1% | -0.09% | -0.09% at 15.00h |
| 00050Y_0720m | 0 | 1 | 15 | 1 | -152664 or -0.2% | -0.16% | -0.16% at 20.00h |
| 00100Y_0180m* | 0 | 24 | 15 | 24 | -42233 or -0.1% | -0.07% | -0.07% at 12.00h |
| 00100Y_0360m* | 0 | 87 | 15 | 87 | -101737 or -0.1% | -0.12% | -0.12% at 15.00h |

| Simulation | Total 1D Negative Depths | Total 2D Negative Depths | WARNINGs prior to simulation | WARNINGs during simulation | Volume Error (m3) | Final Cumulative ME | Whole Simulation Peak Cumulative ME |
|---|---|---|---|---|---|---|---|
| 00100Y_0720m* | 0 | 12 | 15 | 12 | -228657 or -0.2% | -0.20% | -0.20% at 20.00h |
| 00100Y_EDS* | 0 | 26 | 15 | 26 | -66592 or -0.1% | -0.10% | -0.10% at 12.00h |
| 00100Y_0010m | 0 | 0 | 16 | 0 | -3017 or 0.0% | -0.02% | -0.06% at 4.05h |
| 00100Y_0015m | 0 | 0 | 16 | 0 | -3624 or 0.0% | -0.02% | -0.06% at 4.16h |
| 00100Y_0030m | 0 | 0 | 16 | 0 | -7473 or 0.0% | -0.03% | -0.07% at 4.38h |
| 00100Y_0045m | 0 | 0 | 16 | 0 | -11085 or 0.0% | -0.04% | -0.07% at 4.63h |
| 00100Y_0060m | 0 | 1 | 16 | 1 | -10767 or 0.0% | -0.03% | -0.07% at 4.88h |
| 00100Y_0090m | 0 | 0 | 16 | 0 | -19731 or 0.0% | -0.04% | -0.07% at 5.88h |
| 00100Y_0120m | 0 | 0 | 16 | 0 | -19731 or 0.0% | -0.04% | -0.07% at 5.88h |
| 00100Y_0180m | 0 | 1 | 16 | 1 | -30537 or -0.1% | -0.05% | -0.07% at 6.88h |
| 00100Y_0270m | 0 | 1 | 16 | 1 | -46358 or -0.1% | -0.07% | -0.07% at 12.00h |
| 00100Y_0360m | 0 | 0 | 16 | 0 | -61525 or -0.1% | -0.08% | -0.08% at 12.00h |
| 00100Y_0540m | 0 | 0 | 16 | 0 | -112705 or -0.1% | -0.12% | -0.12% at 15.00h |
| 00100Y_0720m | 0 | 0 | 16 | 0 | -172773 or -0.2% | -0.15% | -0.15% at 19.78h |
| 00100Y_1080m | 0 | 1 | 16 | 1 | -211516 or -0.2% | -0.16% | -0.16% at 24.91h |
| 00100Y_1440m | 0 | 1 | 16 | 1 | -219970 or -0.1% | -0.14% | -0.15% at 27.84h |
| 00100Y_1800m | 0 | 2 | 16 | 2 | -216829 or -0.1% | -0.13% | -0.13% at 38.18h |
| 00100Y_2160m | 0 | 0 | 16 | 0 | -206923 or -0.1% | -0.11% | -0.12% at 43.52h |
| 00100Y_2880m | 0 | 2 | 16 | 2 | -242097 or -0.1% | -0.12% | -0.13% at 21.58h |
| 00100Y_4320m | 0 | 1 | 16 | 1 | -279976 or -0.1% | -0.12% | -0.15% at 20.82h |
| 00200Y_0120m | 0 | 2 | 16 | 2 | -34263 or -0.1% | -0.06% | -0.07% at 5.88h |
| 00200Y_0180m | 0 | 1 | 16 | 1 | -46491 or -0.1% | -0.07% | -0.07% at 12.00h |
| 00200Y_0360m | 0 | 0 | 16 | 0 | -126725 or -0.1% | -0.14% | -0.14% at 15.00h |
| 00500Y_0120m | 0 | 1 | 16 | 1 | -57073 or -0.1% | -0.08% | -0.08% at 10.00h |
| 00500Y_0180m | 0 | 0 | 16 | 0 | -80556 or -0.1% | -0.10% | -0.10% at 12.00h |
| 00500Y_0360m | 0 | 1 | 16 | 1 | -191722 or -0.2% | -0.18% | -0.18% at 15.00h |
| 01000Y_0120m | 0 | 1 | 16 | 1 | -80643 or -0.1% | -0.10% | -0.10% at 10.00h |
| 01000Y_0180m | 0 | 2 | 16 | 2 | -113607 or -0.1% | -0.13% | -0.13% at 12.00h |
| 01000Y_0360m | 0 | 4 | 16 | 4 | -253561 or -0.2% | -0.21% | -0.21% at 15.00h |
| 02000Y_0120m | 0 | 0 | 16 | 0 | -111314 or -0.1% | -0.12% | -0.12% at 10.00h |
| 02000Y_0180m | 0 | 2 | 16 | 2 | -152528 or -0.2% | -0.16% | -0.16% at 12.00h |
| 02000Y_0360m | 0 | 3 | 16 | 3 | -328747 or -0.2% | -0.24% | -0.24% at 15.00h |
| PMF_0015m | 0 | 3 | 16 | 3 | -50782 or -0.1% | -0.07% | -0.08% at 4.20h |
| PMF_0030m | 0 | 2 | 16 | 2 | -146426 or -0.1% | -0.14% | -0.14% at 8.00h |

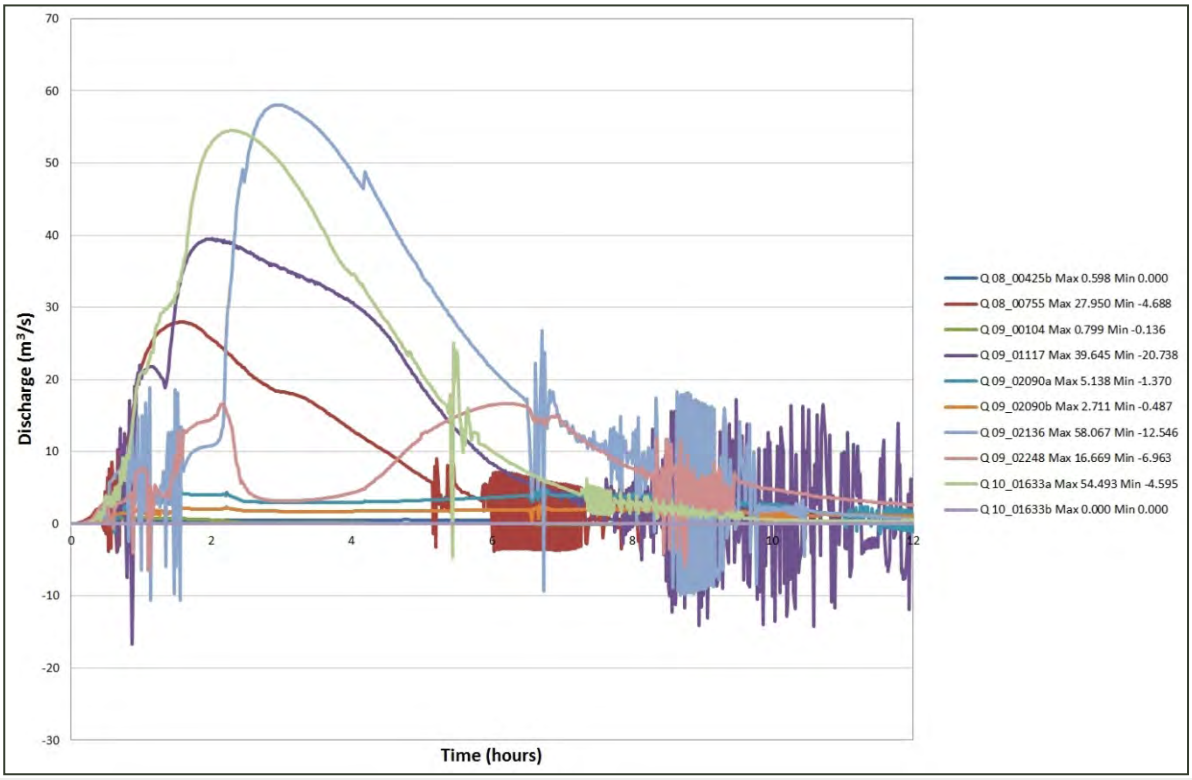
| Simulation | Total 1D Negative Depths | Total 2D Negative Depths | WARNINGs prior to simulation | WARNINGs during simulation | Volume Error (m3) | Final Cumulative ME | Whole Simulation Peak Cumulative ME |
|---|---|---|---|---|---|---|---|
| PMF_0045m | 0 | 4 | 16 | 4 | -281654 or -0.2% | -0.22% | -0.22% at 8.00h |
| PMF_0060m | 0 | 3 | 16 | 3 | -585636 or -0.4% | -0.35% | -0.35% at 10.00h |
| PMF_0090m | 0 | 2 | 16 | 2 | -1134463 or -0.5% | -0.51% | -0.51% at 10.00h |
| PMF_0120m | 0 | 3 | 16 | 3 | -1643673 or -0.6% | -0.63% | -0.63% at 10.00h |
| PMF_0150m | 0 | 3 | 16 | 3 | -2228046 or -0.7% | -0.74% | -0.74% at 12.00h |
| PMF_0180m | 0 | 3 | 16 | 3 | -2840973 or -0.8% | -0.84% | -0.84% at 12.00h |
| PMF_0240m | 0 | 3 | 16 | 3 | -3696781 or -1.0% | -0.97% | -0.97% at 12.00h |
| PMF_0300m | 0 | 1 | 16 | 1 | -4630662 or -1.1% | -1.06% | -1.06% at 13.48h |
| PMF_0360m | 0 | 3 | 16 | 3 | -4958171 or -1.1% | -1.09% | -1.09% at 14.02h |
| PMF_0720m_ GSDM | 0 | 2 | 16 | 2 | -5843507 or -1.1% | -1.06% | -1.06% at 18.08h |
| PMF_1440m | 0 | 3 | 16 | 3 | -5785472 or -0.8% | -0.85% | -0.86% at 28.23h |
| PMF_2160m | 0 | 0 | 16 | 0 | -6665510 or -0.8% | -0.79% | -0.80% at 41.32h |
| PMF_2880m | 0 | 0 | 16 | 0 | -7041982 or -0.7% | -0.72% | -0.73% at 45.73h |
| PMF_4320m | 0 | 0 | 16 | 0 | -7886653 or -0.6% | -0.64% | -0.72% at 37.44h |
| 00100Y_EDS | 0 | 0 | 16 | 0 | -47502 or -0.1% | -0.07% | -0.07% at 12.00h |
| 00100Y_EDS_S2 | 0 | 0 | 16 | 0 | -37311 or -0.1% | -0.06% | -0.07% at 8.38h |
| 00100Y_EDS_S3 | 0 | 0 | 16 | 0 | -40523 or -0.1% | -0.06% | -0.07% at 8.38h |
| 00100Y_EDS_S4 | 0 | 1 | 16 | 1 | -72261 or -0.1% | -0.09% | -0.09% at 12.00h |
| 00100Y_EDS_S5 | 0 | 0 | 16 | 0 | -22218 or 0.0% | -0.03% | -0.04% at 8.38h |
| 00100Y_EDS_S6 | 0 | 0 | 16 | 0 | -29074 or 0.0% | -0.04% | -0.05% at 8.38h |
| 00100Y_EDS_S7 | 0 | 7 | 16 | 7 | -3462753 or -0.7% | -0.69% | -0.83% at 23.15h |
| 00100Y_EDS_S8 | 0 | 1 | 16 | 1 | -15095 or 0.0% | -0.02% | -0.04% at 8.38h |
| 00100Y_EDS_S9 | 0 | 1 | 16 | 1 | -16091 or 0.0% | -0.02% | -0.02% at 8.38h |
| 00100Y_EDS_ S10 | 0 | 0 | 16 | 0 | -44474 or -0.1% | -0.07% | -0.07% at 8.38h |
| 00100Y_EDS_ S11 | 0 | 1 | 16 | 1 | -48184 or -0.1% | -0.07% | -0.07% at 12.00h |
| 00100Y_EDS_ S12 | 0 | 0 | 16 | 0 | -44489 or -0.1% | -0.07% | -0.07% at 8.38h |

** 100 year ARI 5 m grid model results*

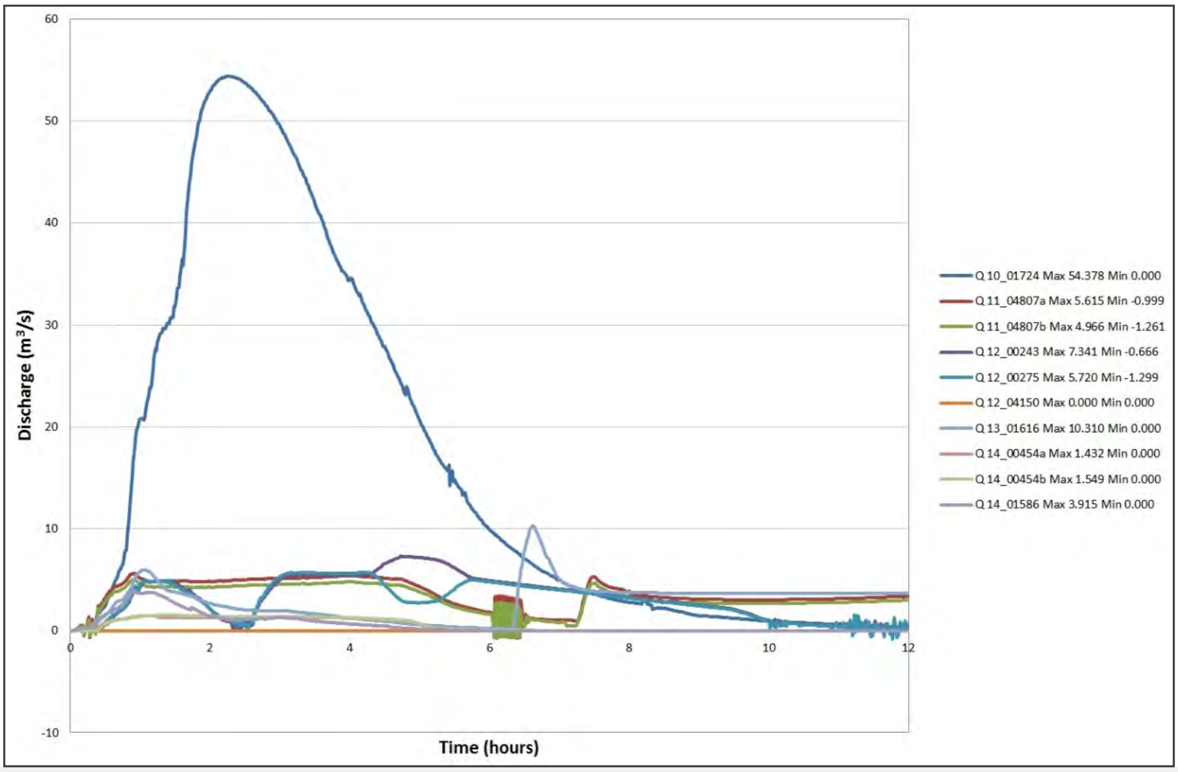
# Appendix C
# EDS Culvert Discharge Graphs



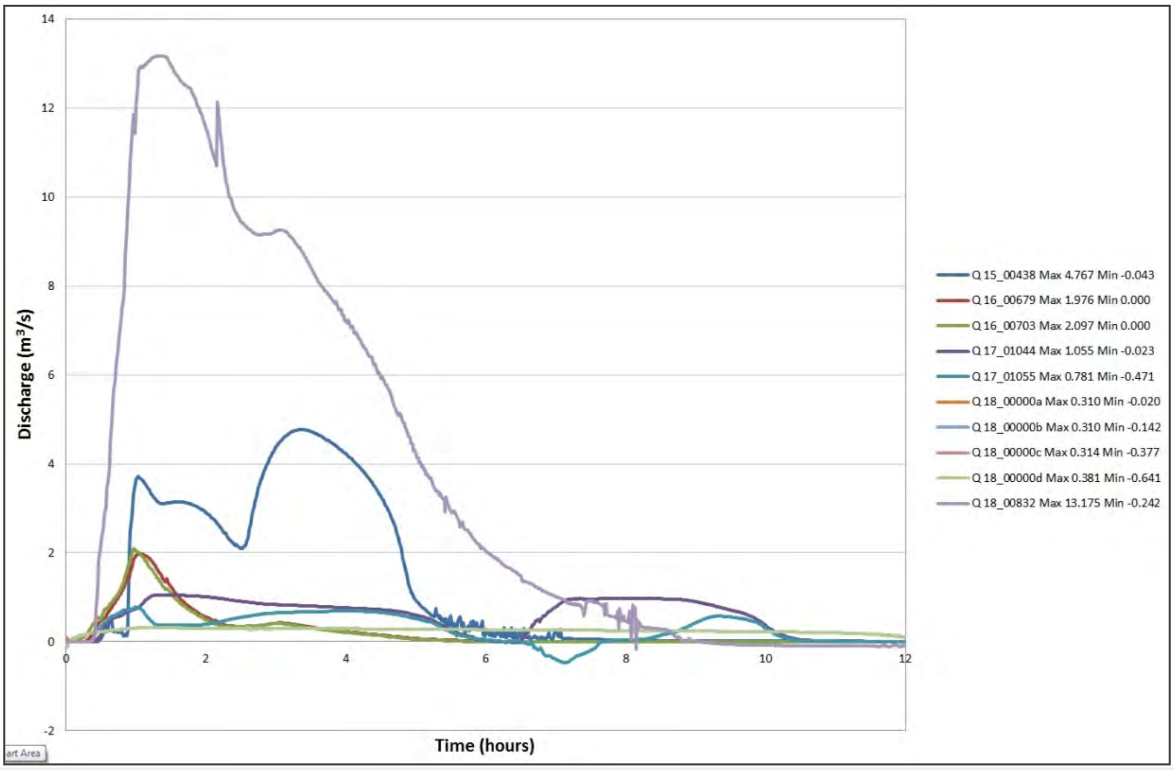

PUM Culvert Discharge Results



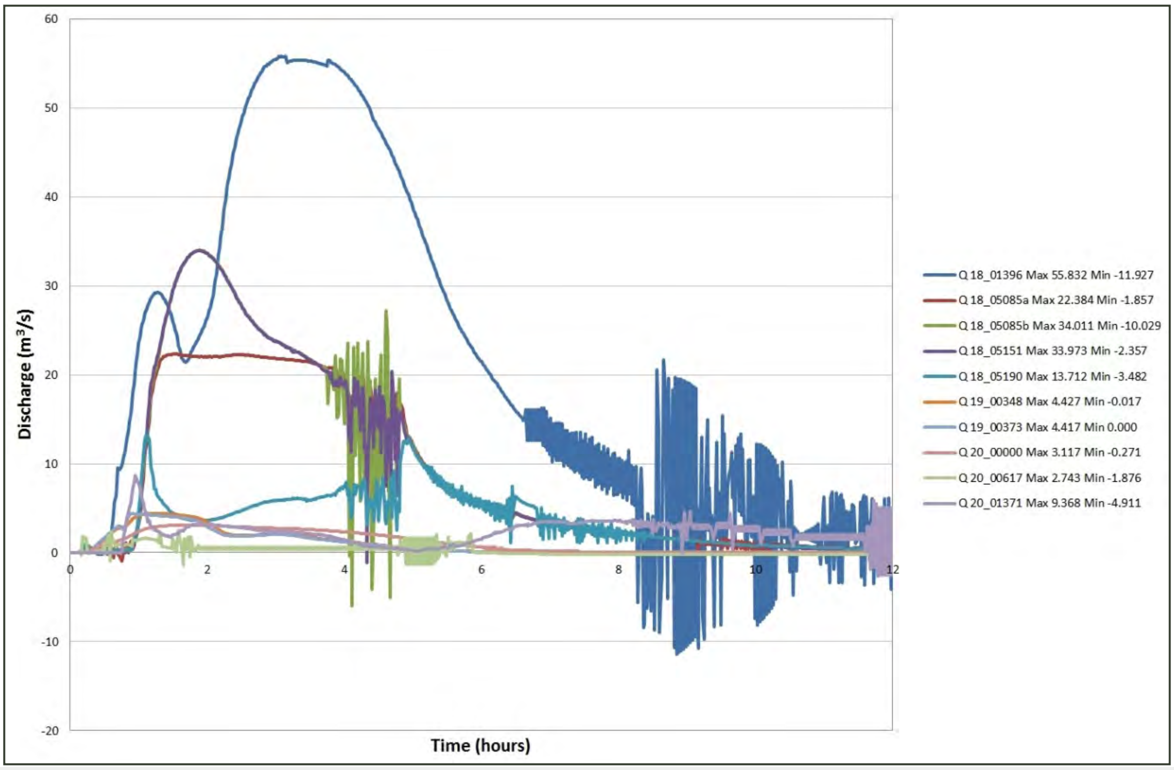

PUM Culvert Discharge Results



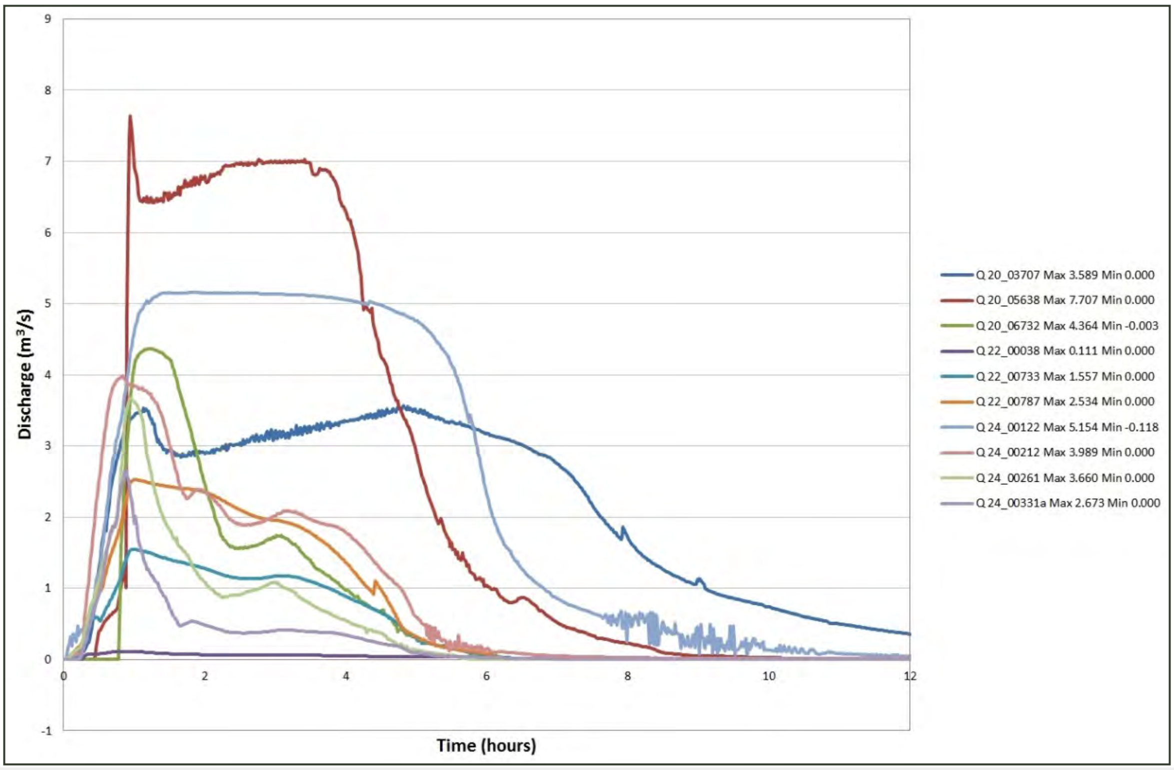

**PUM Culvert Discharge Results**



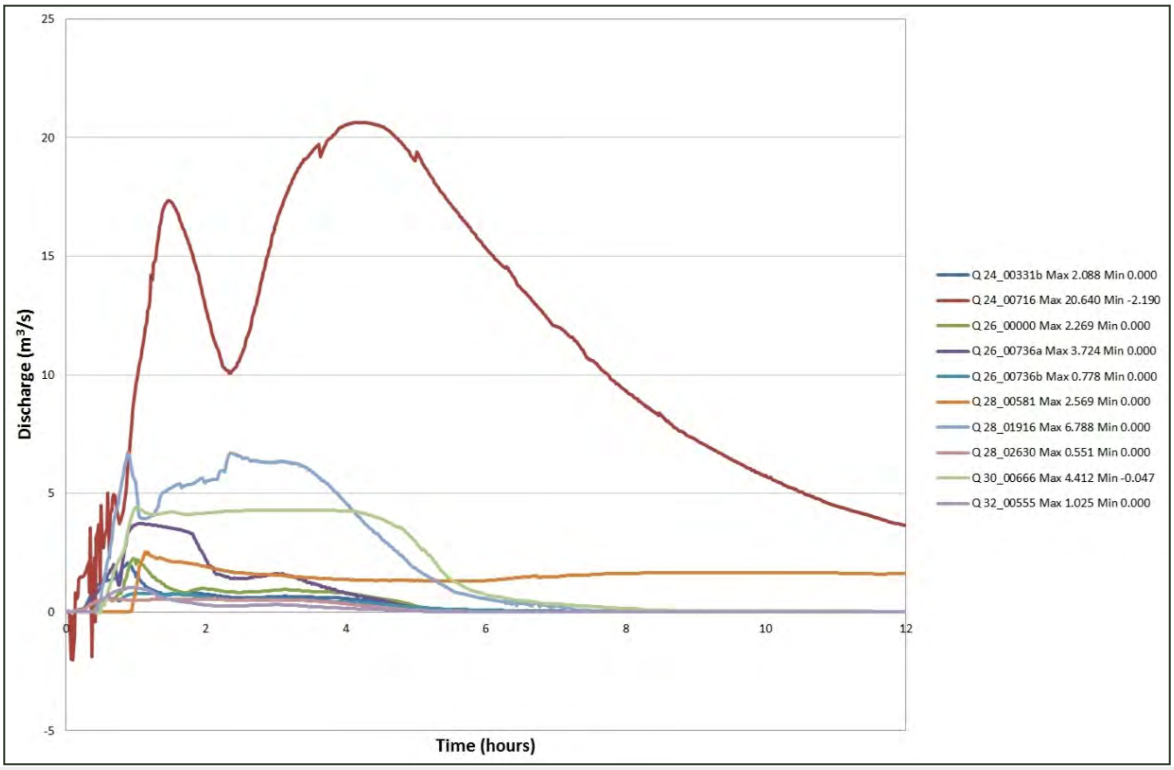

**PUM Culvert Discharge Results**



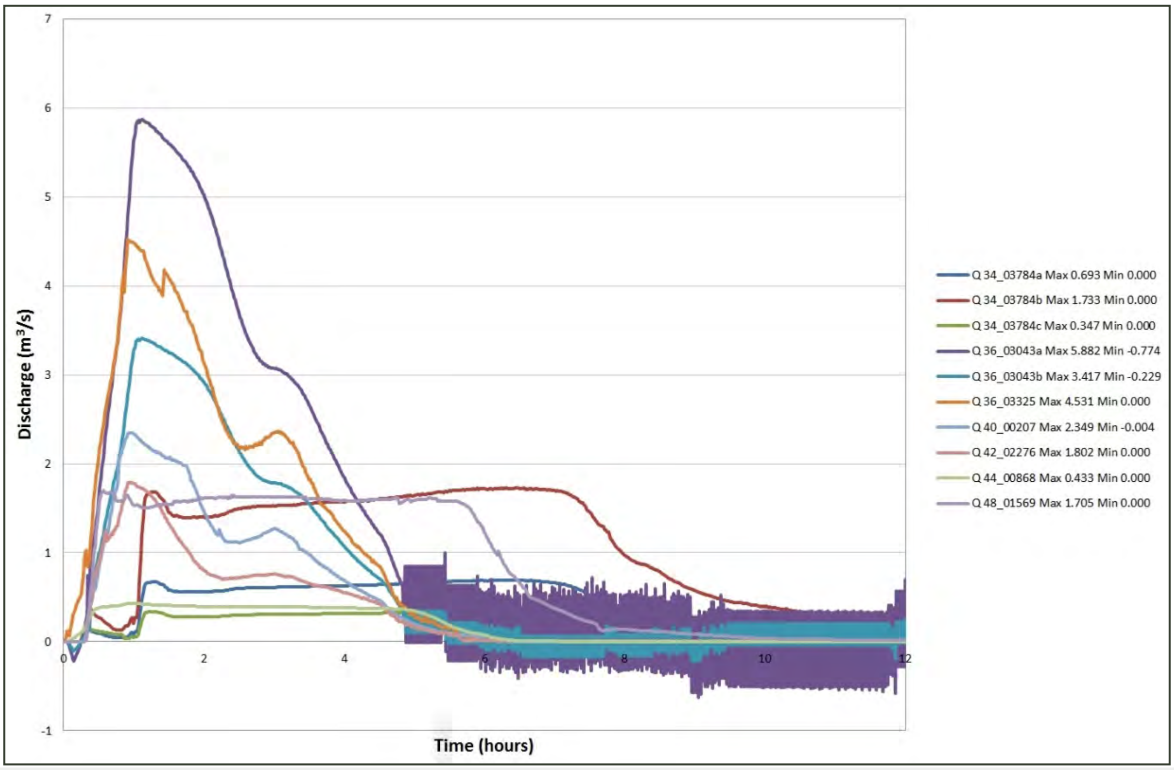

**PUM Culvert Discharge Results**



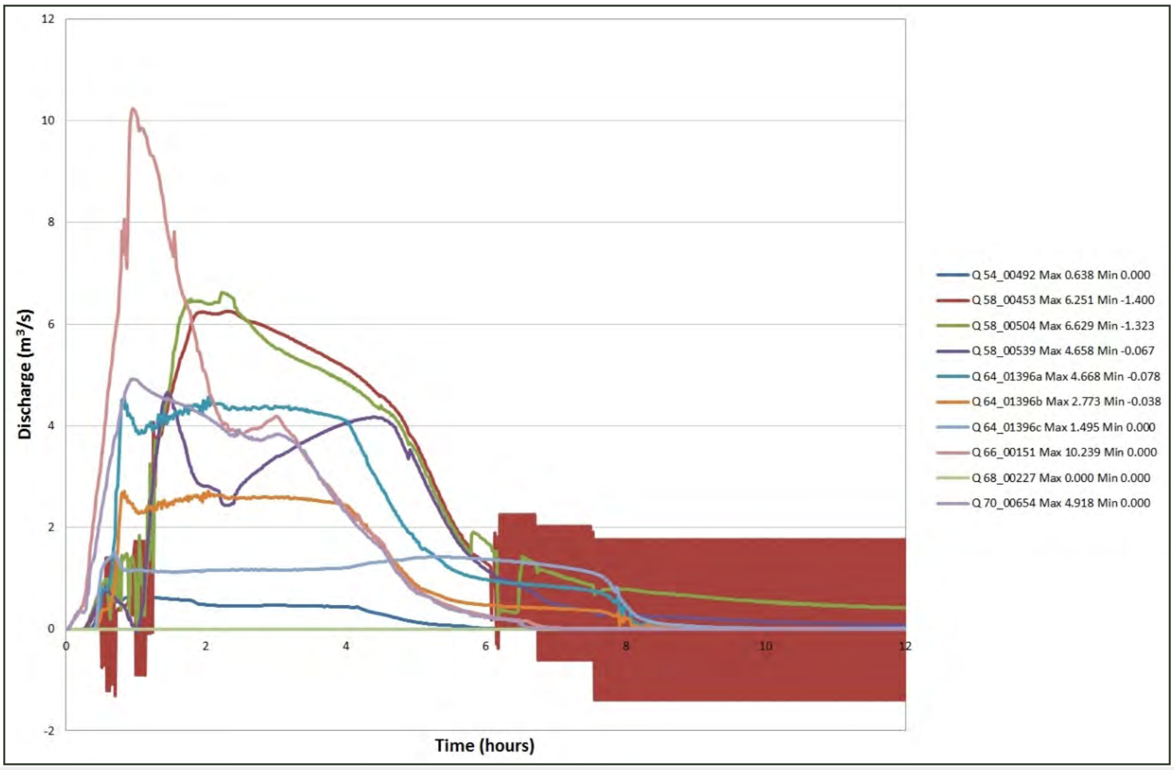

**PUM Culvert Discharge Results**




PUM Culvert Discharge Results




PUM Culvert Discharge Results




**PUM Culvert Discharge Results**

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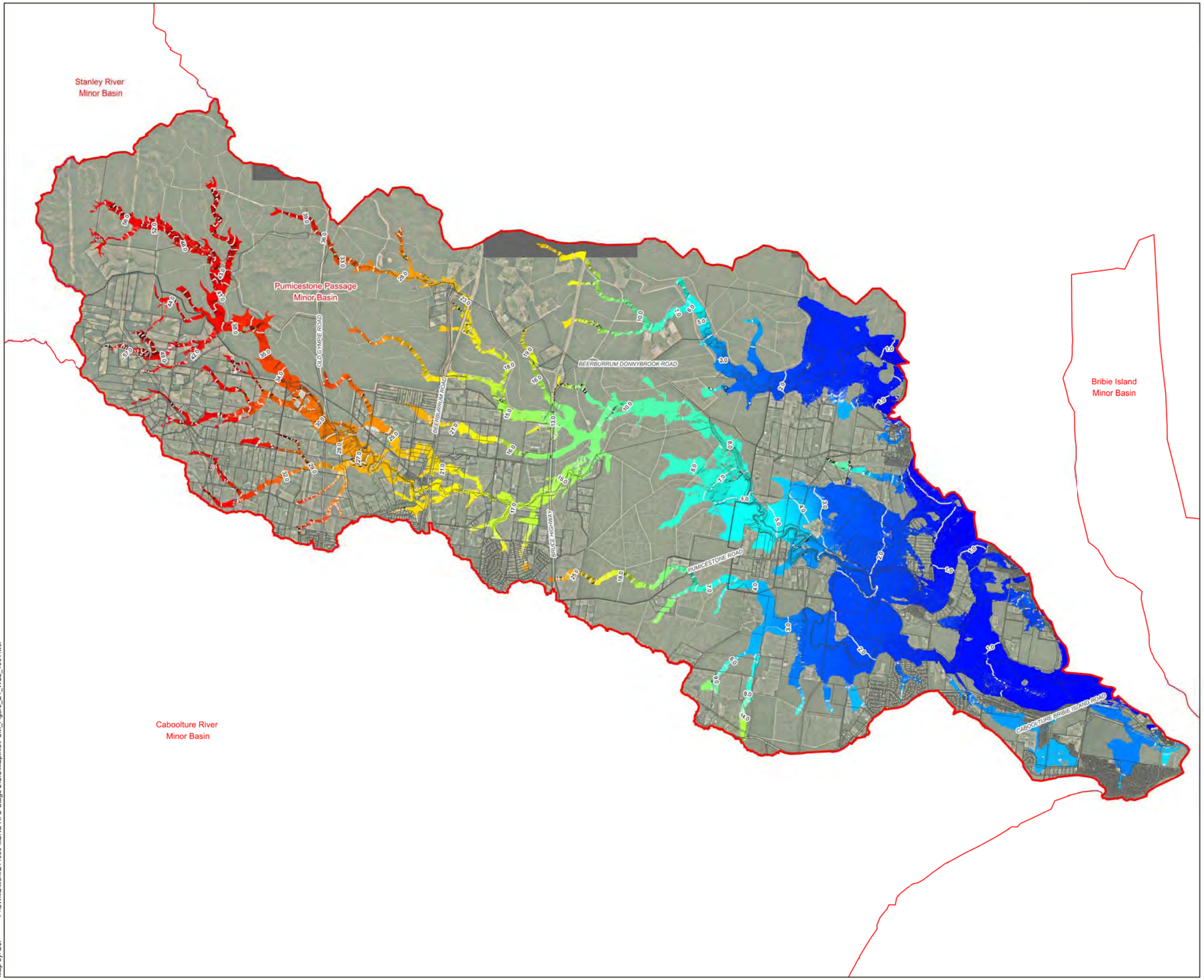
# Appendix E
# Flood Maps – 100 Year ARI

# Appendix E
# Flood Maps – 100 Year ARI

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## Legend

- Cadastre
- Minor Basin Boundaries
- Contour Lines (m AHD)

100 Year ARI Peak Floood level (m AHD)

- >40.0
- 30.0
- 20.0
- 5.0
- 0.0

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

**Date: 31/05/2012** **Version: 0**

Map by: DJF P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\PUM_Figure_E1_WSL_100Y.wor

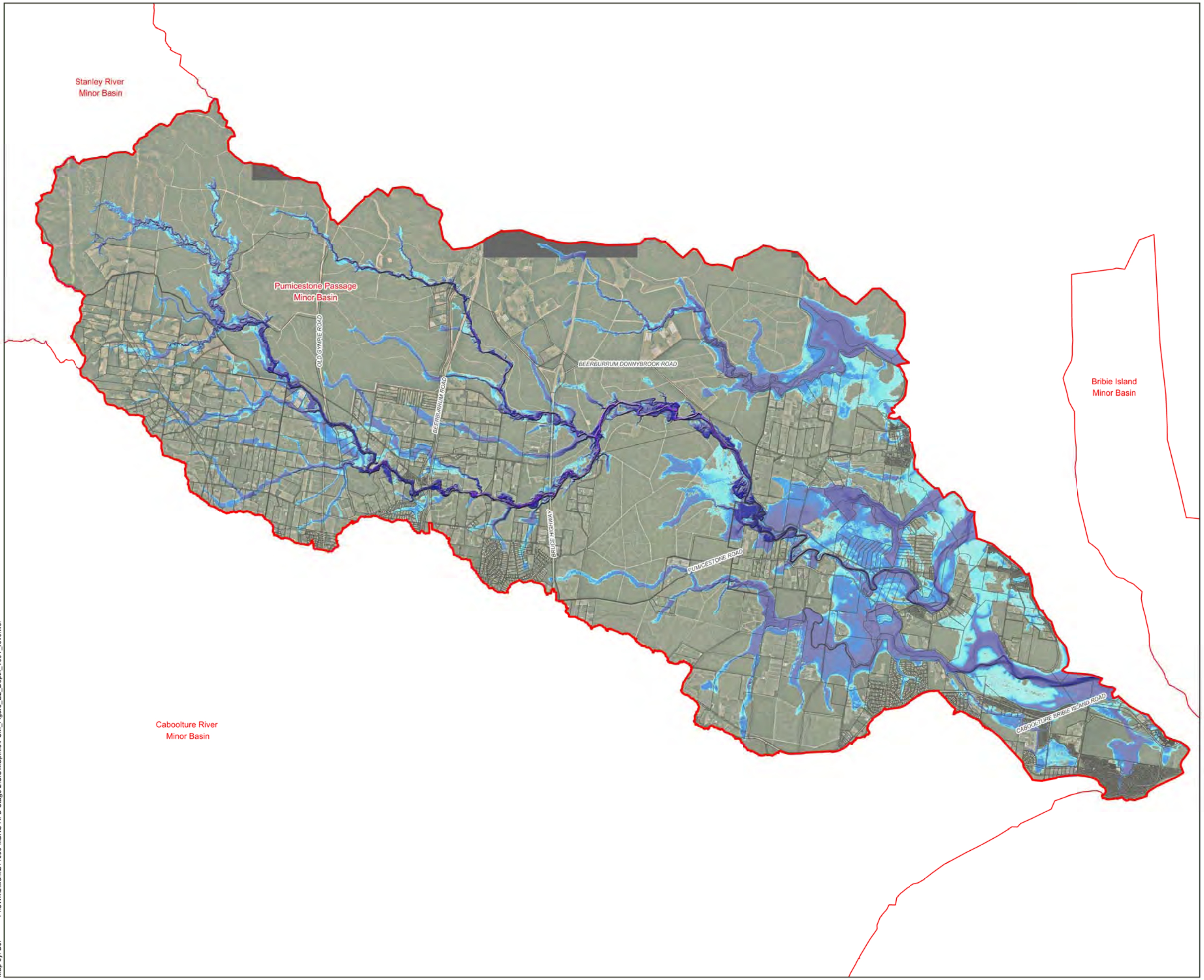
A3 scale 1:100,000

0 2,500 m 5,000 m

Projection: MGA Zone 56

**RFD Detailed Modelling (PUM)**

**Figure E1: Peak Flood Level Map 100 Year ARI**




Map by: DJF P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\PUM_Figure_E2_Depth_100Y_rev0.wor

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## Legend

Cadastre

Minor Basin Boundaries

100 Year ARI Peak Flood Depth (m)

>4.0

3.0

2.0

1.0

0.0

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

**Date: 31/05/2012** **Version: 0**

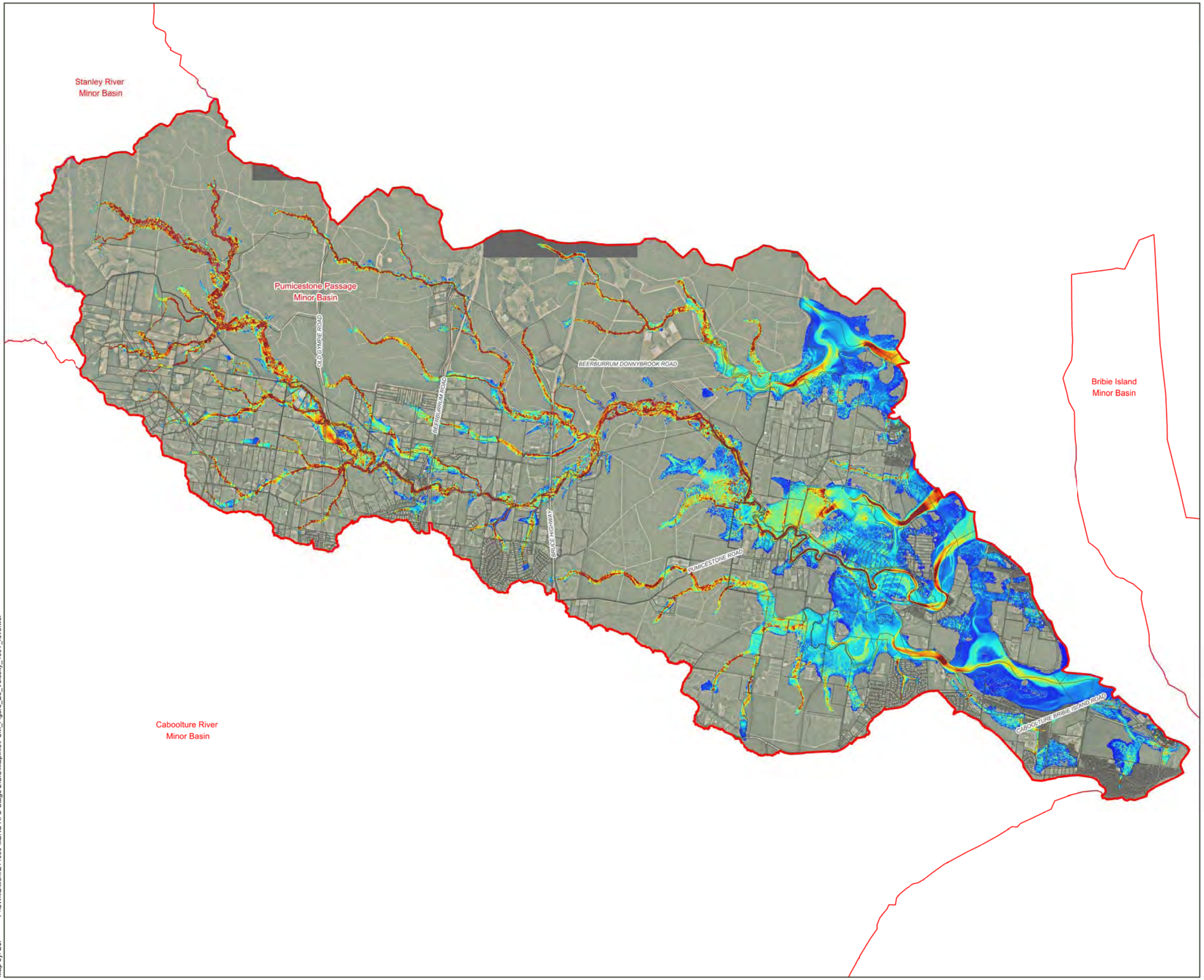
A3 scale 1:100,000

0 2,500 m 5,000 m

Projection: MGA Zone 56

**RFD Detailed Modelling (PUM)**

**Figure E2: Peak Flood Depth Map**
**100 Year ARI**

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## Legend

Cadastre

Minor Basin Boundaries

100 Year ARI Peak Flood Velocity (m/s)

>6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

**Date: 31/05/2012** **Version: 0**

Map by: DJF P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\PUM_Figure_E3_Velocity_100Y_rev0.wor

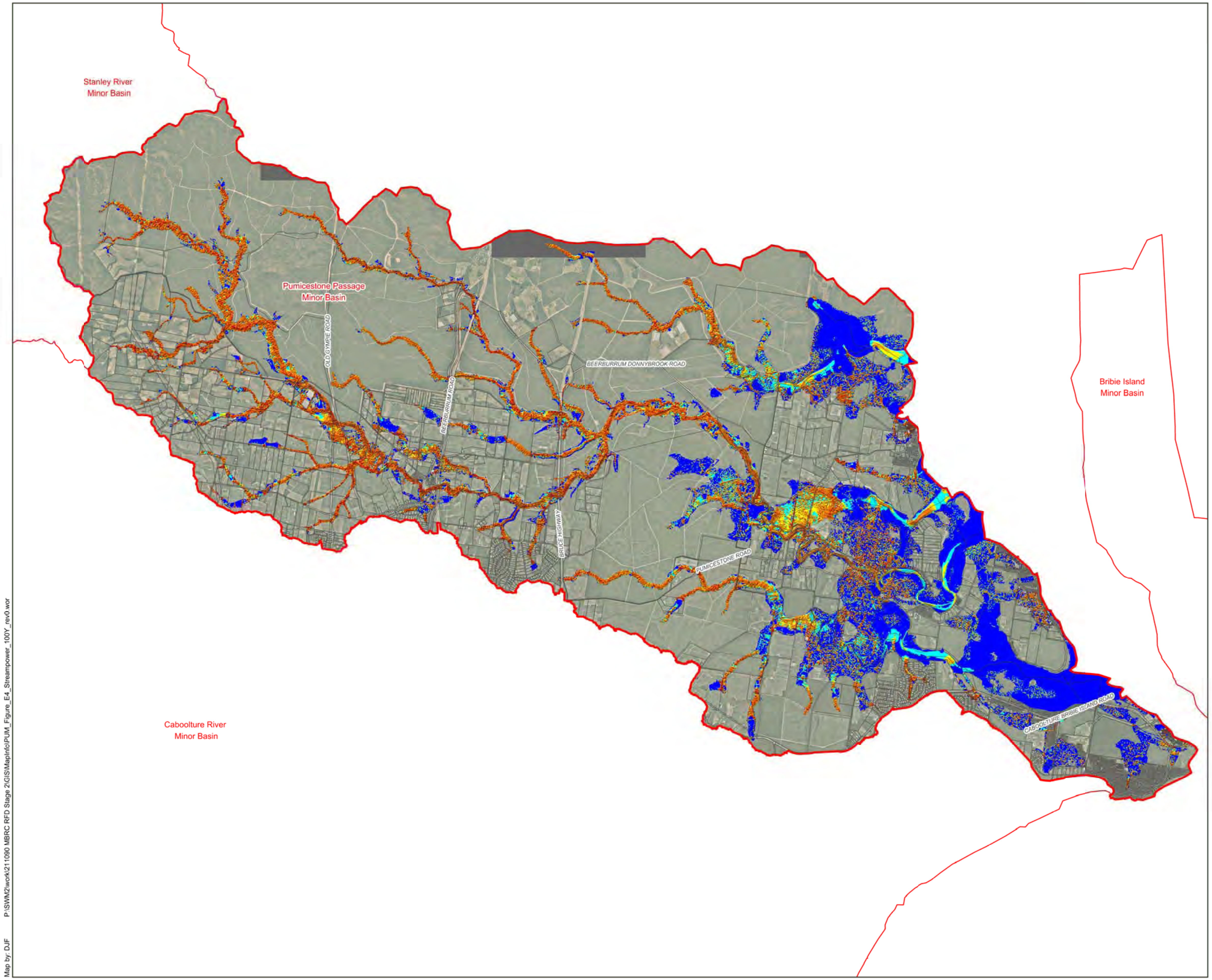
A3 scale 1:100,000

0 2,500 m 5,000 m

Projection: MGA Zone 56

## RFD Detailed Modelling (PUM)

**Figure E3: Peak Flood Velocity Map 100 Year ARI**




aurecon

## Legend

Cadastre

Minor Basin Boundaries

100 Year ARI Peak Stream Power

>500

10

5

3

0

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

**Date: 31/05/2012** **Version: 0**

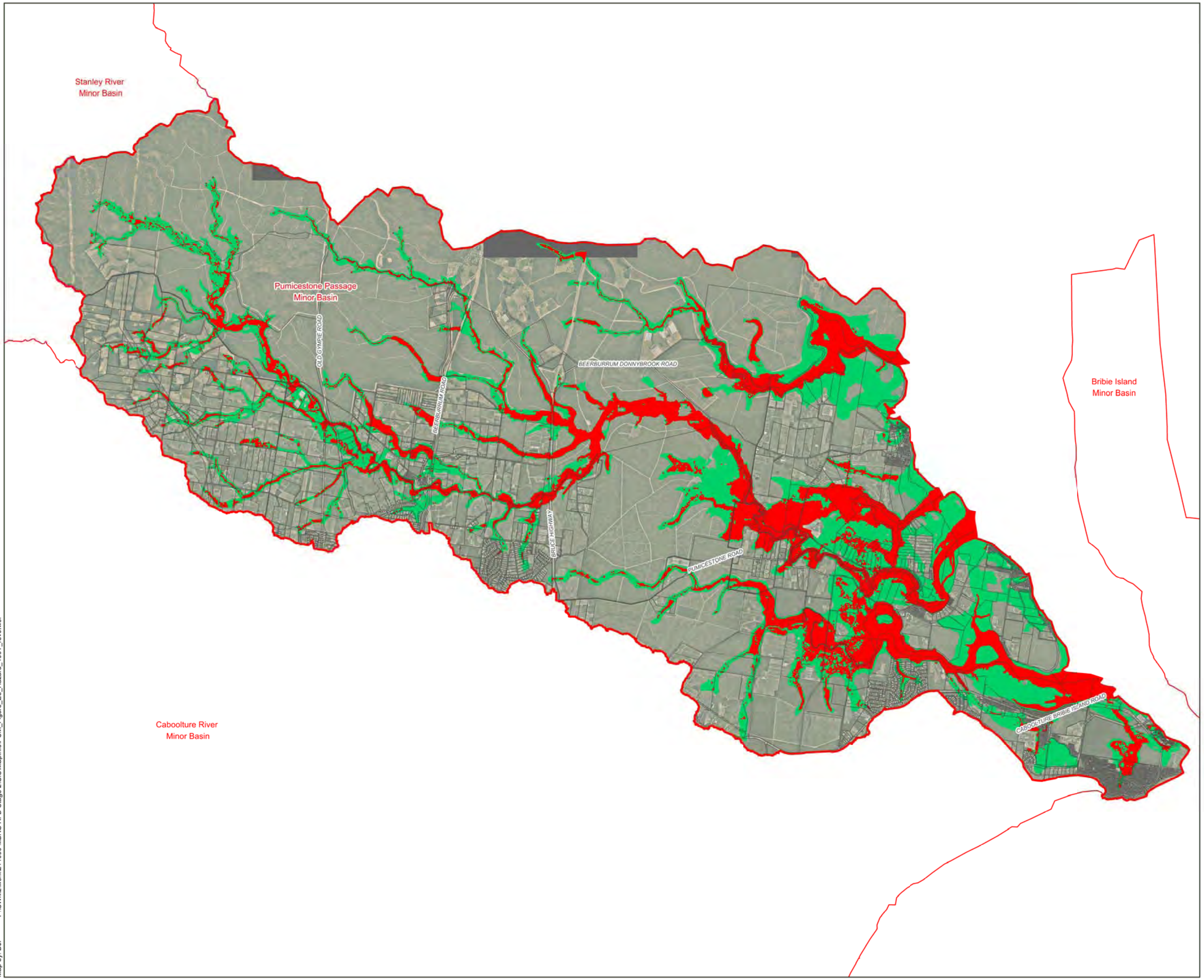
A3 scale 1:100,000

0 2,500 m 5,000 m

Projection: MGA Zone 56

**RFD Detailed Modelling (PUM)**

**Figure E4: Peak Flood Stream Power Map**
**100 Year ARI**

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## Legend

- Cadastre
- Minor Basin Boundaries

New South Wales Floodplain Development Manual Flood Hazard Category
100 Year ARI Event

- Low Hazard
- High Hazard

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

**Date: 31/05/2012** **Version: 0**

Map by: DJF P:\SWN2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\PUM_Figure_E5_Hazard_100Y_rev0.wor

A3 scale 1:100,000

0 2,500 m 5,000 m

Projection: MGA Zone 56

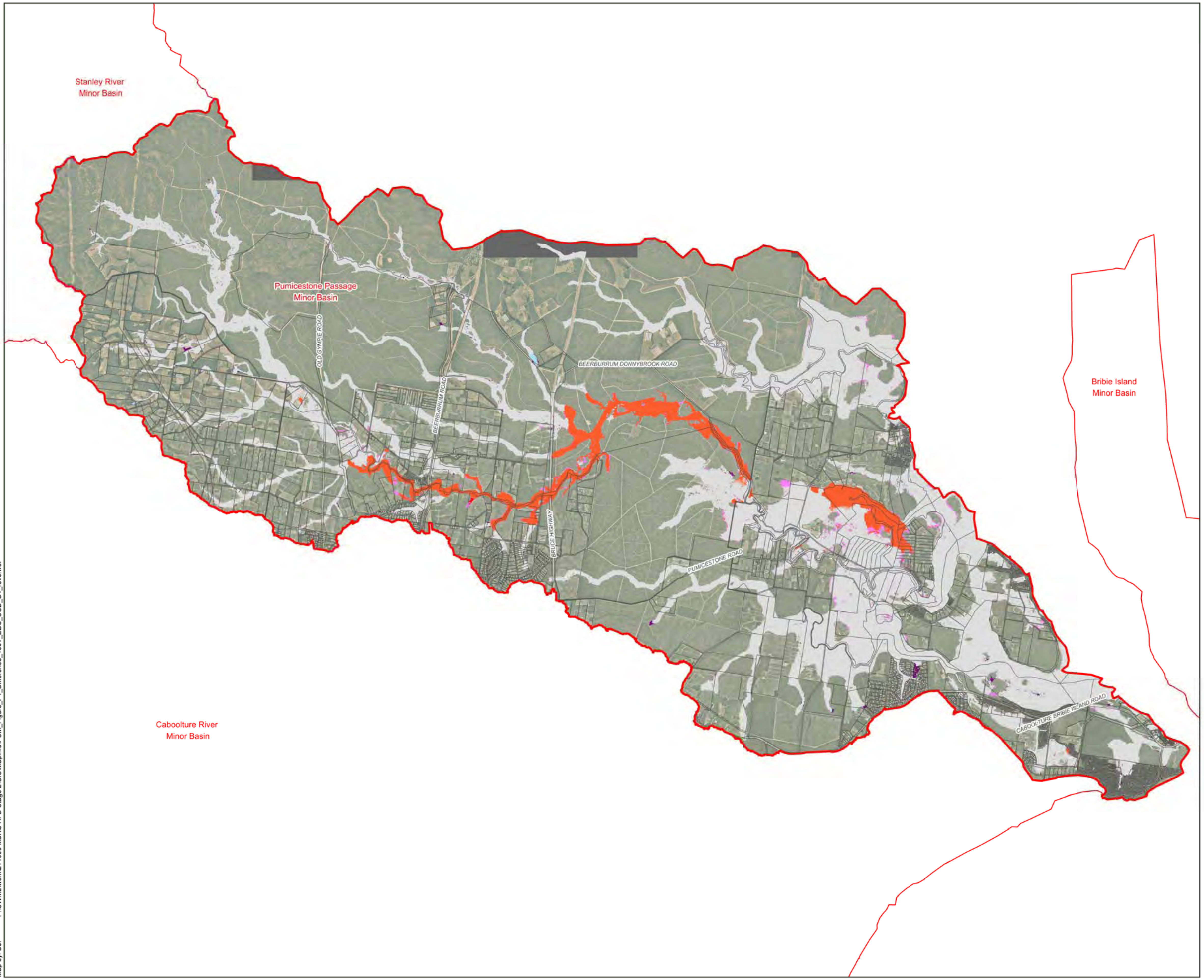
**RFD Detailed Modelling (PUM)**

**Figure E5: Peak Flood Hazard Map**
**100 Year ARI**

# Appendix F
# Model Sensitivity Analysis Maps

# Appendix F
# Model Sensitivity Analysis Maps

aurecon




Map by: DJF

P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\PUM_Figure_F1_Difference_100Y_EDS_SCD_S1_rev0.wor

**Legend**

- Cadastre
- Minor Basin Boundaries

Peak Flood Level Difference (m)

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows selected critical durations peak water level minus EDS peak water level

Date: 31/05/2012 Version: 0

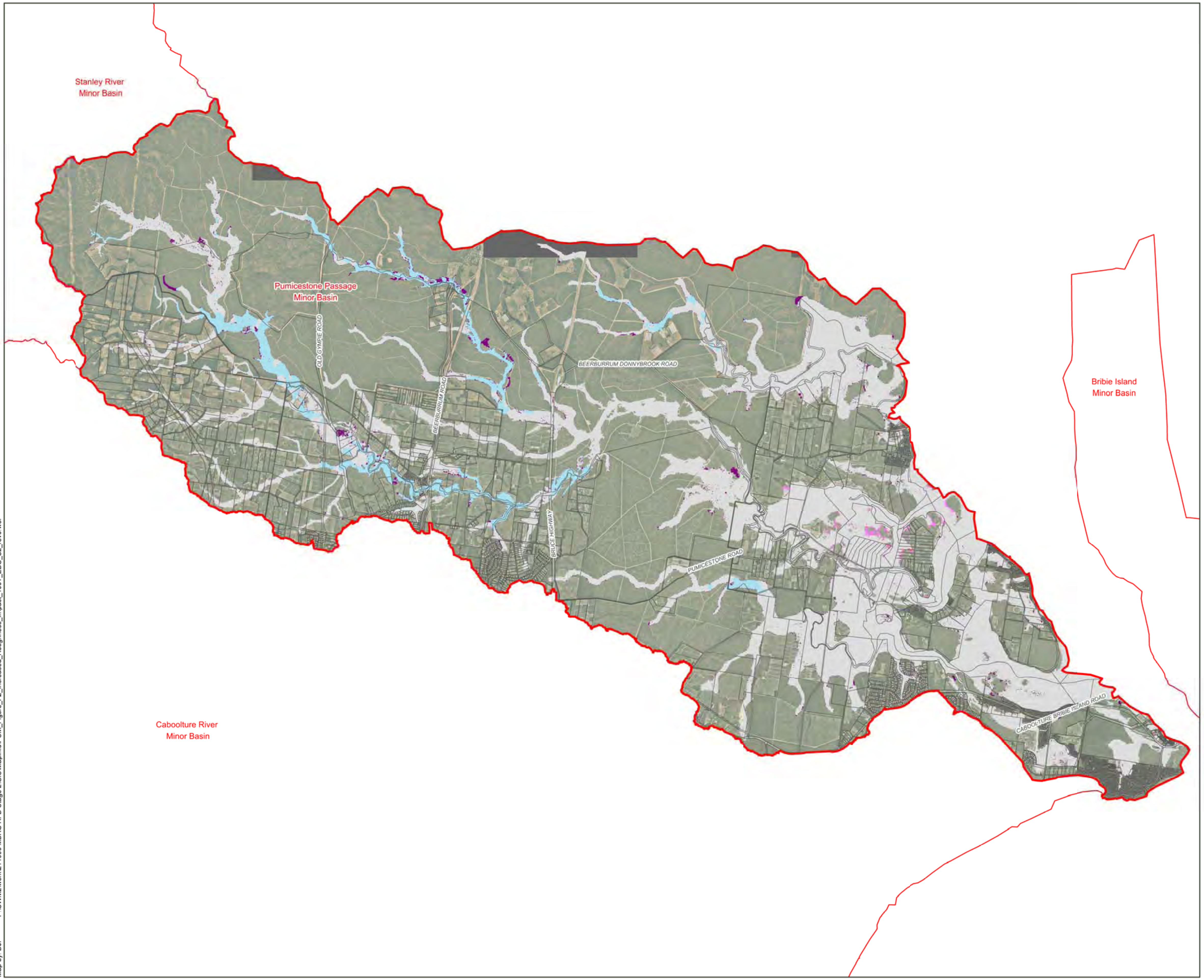
A3 scale 1:100,000

0 2,500 m 5,000 m

Projection: MGA Zone 56

**RFD Detailed Modelling (PUM)**

**Figure F1: Flood Level Difference between EDS and Selected Critical Storm Durations 100 Year ARI (S1)**




aurecon

## Legend

Cadastre

Minor Basin Boundaries

Peak Flood Level Difference (m)

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows increase in roughness peak water level minus EDS peak water level

Date: 31/05/2012 Version: 0

Map by: DJF P:\SWM2\work\21090 MBRC RFD Stage 2\GIS\MapInfo\PUM_Figure_F2_Increased_Roughness_Impact_100Y_EDS_S2_rev0.wor

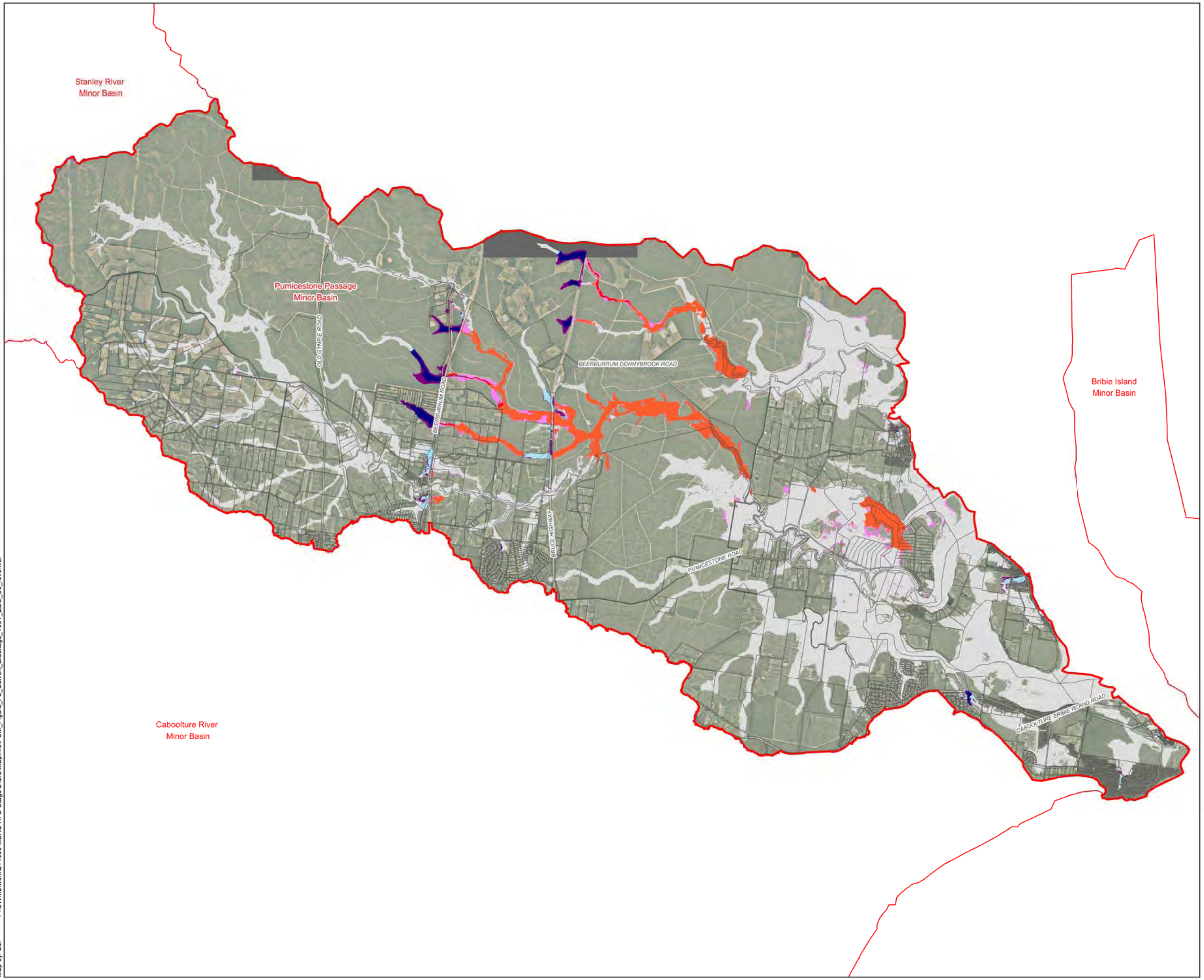
A3 scale 1:100,000

0 2,500 m 5,000 m

Projection: MGA Zone 56

**RFD Detailed Modelling (PUM)**

**Figure F2: Increase in Roughness Flood Level Impact 100 Year EDS (S2)**




Map by: DJF    P:\SWM2\work\21090 MBRC RFD Stage 2\GIS\MapInfo\PUM_Figure_F3_Culvert_Blockage_100Y_EDS_S3_rev0.wor

aurecon

## Legend

- Cadastre
- Minor Basin Boundaries

**Peak Flood Level Difference (m)**

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows structure blockage peak water level minus EDS peak water level

**Date: 31/05/2012**    **Version: 0**

A3 scale 1:100,000

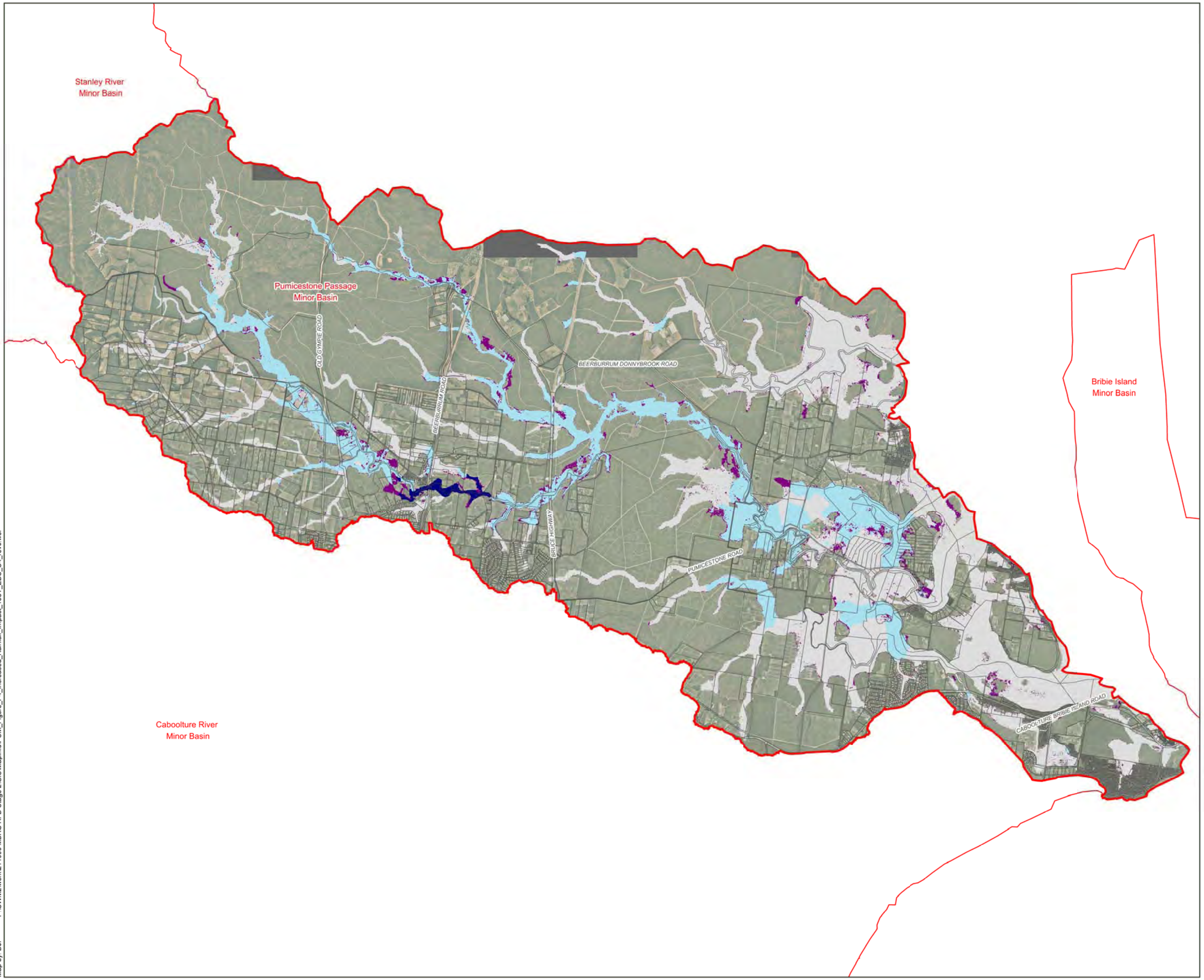
0    2,500 m    5,000 m

Projection: MGA Zone 56

**RFD Detailed Modelling (PUM)**

**Figure F3: Structure Blockage Flood Level Impact 100 Year EDS (S3)**

aurecon




Map by: DJF    P:\SWM2\work\21090 MBRC RFD Stage 2\GIS\MapInfo\PUM_Figure_F4_Increased_Rainfall_Impact_100Y_EDS_S4_rev0.wor

## Legend

- Cadastre
- Minor Basin Boundaries

**Peak Flood Level Difference (m)**

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

**Notes:**

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This figure shows increase in rainfall peak water level minus EDS peak water level

Date: 31/05/2012    Version: 0

A3 scale 1:100,000

0    2,500 m    5,000 m

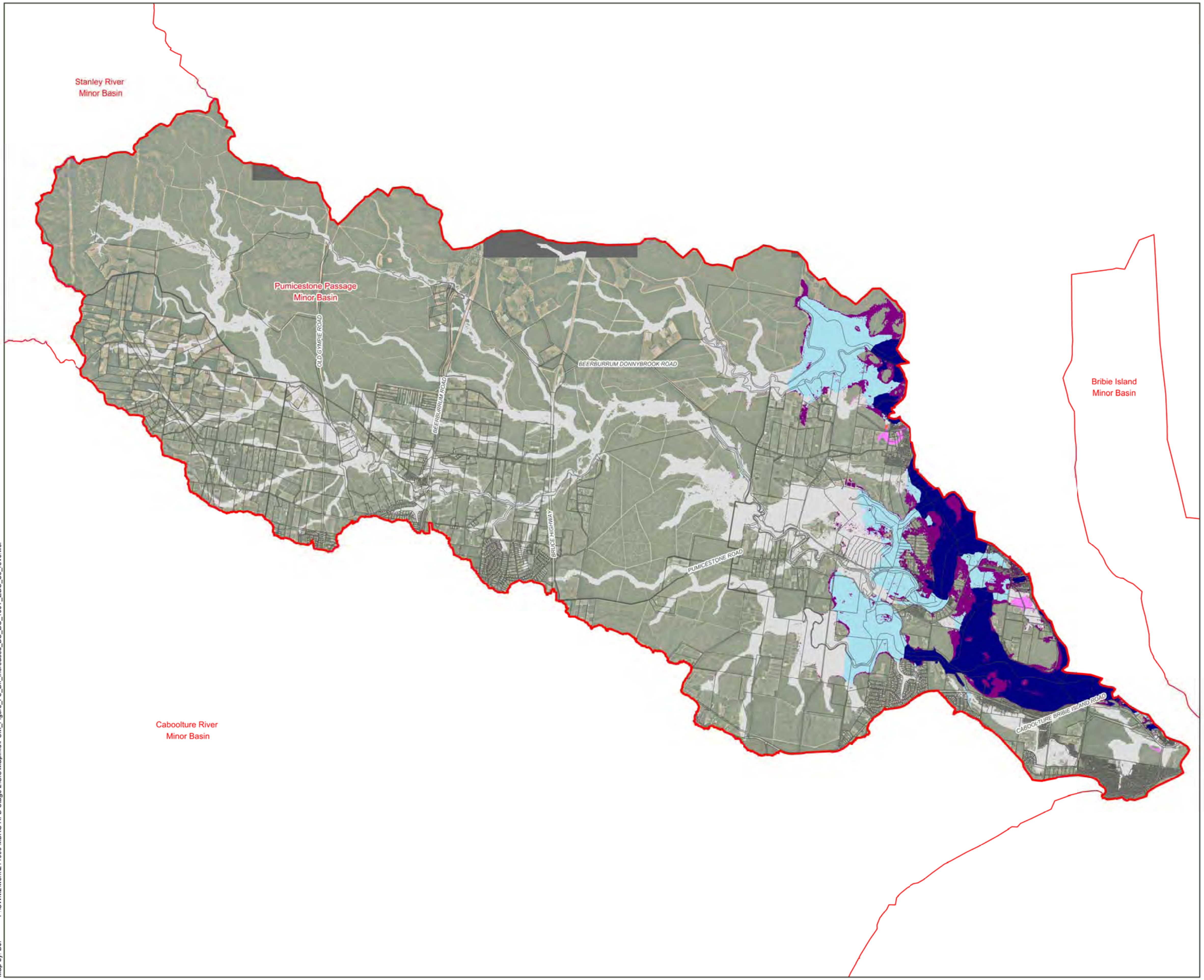
Projection: MGA Zone 56

**RFD Detailed Modelling (PUM)**

**Figure F4: Increase in Rainfall Flood Level Impact 100 Year EDS (S4)**

Map by: DJF

P:\SWM2\work\21090 MBRC RFD Stage 2\GIS\MapInfo\PUM_Figure_F5_Dif_Increased_DS_BC_100Y_EDS_S5_rev0.wor




aurecon

## Legend

- Cadastre
- Minor Basin Boundaries

**Peak Flood Level Difference (m)**

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows increase in downstream boundary peak water level minus EDS peak water level

**Date: 31/05/2012** **Version: 0**

A3 scale 1:100,000

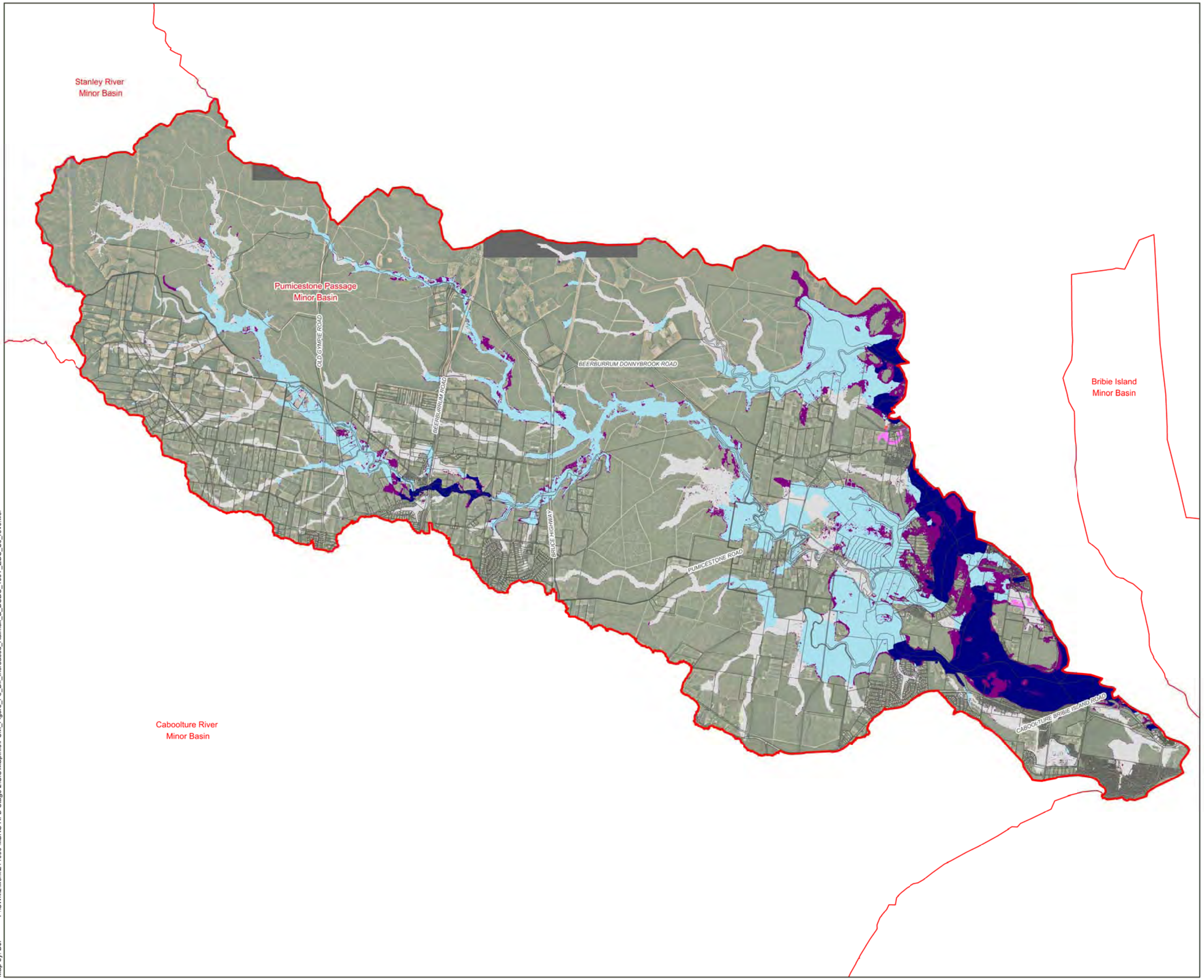
0 2,500 m 5,000 m

Projection: MGA Zone 56

**RFD Detailed Modelling (PUM)**

**Figure F5: Increase in Downstream Boundary Flood Level Impact 100 Year EDS (S5)**

aurecon




## Legend

- Cadastre
- Minor Basin Boundaries

Peak Flood Level Difference (m)

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows increase in rainfall & downstream boundary peak water level minus EDS peak water level

Date: 31/05/2012 Version: 0

Map by: DJF P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\PUM_Figure_F6_Dif_Increased_Rainfall_&_DSBC_100Y_EDS_S6_rev0.wor

A3 scale 1:100,000

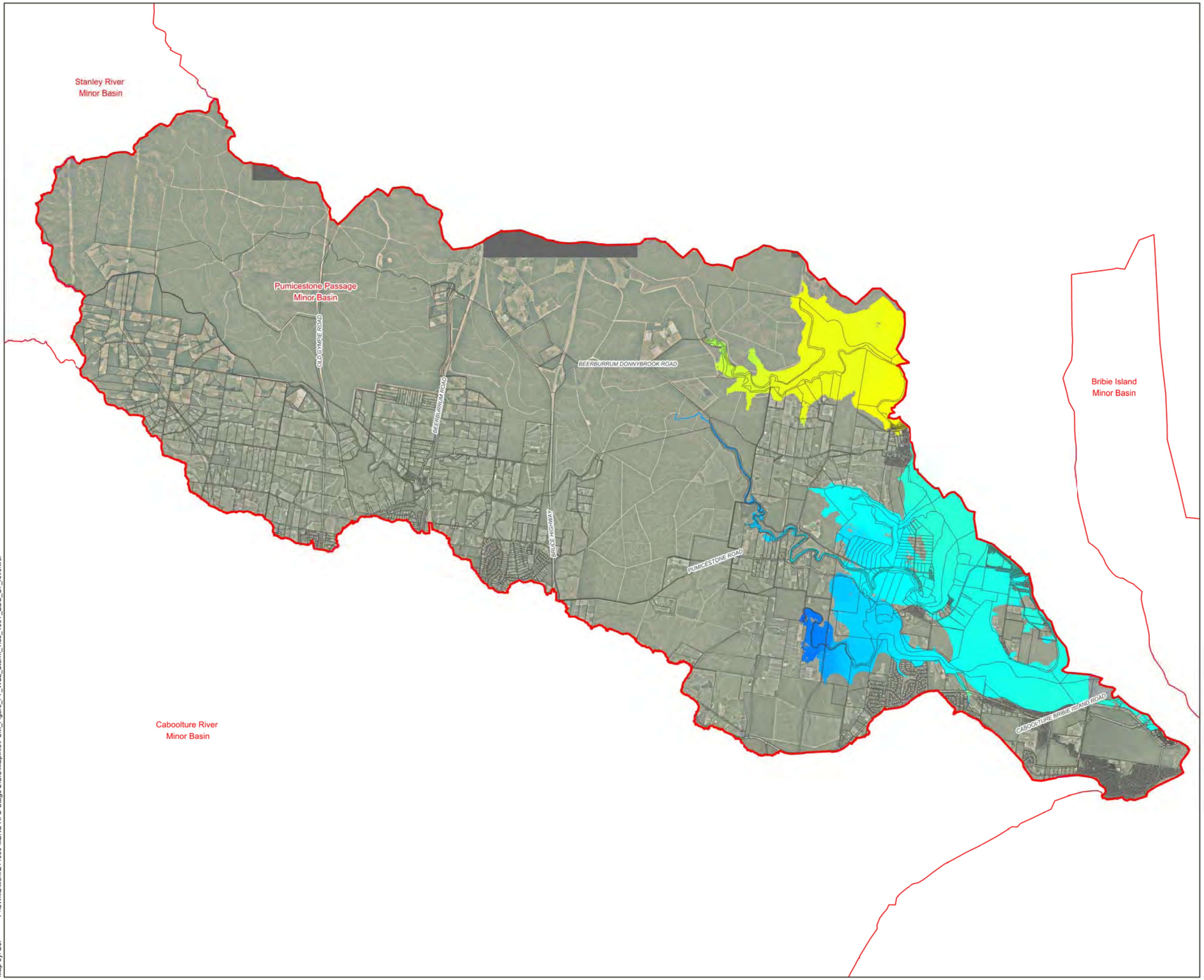
0 2,500 m 5,000 m

Projection: MGA Zone 56

**RFD Detailed Modelling (PUM)**

**Figure F6: Increase in Rainfall & Downstream Boundary Flood Level Impact 100 Year EDS (S6)**

aurecon




## Legend

Cadastre

Minor Basin Boundaries

Flood Level (m AHD)

>5.0
4.0
3.0
2.0
<1.0

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

Date: 31/05/2012 Version: 0

Map by: DJF

P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\PUM_Figure_F7_WSL_Storm_Tide_100Y_EDS_S7_rev0.wor

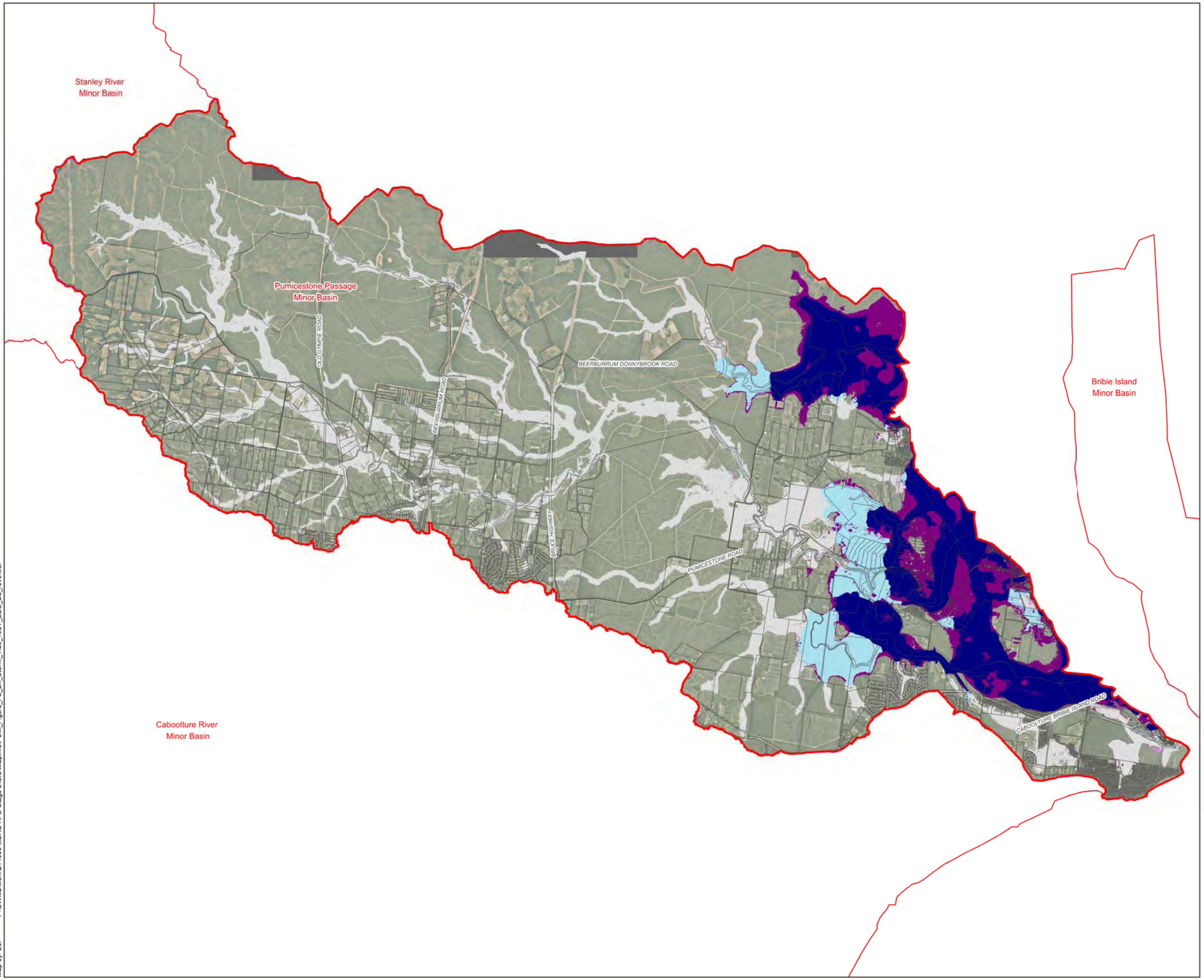
A3 scale 1:100,000

0 2,500 m 5,000 m

Projection: MGA Zone 56

**RFD Detailed Modelling (PUM)**

**Figure F7: Dynamic Storm Tide Peak Flood Level 100 Year ARI (S7)**




aurecon

## Legend

Cadastre

Minor Basin Boundaries

Peak Flood Level Difference (m)

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows static storm tide peak water level minus EDS peak water level

**Date:** 31/05/2012 **Version:** 0

Map by: DJF P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\PUM_Figure_F8_Dif_Storm_Tide_100Y_EDS_S8_rev0.wor

A3 scale 1:100,000

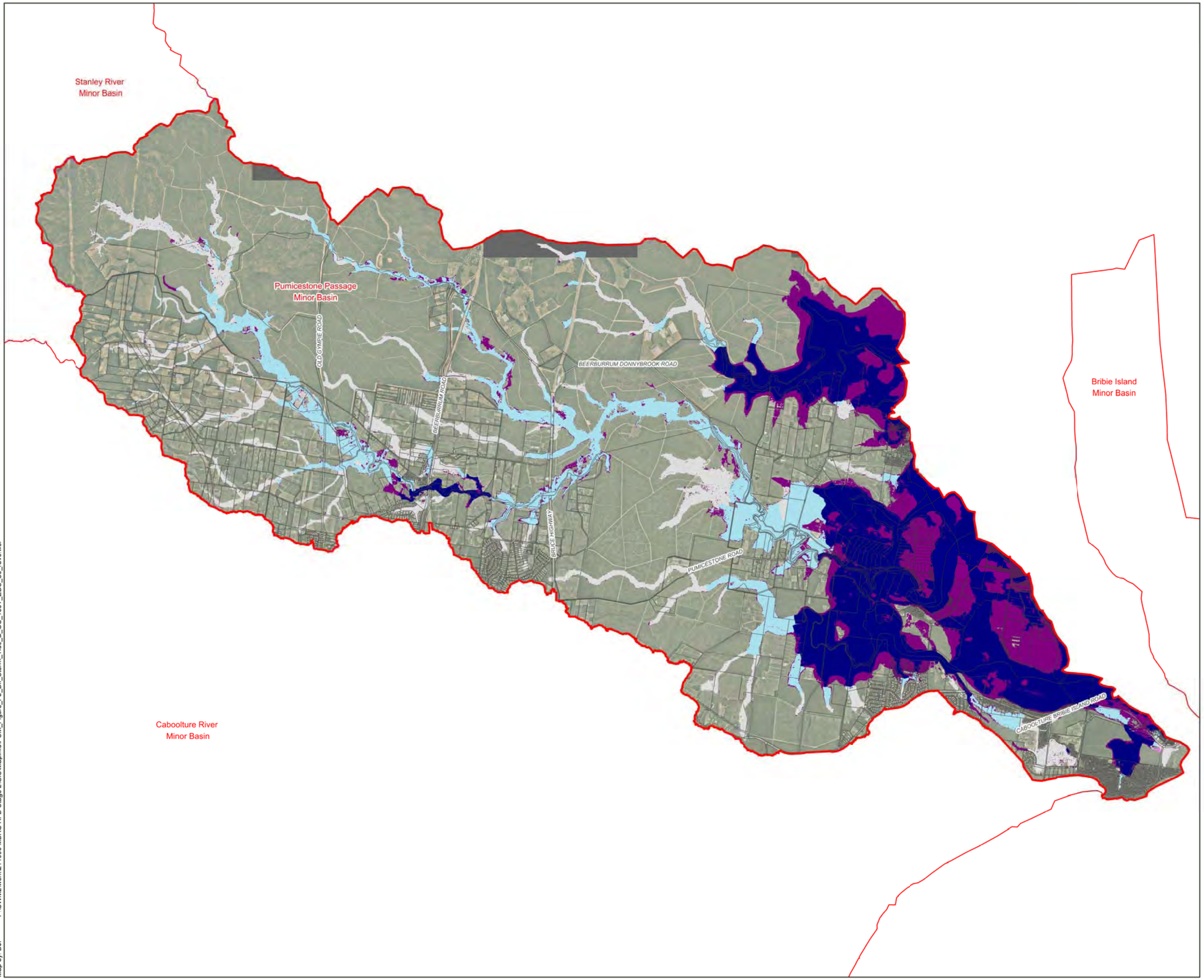
0 2,500 m 5,000 m

Projection: MGA Zone 56

**RFD Detailed Modelling (PUM)**

**Figure F8: Static Storm Tide Level Flood Level Impact - 100 Year EDS (S8)**

aurecon




## Legend

- Cadastre
- Minor Basin Boundaries

**Peak Flood Level Difference (m)**

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows static storm tide and climate change peak water level minus EDS peak water level

Date: 31/05/2012 Version: 0

Map by: DJF P:\SWM2\work\21090 MBRC RFD Stage 2\GIS\MapInfo\PUM_Figure_F9_Dif_Storm_Tide_&_CC_100Y_EDS_S9_rev0.wor

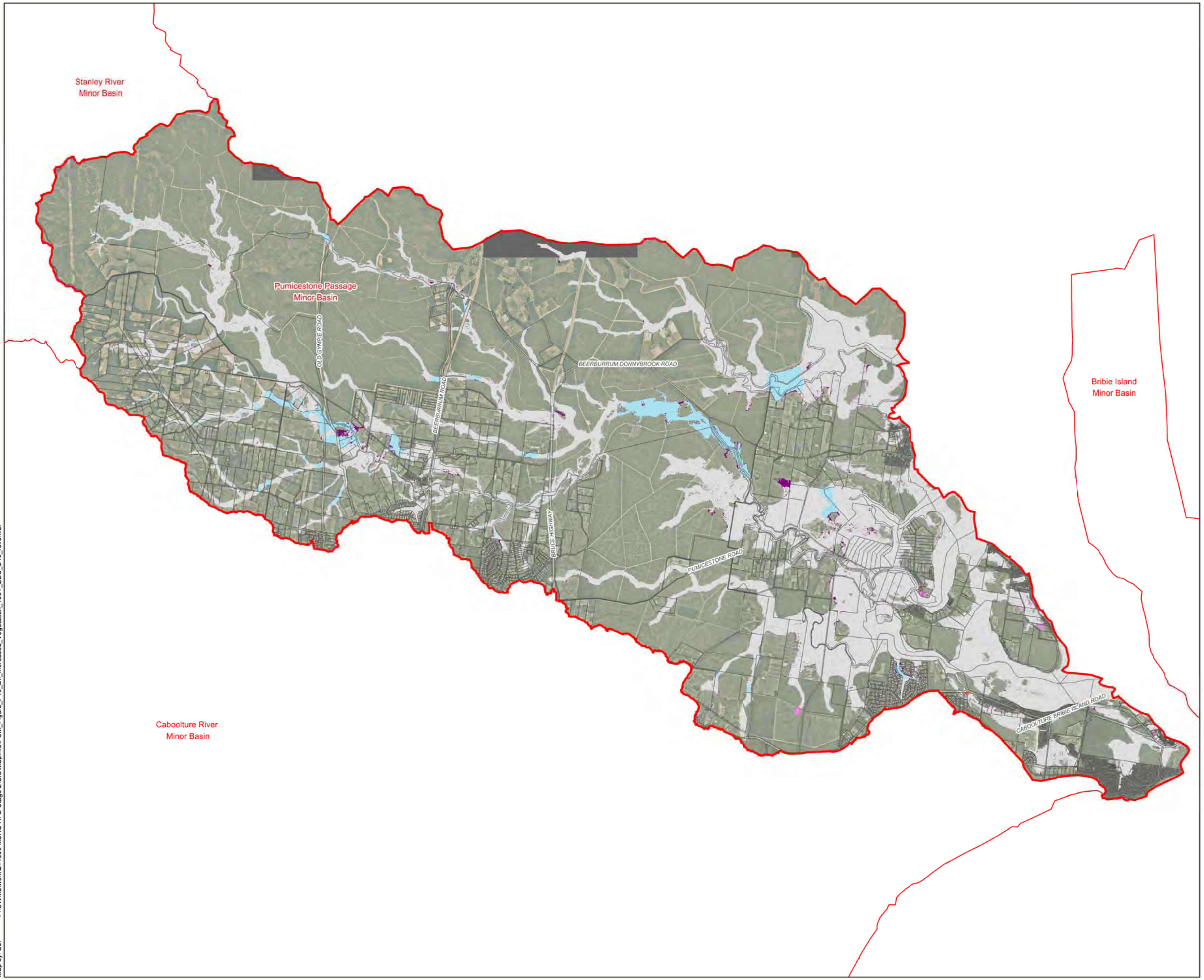
A3 scale 1:100,000

0 2,500 m 5,000 m

Projection: MGA Zone 56

**RFD Detailed Modelling (PUM)**

**Figure F9: Static Storm Tide and Climate Change Flood Level Flood Level Impact 100 Year EDS (S9)**




Map by: DJF

P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\PUM_Figure_F10_Dif_Increased_Vegetation_100Y_EDS_S10_rev0.wor

aurecon

## Legend

- Cadastre
- Minor Basin Boundaries

**Peak Flood Level Difference (m)**

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows increase in vegetation peak water level minus EDS peak water level

Date: 31/05/2012 Version: 0

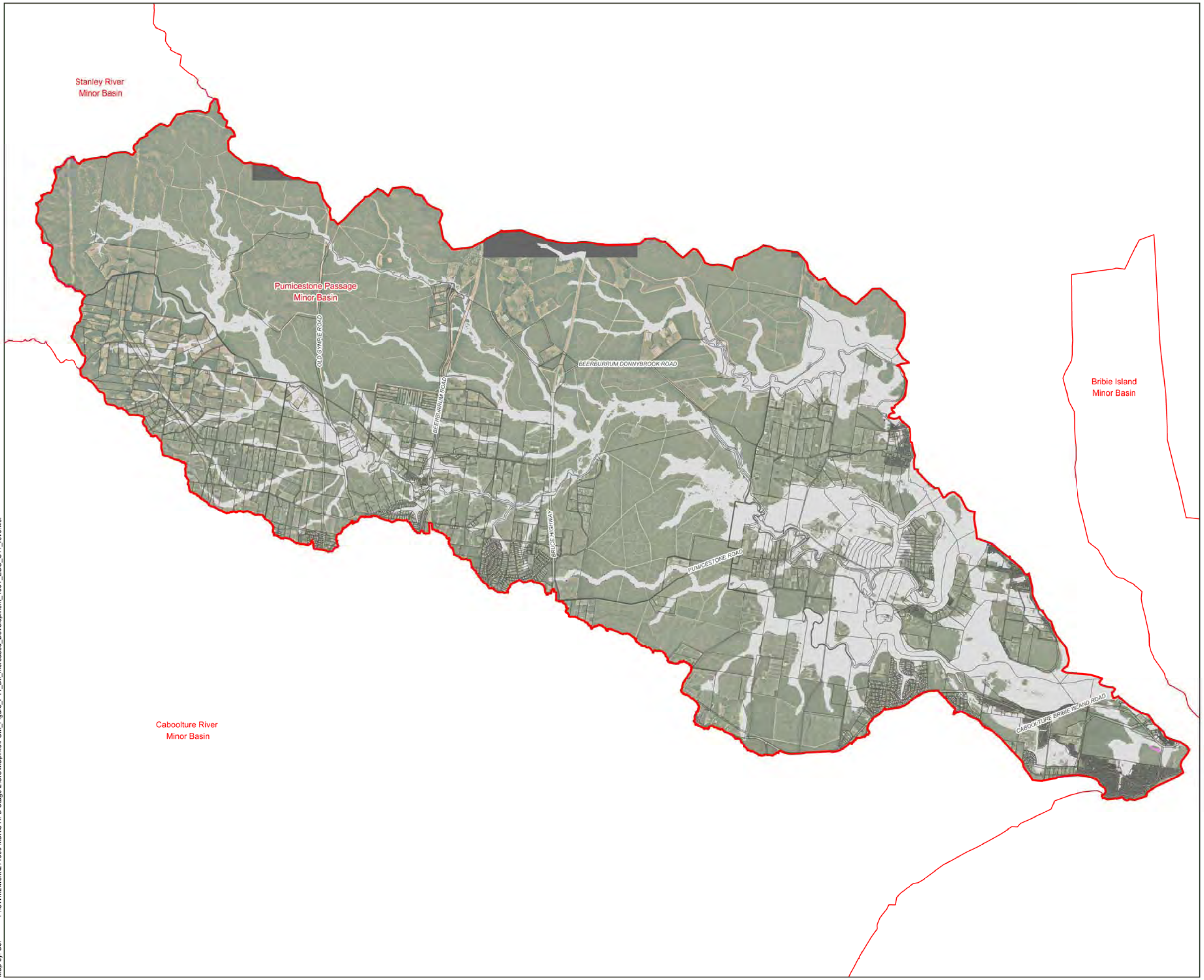
A3 scale 1:100,000

0 2,500 m 5,000 m

Projection: MGA Zone 56

**RFD Detailed Modelling (PUM)**

**Figure F10: Increase in Vegetation Flood Level Impact 100 Year EDS (S10)**




aurecon

## Legend

- Cadastre
- Minor Basin Boundaries

Peak Flood Level Difference (m)

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

**Notes:**

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This figure shows increase in residential development peak water level minus EDS peak water level

**Date: 31/05/2012** **Version: 0**

A3 scale 1:100,000

0 2,500 m 5,000 m

Projection: MGA Zone 56

**RFD Detailed Modelling (PUM)**

**Figure F11: Increase in Residential Development Flood Level Impact 100 Year EDS (S11)**


Map by: DJF P:\SWM2\work\21090 MBRC RFD Stage 2\GIS\MapInfo\PUM_Figure_F12_Df_Increased_Development_100Y_EDS_S12_rev0.wor

aurecon

## Legend

- Cadastre
- Minor Basin Boundaries

Peak Flood Level Difference (m)

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows increase in vegetation and residential development peak water level minus EDS peak water level

Date: 31/05/2012 Version: 0

A3 scale 1:100,000

0 2,500 m 5,000 m

Projection: MGA Zone 56

**RFD Detailed Modelling (PUM)**

**Figure F12: Increase in Vegetation and Residential Development Flood Level Impact 100 Year EDS (S12)**

# Appendix G
# Hydrologic Modelling Details

# Appendix G
# Hydrologic Modelling Details

A separate report for hydrologic model establishment was not created as part of the study; therefore this section has been included to describe the process undertaken in the hydrologic modelling.

## Available data

The following data was made available for the hydrologic modelling:

- Base WBNM model supplied by Andrew Wiersma on 30 March 2011. This model was supplied with notes that C-value = 1.6; ARF = 1.0 and IFD file location in all runfiles will need to be amended
- Design rain gauge locations were also supplied by Andrew Wiersma on 30 March 2011
- Guidance on how climate change modelling is to be undertaken ie IFD coefficients to be increased by 12% (as per email correspondence from Hester van Zijl on 10 April 2012)
- Future development impervious values as supplied by Hester van Zijl on 2 May 2012
- Guidance for rainfall data setup was provided in the Worley Parsons (2010) *Database Design Rainfall - Burpengary Pilot Project (Draft)* report

## Methodology

### Model version

WBNM version 2010_000 was used to undertake the analyses.

The TUFLOW convert_to_ts1 utility (v 2009-10-AB) was used to convert the results to TUFLOW format.

### Design event modelling

A separate .wbn file was created for each duration for each event (ARI). This was done in order to create separate output files for each event, which could then be used as input to the TUFLOW hydraulic model.

Five (5) design event rain gauge locations were adopted for the PUM minor basin as per the IFD data supplied.

The model results were then converted to .ts1 files for input to TUFLOW. Zero flow values were added to the end of each hydrograph. This was done for all WBNM model results, including the extreme events, PMP events and climate change events. Only the .loc files were used as input to the TUFLOW models.

### Extreme event modelling

CRC-Forge was used to provide rainfall intensities.  These were calculated for each of the five rainfall gauge locations adopted for the design events. For the 0045, 0090 and 0120 minute durations, no values are provided by CRC-Forge, therefore these were linearly interpolated between the 0030, 0060 and 0180 intensities.

PMP temporal patterns were applied to the extreme events. For the 0015, 0030, 0045, 0060, 0090, 0120, 0180 and 0360 minute events the temporal pattern for the Generalised Short Duration Method (GSDM) (BoM, 2003) was adopted. For the 1440, 2160, 2880 and 4320 minute events the temporal patterns from the coastal_avm_100 storms were adopted (as per the Generalised Tropical Storm Method (GTSMR), BoM 2003).

For the 0720 minute duration, both the GSDM and GTSMR temporal patterns were analysed. For the GTSMR, the times applying to the 1440 minute duration pattern were halved to create a 0720 minute pattern.

## PMP event modelling

For the PMP event, a single storm was used across the entire model extents. The temporal patterns used for the extreme events were also used for the PMP events.

The methods set out in the GSDM (BoM, 2003) were used to provide rainfall intensities for the 0015, 0030, 0045, 0060, 0120, 0150, 0180, 0240, 0300 and 0360 minute events. The GTSMR methods (BoM, 2003) were used to provide intensities for the 1440, 2160, 2880 and 4320 minute events. For the 0720 minute event, a line of best fit was applied between the short and long duration intensities and the rainfall intensity was calculated to provide the best $R^2$ value to this line.

Key parameters used in the PMP analysis are provided in Table G1.

**Table G1 | Adopted PMP Parameters**

| Parameter/Method | Value |
|---|---|
| GSDM – initial depths | Rough surface for area = 1km$^2$ |
| GSDM – EAF | 1 as topography is below 1500m AHD |
| GSDM – MAF | 0.85 (as per design events) |
| GTSMR – initial depths | Coastal summer values for area = 1km$^2$ |
| GTSMR – TAF | 1.505 – median value from region inspection |
| GTSMR – DAF | 0.997 – median value from region inspection |
| GTSMR – EPW | 88.525 – median value from region inspection |

## Climate change event analysis

For the climate change scenario (S4), the IFD data adopted for the design events was increased by 12%. No other changes were made to the EDS model setup.

## Future landuse scenario analysis

For the future landuse scenario (S11), the revised fraction impervious values provided by MBRC were incorporated into the .wbn file. No other changes were made to the model setup.

# Appendix H
# Landuse Polygon Review

# Appendix H
# Landuse Polygon Review

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**W** aurecongroup.com

| Project: Moreton Bay Flood Modelling | Reference: 211090 |
|---|---|

| To: | Copy: | Circulate: | Name: | Organisation: | Location/Facsimile: |
|---|---|---|---|---|---|
| ✔ | | | Hester van Zijl | MBRC | Hester.vanzijl@moretonbay.qld.gov.au |
| | ✔ | | Talia Campbell | Aurecon | campbellt@ap.aurecongroup.com |
| | | | | | |
| | | | | | |
| From: Brandon Breen | | | | Date: 1 March 2011 | Total pages: 6 |



| Subject: Land Use Polygon Review |
|---|

Hester

We have undertaken a review of the land use polygons developed by SKM. As part of our land use review, the following land use polygon layers have been visually compared to the available aerial images:

- Roads - MBRC_DigitisedRoads_2009AerialsOnly_MGA56 and AllMBRC_Roads_Merged_MGA56
- Buildings - MBRC_Buildings_Updatedw2009Aerials_MGA56
- Footpaths - MBRC_Footpaths_Updatedw2009Aerials_MGA56
- Vegetation - MBRC_Vegetation_Existing_2009_MGA56
- Water bodies (creeks) - MBRC_Waterbodies_Creeks_2009Aerials_MGA56
- Water bodies (rivers) - MBRC_Waterbodies_Rivers_2009Aerials_MGA56
- Urban blocks - MBRC_UrbanBlock_2000SqmBlocks_MGA56

This review has shown that the above layers cover the MBRC region and have also been extended to cover the portion of the SCRC region which falls within the Pumicestone Passage minor basin.

This memo presents the findings of our review and our proposed approach in areas that discrepancies occur.

| Project: Moreton Bay Flood Modelling | Reference: 211090 |
|---|---|

**Roads Land Use Layer**

The SKM land use polygons partially include dirt roads (as shown in Figure 1 below). If the digitised road at location 1 is to be included in the roads land use layer, then in order to provide consistency throughout the model other dirt roads such as that in location 2 should also be digitised.

We think the inclusion of the dirt tracks is not likely to make a large impact on the modelling and therefore propose to provide consistency by excluding dirt roads from the modelling, rather than digitising all remaining dirt roads in the Pumicestone domain. The railway line, which has similar properties to a dirt road, has not been included in roads land use layer which suggests the dirt roads are not required.

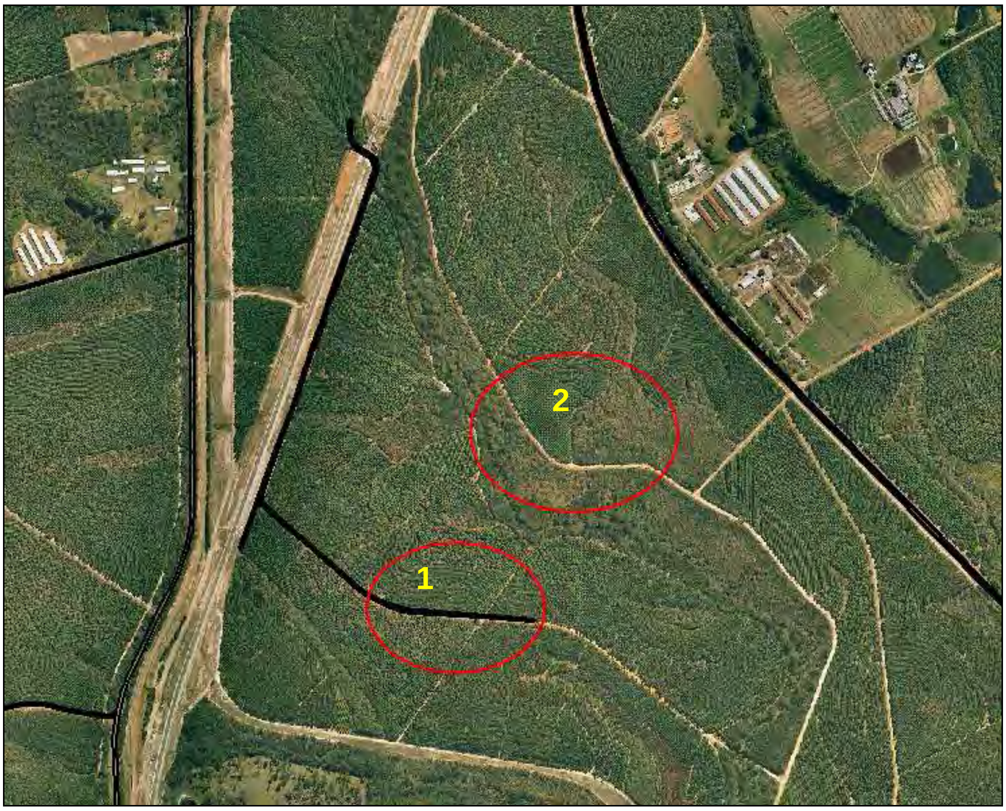


**Figure 1 Example of Digitised Dirt Roads**

**Buildings Land Use Layer**

Review of the SKM buildings land use layer shows that all buildings in the urban areas have been digitised; however there are some inconsistencies in the rural areas of the Pumicestone domain. The example in Figure 2 below shows a small cluster of buildings at location 1 have been included in the buildings layer and the larger buildings at location 2 have not been included.

We propose to add all large buildings and residential buildings into the buildings land use layer in order to provide consistency throughout the model.

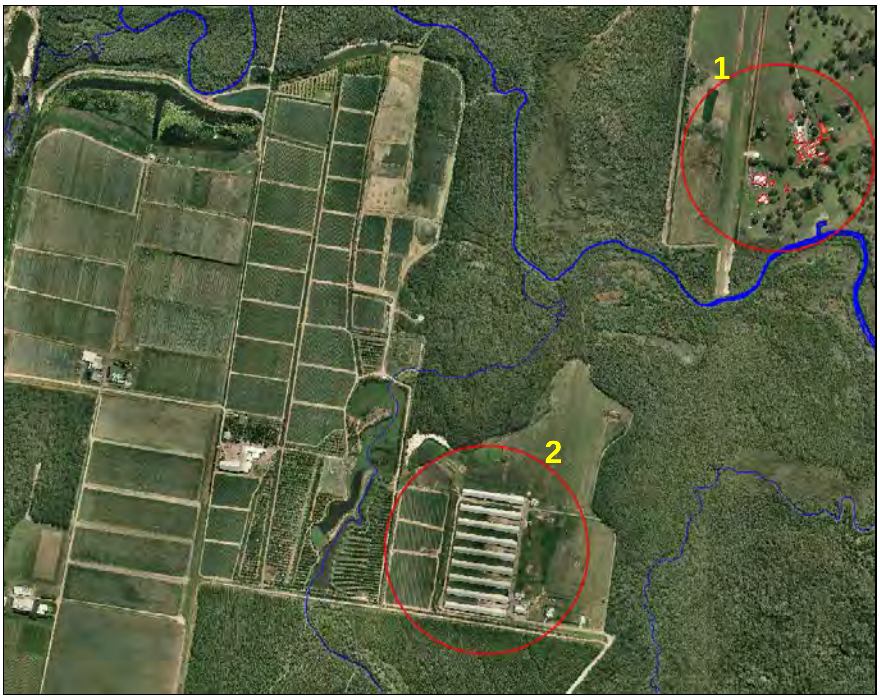


**Figure 2 Example of Digitised buildings**

| | |
|---|---|
| Project: Moreton Bay Flood Modelling | Reference: 211090 |

**Footpaths Land Use Layer**

A review of the SKM footpaths layer has shown that they are generally well aligned and well defined. In a few locations, particularly on Bribie Island, some minor realignment, extension and addition of short sections to these polygons is proposed. We do not propose to make and any major changes to this layer. An example of minor adjustments is shown in Figure 3 with the proposed updated alignment in red.

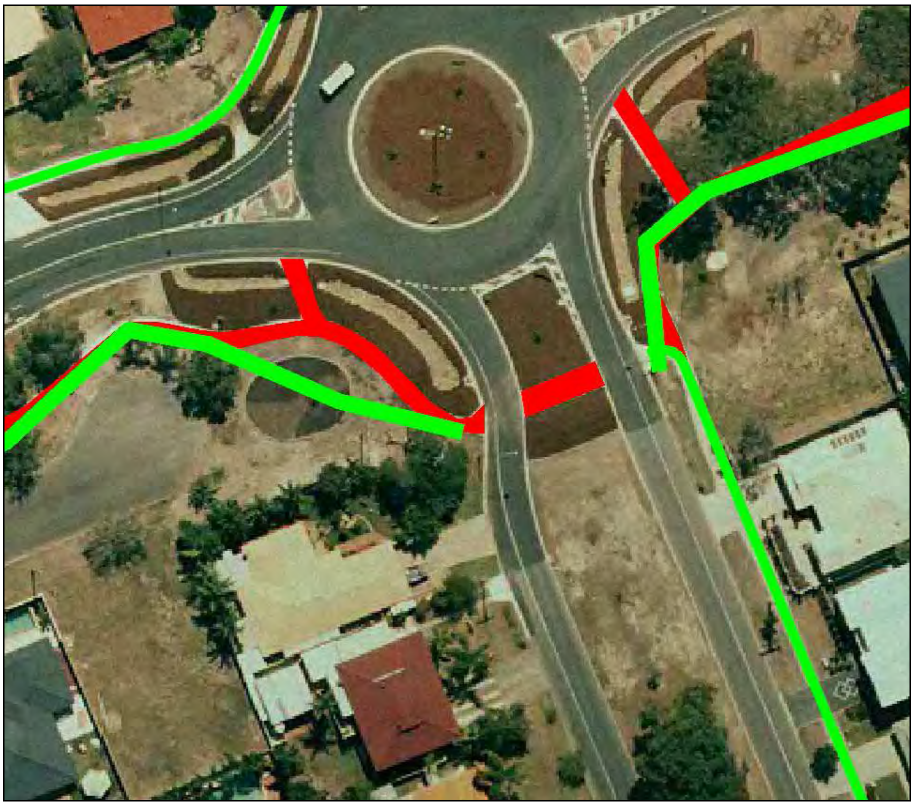

**Figure 3 Example of Digitised Footpaths**

**Vegetation Land Use Layer**

A review of the SKM land use layer found the polygons to be accurate within the MBRC region. The portion of these polygons which have been digitised in the SCRC region have not picked up all the vegetated land. We propose to maintain the existing SKM land use layer, with the additional definition of vegetation layers in the SCRC area as shown in Figure 4 below – this figure shows the areas defined by SKM (green) and the additional definition we are proposing (red).

**Figure 4 Example of Digitised Vegetation**

**Waterbodies (Creeks)**

The waterbodies (creeks) were well defined in the SKM land use layer. In the SCRC portion of the Pumicestone Passage catchment we found three waterbodies which were not included. We propose to maintain the existing SKM land use layer, with the addition of these three waterbodies in the SCRC area.

**Waterbodies (Rivers)**

The waterbodies (rivers) are well defined in the SKM land use layers. We do not propose to make any changes to this layer.

**Urban Blocks**

A review of the urban blocks layer showed that all blocks under 2000m$^2$ within the MBRC region were defined. The urban blocks in the Beerburrum area were not included in this layer. We propose to maintain the existing SKM urban blocks land use layer, with the addition of urban blocks in Beerburrum (based upon cadastral data sourced from DERM on 25$^{th}$ February) as shown in Figure 5.


**Figure 5 Example of Urban Blocks to be Included**

Could you please review this memo and provide your comments regarding our proposed changes to the land use polygons?

Regards

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Water

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