Regional Floodplain Database:

2014 Model Maintenance Report - Sideling Creek (SID)

Moreton Bay Regional Council

BMT WBM

"Where will our knowledge take you?"

Regional Floodplain Database
2014 Model Maintenance Report

Sideling Creek (SID) **June 2015**

Moreton Bay Regional Council

“This page left intentionally blank”

Regional Floodplain Database 2014 Model Maintenance Report – Sideling Creek (SID)

Prepared for:	Moreton Bay Regional Council
Prepared by:	BMT WBM Pty Ltd (Member of the BMT group of companies)

Offices

Brisbane
Denver
London
Mackay
Melbourne
Newcastle
Perth
Sydney
Vancouver

Document Control Sheet

BMT WBM Pty Ltd
Level 8, 200 Creek Street
Brisbane Qld 4000
Australia
PO Box 203, Spring Hill 4004

Tel: +61 7 3831 6744
Fax: + 61 7 3832 3627

ABN 54 010 830 421

www.bmtwbm.com.au

Document:	R.B20980.001.03.SID.docx
Title:	Regional Floodplain Database 2014 Model Maintenance Report – Sideling Creek (SID)
Project Manager:	Richard Sharpe / Eoghain O'Hanlon
Author:	Melissa Blum
Client:	Moreton Bay Regional Council
Client Contact:	Hester van Zijl
Client Reference:	MBRC003898

Synopsis:

REVISION/CHECKING HISTORY

Revision Number	Date	Checked by		Issued by	
0	24th April 2015	AK		RGS	
1	1st July 2015	AK		MB	
2	3rd July 2015	AK		MB	
3	7th July 2015	AK		MB	

DISTRIBUTION

Destination	Revision										
	0	1	2	3	4	5	6	7	8	9	10
Moreton Bay Regional Council	PDF	PDF	PDF	PDF							
BMT WBM File	PDF	PDF	PDF	PDF							
BMT WBM Library	PDF	PDF	PDF	PDF							

Contents

List of Figures

List of Tables

1 Introduction

WorleyParsons has developed the Sideling Creek (SID) hydrologic and hydraulic models as part of the Stage 2, Regional Floodplain Database Project (RFD) (Worley Parsons, 2012).

In 2014, Moreton Bay Regional Council (Council) has obtained additional information that could further enhance the model performance, including newly flown Light Detection and Ranging (LiDAR) elevation data and additional structure details. The hydraulic modelling software, TUFLOW, has had many advances made to it that improves modelling efficiencies. Finally, there has been improvement to modelling techniques that will provide a better representation of flood behaviour.

Due to these reasons, Council have decided to upgrade the existing SID model to incorporate the most recent data and improved modelling platform and techniques. The model has been re-run, incorporating these changes, for all events, including the sensitivity analysis.

This report highlights the changes and results from the 2014 model for the simulated events.

2 2014 Model Maintenance Details

2.1 WBNM Model

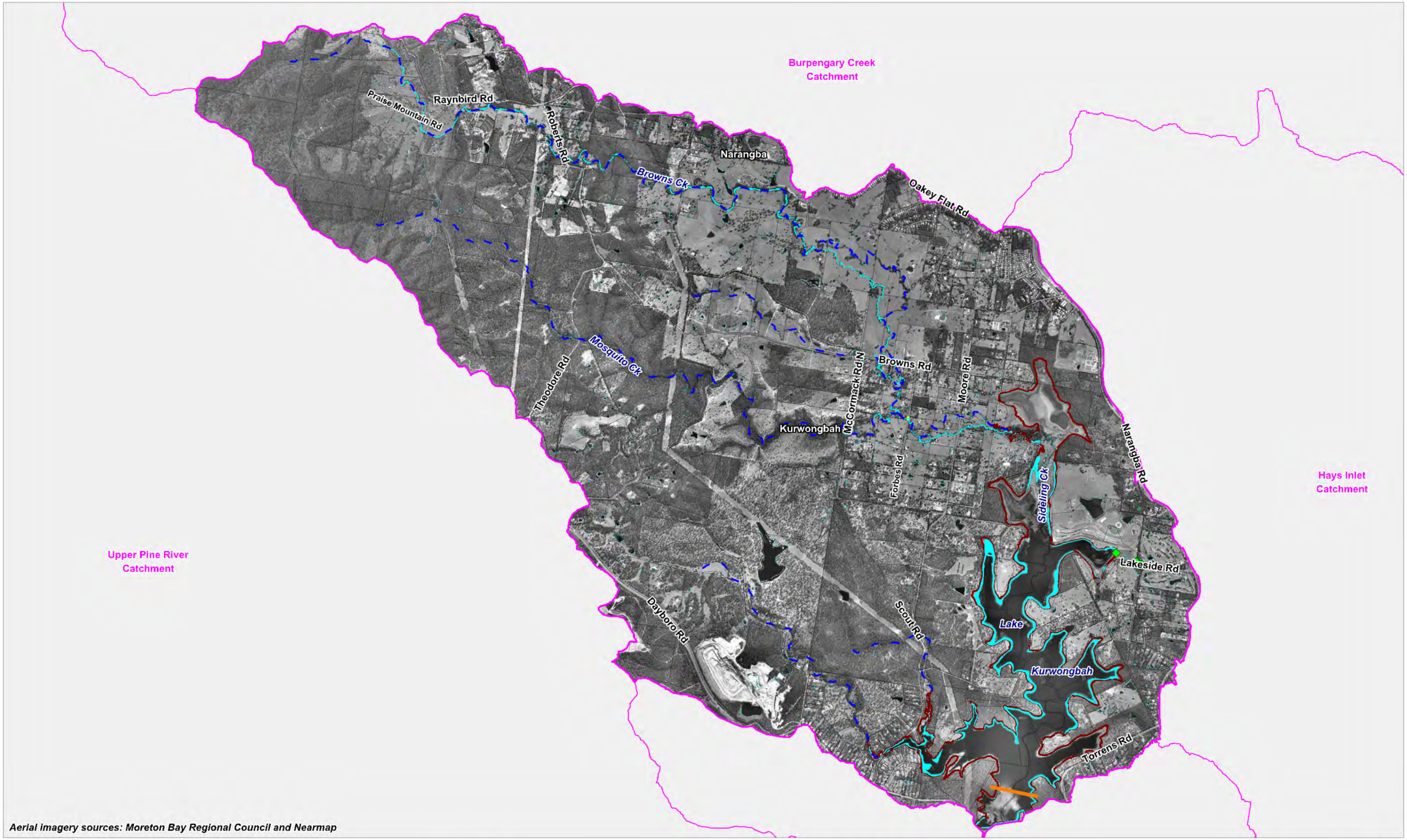
The catchment boundaries of the existing SID hydrologic model were reviewed against the 2014 LiDAR and no changes were deemed necessary. Council advised that the initial loss (IL) value for events up to and including the 5% AEP event be changed from 0mm to 15mm. Initial losses for events over the 5% AEP remain at 0mm.

2.2 TUFLOW Model

Council consolidated and provided the data for the model maintenance in various formats. Figure 2-1 presents the locations of the additional data incorporated into the 2014 SID model. In summary, the following information was incorporated into the SID model:

- Updated topography data. This data has been read into the model as a DEM (rather than Z-points):
  - 2014 LiDAR data for the entire catchment;
  - Elevation data of Lake Kurwongbah dam, previously incorporated into the Z-points;
- Inclusion of additional culverts under Lakeside Road:
  - One set of culverts from Plan 1/0566; and
  - Culverts 3 & 4 from Plan 10-011-25.
- Breaklines were incorporated along all stream centrelines, as per the methodology developed as part of the Lower Pine River Pilot Study (BMT WBM, 2014).
- Waterbody material layer has been updated to include a 5m waterway materials layer along the streamlines.
- Inclusion of zlines to represent the crest elevation of key roads within the modelled area.
- Plot output (PO) lines updated to include all locations of interest and to ensure all are located perpendicular to the general flow direction.

On review of the model results, the changes outlined above (mainly the updated LiDAR), resulted in the model showing instabilities at the downstream boundary. The approach of modelling the downstream boundary was therefore adjusted to a more stable arrangement. This included moving the end of the 2D boundary to a pinch point further upstream, as shown in Figure 2-1, and including the downstream area as a 1D element, taking into account the storage using a nodal storage relationship.



LEGEND

Sideling Creek Catchment Boundary

Cadastral Boundaries

Additional Features

Lake Kurwongbah

Roads

Streamlines

Updated Waterbody Materials

End of 2d Extent

Culverts

Title:

Sideling Creek Model Maintenance Features

Figure

2-1

Rev:

B

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

N

0 0.75 1.5km

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : I:\B20980_k_cmp_RFD_Maintenance\DRG\SID\FLD_007_152306_SID_Model_Features.WOR

3 Model Simulations

3.1 Verification

Verification against recorded rainfall and flood marks was not undertaken for the SID model because of limited historical event data.

3.2 Design Flood Events

This section describes the design storm conditions used in the hydrodynamic modelling tasks. Design storm events are hypothetical events used to estimate design flood conditions. They are based on the probability of occurrence, usually specified as an Average Exceedance Probability (AEP).

3.2.1 River and Creek Critical Duration Assessment

An assessment of critical storm durations (storm duration/s that results in the highest peak flood level) was undertaken. The critical durations were selected based on the hydraulic results, rather than the hydrological model results. This means that the selected critical durations were selected based upon the maximum flood levels rather than flows. Separate assessments were undertaken for two representative flood events;

- 1% AEP event, to represent non-extreme events (1 Exceedance Year (EY) to 1% AEP events); and
- 0.1% AEP event, to represent extreme events (0.5% AEP to Probable Maximum Flood (PMF) events).

To determine the critical storm durations for the Sideling Creek model, the following methodology was adopted:

(1) Hydrologic and hydraulic modelling for a range of storm durations for the 1% AEP and 0.1% AEP events;

(2) Mapping of the peak flood level results for the 'maximum envelope' of all the storm durations for the two representative events;

(3) Mapping of the peak flood level results for the 'maximum envelope' of the three selected storm durations for the two representative events;

(4) Difference comparison between the mapped peak flood levels for the three selected critical durations and the results accounting for all the storm durations; and

(5) Selection of the critical durations was undertaken in consultation with Council and was based on the storm durations generating the highest flood levels across the most widespread areas.

A summary of the selected critical storm durations for all events assessed is outlined in Table 3-1.

Table 3-1 Critical Storm Duration Selection

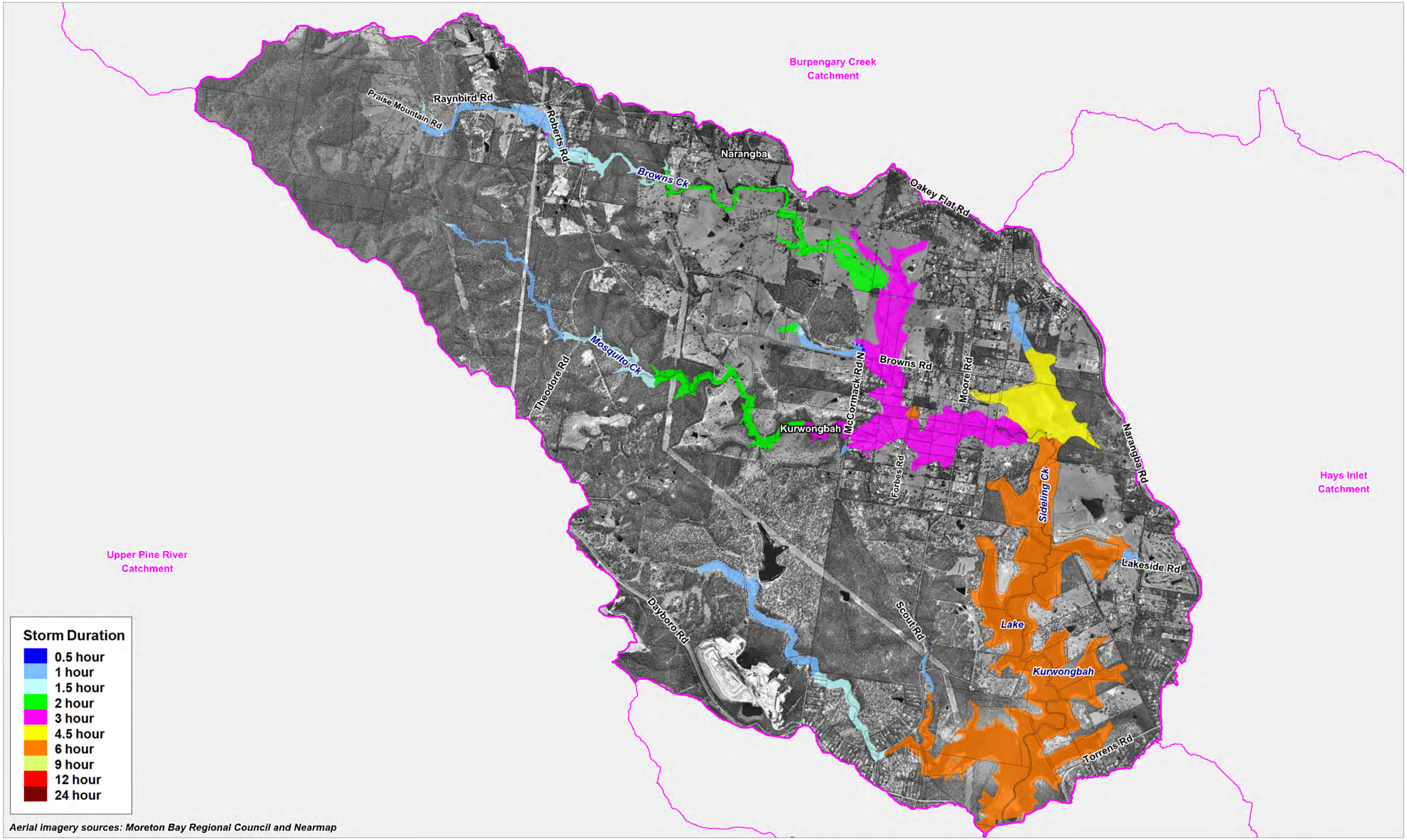
Assessment Event	Assessed Durations	Selected Critical Durations	Adopted Event
1%AEP	0.5, 1, 1.5, 3, 4.5, 6, 9, 12 and 24 hour storm	1.5, 3 and 6 hour storm	1 EY, 0.5 EY, 20%, 10%, 5%, 2% and 1% AEP
0.1% AEP	0.5, 1, 1.5, 3, 5, 6, 12 and 24 hour storm	1, 3 and 6 hour storm	0.5%, 0.2%, 0.1%, 0.05%, 0.02%, 0.01% AEP and PMF

Figure 3-1 and Figure 3-2 show which events generated the highest peak flood levels in different areas throughout the catchment for the 1% and 0.1% AEP events. The following observations can be made:

- The 6 hour event is critical within Lake Kurowongbah in both events;
- Along Sideling Creek until the confluence at Browns Creek, the 3 hour duration is critical for both events;
- The 1.5 hour duration is critical along the middle sections of Browns and Mosquito Creeks for both events, and along the lower reaches of creek to the west of Scout Road in the 1% AEP event;
- The 1 hour duration is critical in the upper reaches of Browns and Mosquito Creeks for both events, and along the creek to the west of Scout Road in the 0.1% AEP event; and
- The tributary along Browns Road has a larger critical duration in the upper reaches and a shorter critical duration in the lower reaches.

The difference comparison for the 1% AEP and 0.1% AEP peak flood levels (as described in step 4 above) is shown in Figure 3-3 and Figure 3-4. For both events, the peak flood levels through the majority of the catchment are not different between the chosen critical durations and all of the durations. The key differences are:

- Along Mosquito Creek for both events – a decrease of up to 0.1m in the 1% AEP event and a decrease of up to 0.2m in the 0.1% AEP event;
- Along Browns Creek for both events – a decrease of up to 0.1m in the 1% AEP event and a decrease of up to 0.2m along the main channel and 0.5m in some small tributaries in the 0.1% AEP event;
- A decrease in levels of up to 0.05m in the 1% AEP event:
  - To the north of Lake Kurwongbah and along Sideling Creek, for the 1% AEP event;
  - On the tributary along Browns Road in the 1% AEP event; and
  - Along the creek to the west of Scout Road in the 1% AEP event.



Aerial imagery sources: Moreton Bay Regional Council and Nearmap

LEGEND

Sideling Creek Catchment Boundary

Cadastral Boundaries

Title:

Critical Duration Assessment - 1% AEP

Figure 3-1

Rev: A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

N

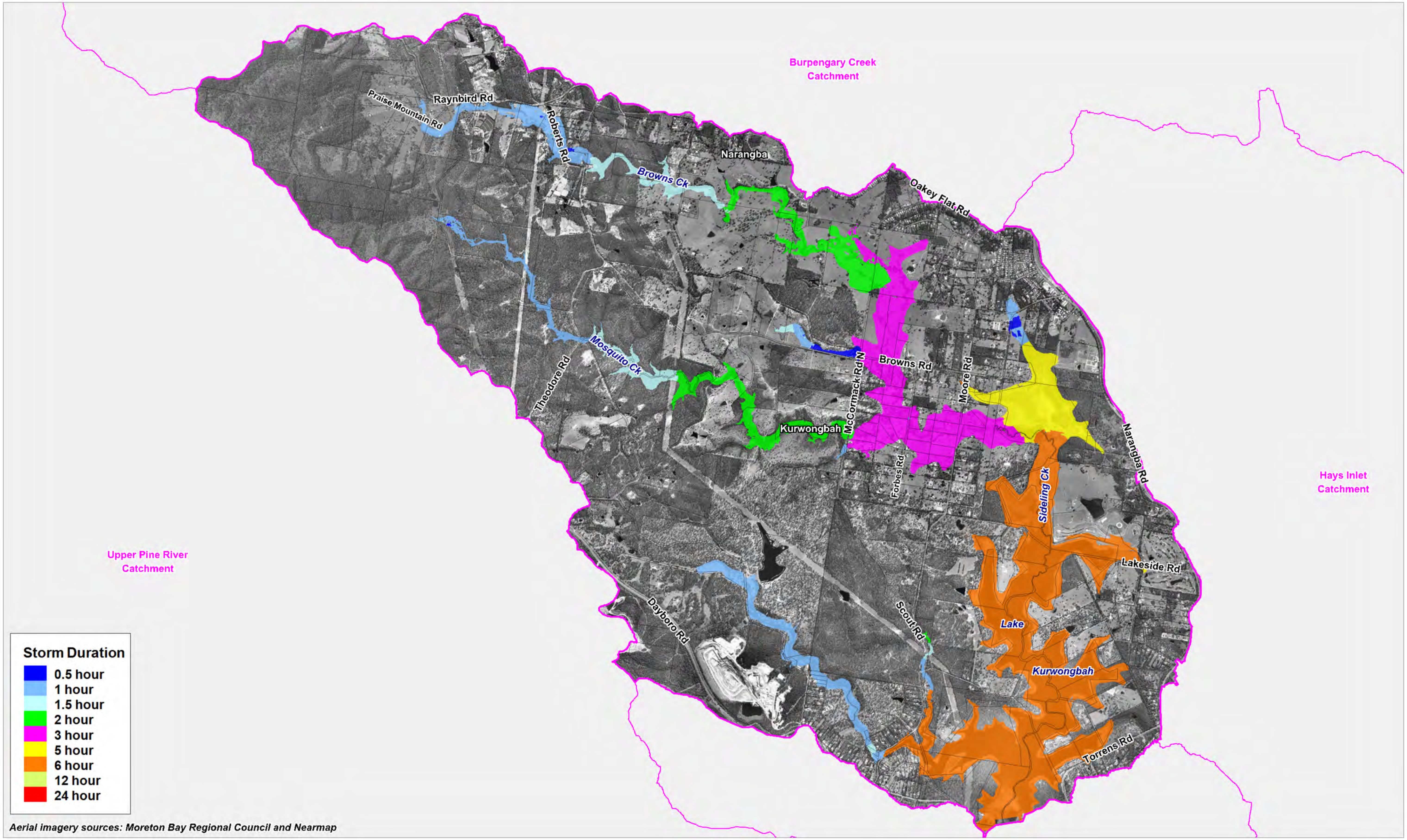
0 0.75 1.5km

Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : I:\B20980_k_cmp_RFD_Maintenance\DRG\SID\FLD_001_141105_SID_Q100_Crit_Dur.WOR

“This page left intentionally blank”



LEGEND

Sideling Creek Catchment Boundary

Cadastral Boundaries

Title:

Critical Duration Assessment - 0.1% AEP

Figure

3-2

Rev:

A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

N

0 0.75 1.5km

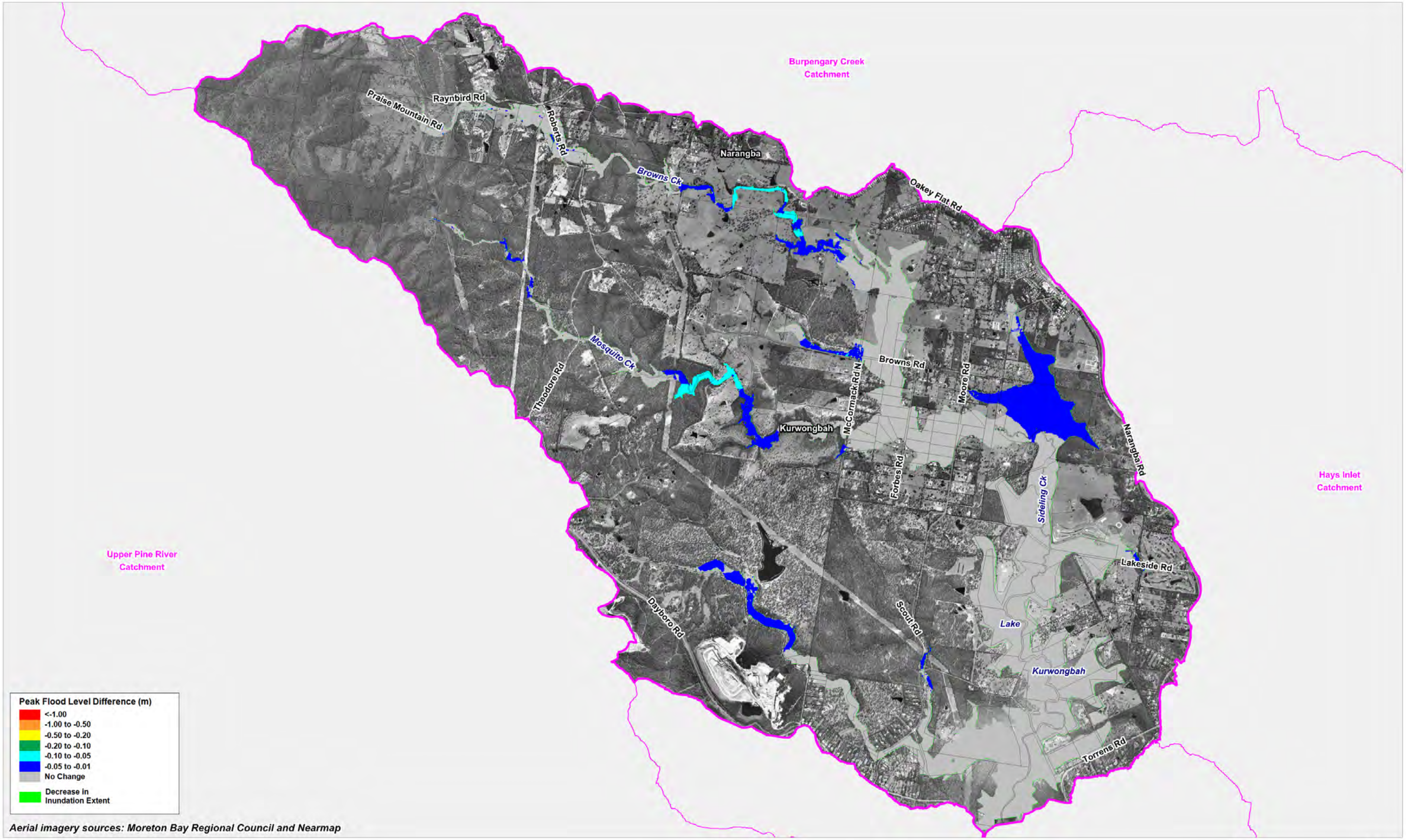
Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : I:\B20980_k_cmp_RFD_Maintenance\DRG\SID\FLD_002_141105_SID_Q1000_Crit_Dur.WOR

“This page left intentionally blank”



LEGEND

Sideling Creek Catchment Boundary

Cadastral Boundaries

Title:

Peak Flood Levels for critical durations minus Peak Flood Levels for all durations - 1% AEP

Figure 3-3

Rev: A

N

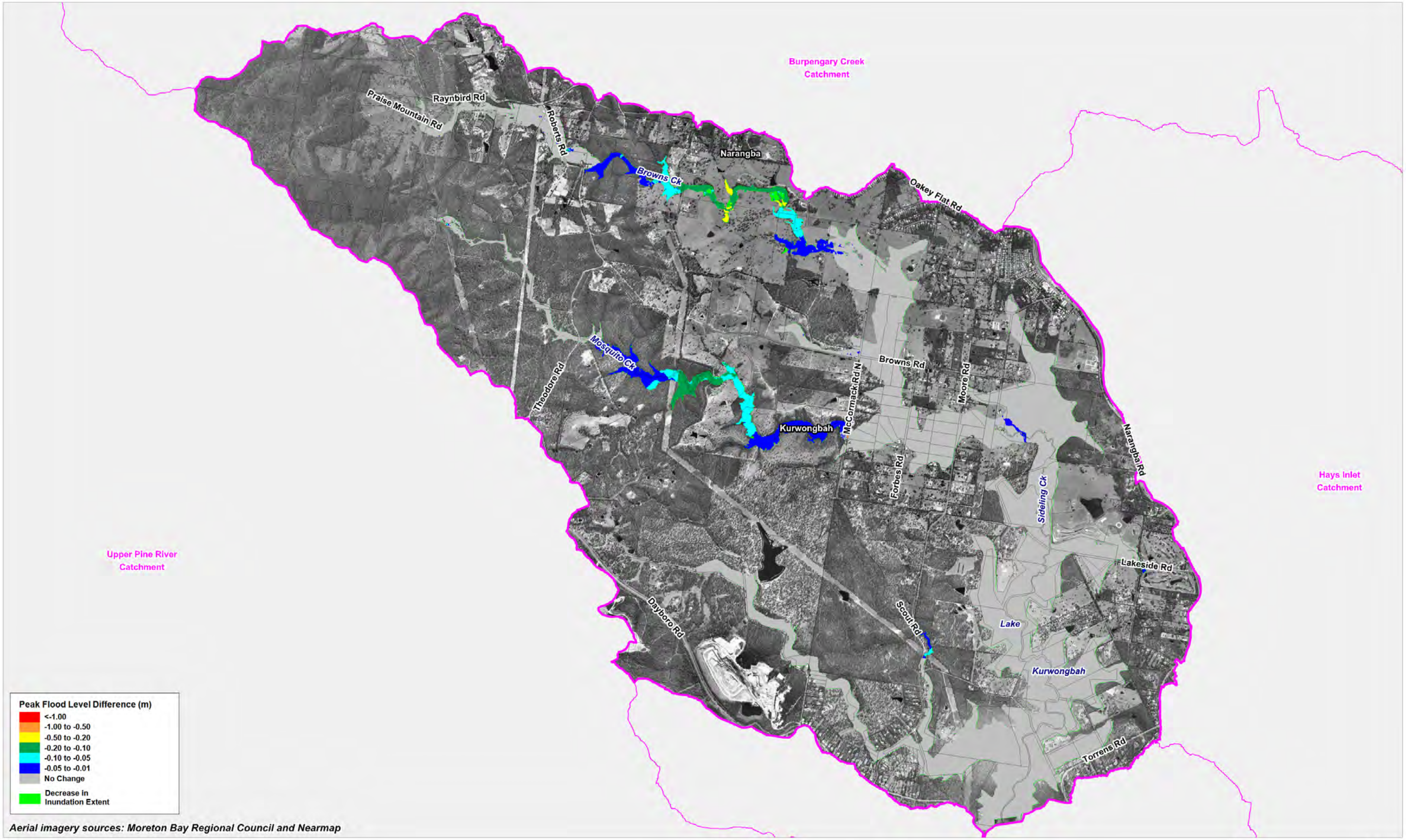
0 0.75 1.5km

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : I:\B20980_k_cmp_RFD_Maintenance\DRG\SID\FLD_003_150707_SID_Q100_Crit_Dur_Difference.WOR



Aerial imagery sources: Moreton Bay Regional Council and Nearmap

LEGEND

Sideling Creek Catchment Boundary

Cadastral Boundaries

Title:

Peak Flood Levels for critical durations minus Peak Flood Levels for all durations - 0.1% AEP

Figure 3-4

Rev: A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

N

0 0.75 1.5km

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : I:\B20980_k_cmp_RFD_Maintenance\DRG\SID\FLD_004_150707_SID_Q1000_Crit_Dur_Difference.WOR

3.2.2 River and Creek Design Event Simulations

The SID model was simulated for a range of AEP events and storm durations, as outlined in Section 3.2.1, as well as a Moreton Bay Design Storm (MDS). Councils adopted design storm is a 1% AEP 15 minute in 270 min embedded design storm. The MDS is useful for general investigations into changes in model parameters and catchment characteristics, as it reduces the number of model runs required (i.e. one run instead of multiple storm durations).

In summary, the SID model was simulated for the following design events:

- The 1 EY, 0.5 EY, 20%, 10%, 5%, 2%, 1%, 0.5%, 0.2%, 0.1%, 0.05%, 0.02%, 0.01% AEP events, and the PMF event for the three selected critical storm durations; and
- The Moreton Bay Design Storm – 1% AEP 15 minute in 270 minute embedded design storm.

3.2.3 Storm Tide Design Event Simulations

Not applicable.

3.3 Sensitivity Analysis

The SID model was simulated for four sensitivity scenarios in total. A summary of the sensitivity scenarios, the model identifier (ID), description and purpose of the four sensitivity scenarios are detailed in Table 3-2.

Table 3-2 Sensitivity Analysis Summary

ID	Description	Section
R01	Roughness	3.3.1
R02	Blockage	3.3.2
R03	Climate Change - Rainfall	3.3.3
R08	Vegetated Floodplain	3.3.4

3.3.1 Hydraulic Roughness Analysis

The sensitivity of the model to landuse roughness (Manning's 'n') parameters was undertaken with the 1% AEP MDS event. All Manning's 'n' values within the 2D domain were increased by 20%.

3.3.2 Structure Blockage Scenario

A blockage scenario was run to simulate the effects of waterway crossing (culverts) becoming blocked during a flood event. This is a reasonably common occurrence and is the result of debris or sand/silt being washed into or moved within the waterways during a flood. Recent storm event showed that blockages are generally caused by debris, or larger items, such as tree stems, wood planks, shopping trolleys or even cars. Blockages reduce the capacity for water to flow through stormwater infrastructure and force water out of the channel, often increasing overland flooding.

A moderate blockage scenario was adopted from the SKM *Floodplain Parameterisation* report (2012b), and includes:

- A full blockage is applied if the culvert diagonal is less than 2.4m; and

- A 15% blockage is applied if the culvert diagonal is greater than 2.4m.

It should be noted that no blockage is applied for trunk drainage infrastructure.

3.3.3 Climate Change and Downstream Boundary Conditions

A climate change assessment investigated the possible impact of projected increases in rainfall intensity of flooding in the catchment. A projected 20% increase in rainfall was investigated, as per *Boundary Conditions, Joint Probability and Climate Change* (SKM, 2012a).

No sensitivity testing was undertaken on the downstream boundary, as this catchment does not discharge to the ocean, therefore storm tide or sea level rise will not impact upon this catchment.

3.3.4 Future Landuse Analysis

One future landuse scenario was assessed to test the impact of future re-vegetation.

Landuse is defined in the hydraulic model through the materials layer. This information covers the entire hydraulic model extent and describes landuse and the Manning's 'n' roughness values associated with each type of landuse. The materials layer was updated to reflect the future landuse scenario (change in vegetation density). Any area with a landuse classification of Medium Dense Vegetation within the 1% AEP extent was changed to High Density Vegetation. Also, Low Grass / Grazing within the 1% AEP extent was changed to a Medium Dense Vegetation landuse classification.

4 Model Results and Outcomes

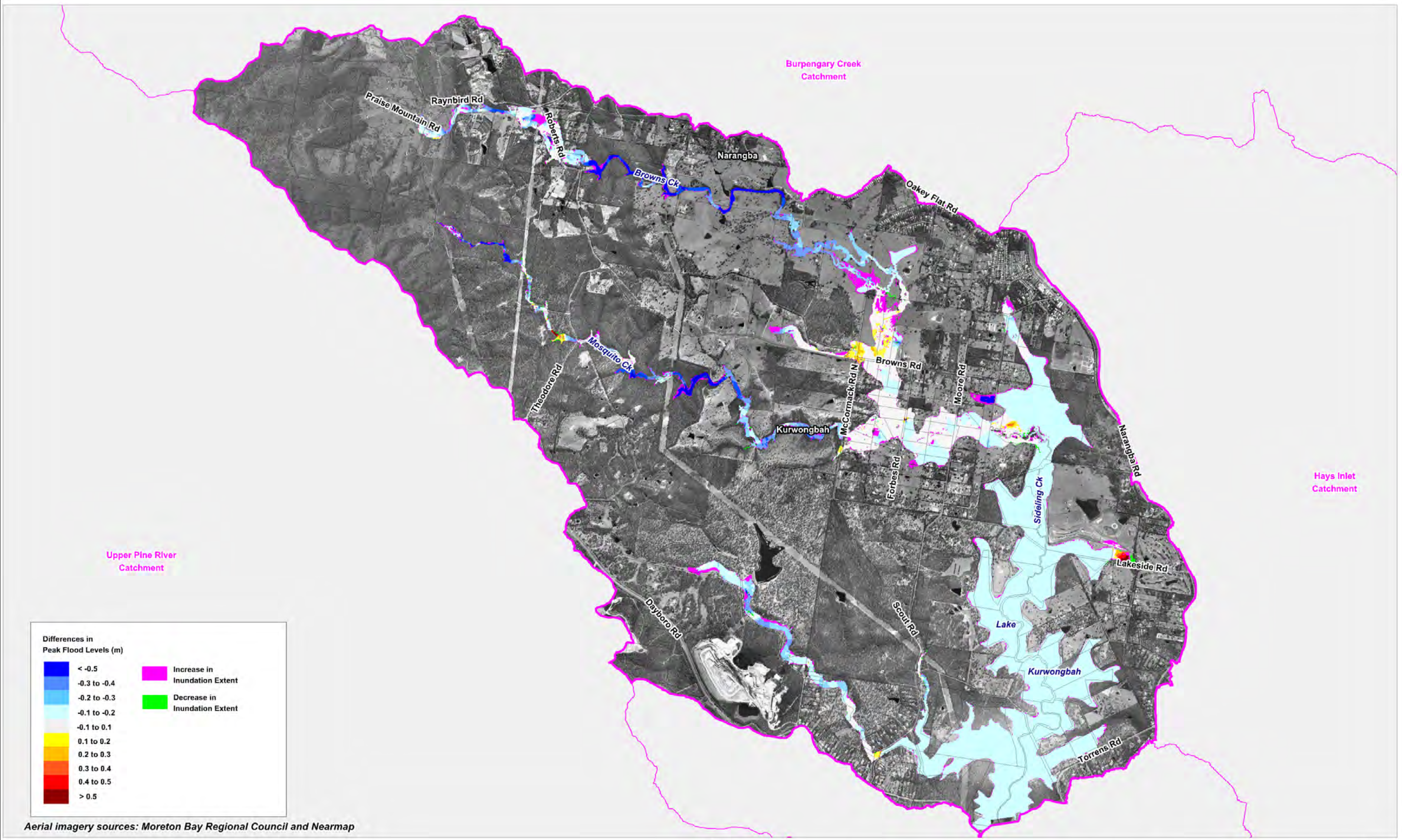
4.1 2014 Model Maintenance

Figure 4-1 and Figure 4-2 shows the difference between the 2014 and 2012 Sideling Creek models for the 5% and 1% AEP events respectively. Both events are based on a comparison between the 1 hour storm duration.

Negative values mean that the 2014 SID model results are lower than the 2012 model results and vice versa (positive values mean that the 2014 SID model results are higher than the 2012 model results).

In the 5% AEP event, flood levels in the lower reaches are generally within ±0.2m. In the upstream reached, there is a decrease of greater than 0.5m. This can be attributed to the change in the initial losses in the hydrology model. There are localised increases in flood levels, particularly upstream of Browns Road and Theodore Road. These differences are caused by the difference in LiDAR levels between the 2014 and 2009 survey.

In the 1% AEP event, the impacts are typically within ±0.1m. There is a localised increase in flood levels in the middle catchment, around Browns Road and Moore Road. This increase is due to the differences in LiDAR. There is also a localised area of decreased flood levels along a road off the eastern end of Browns Road. This is due to the road crest being higher in the 2014 LiDAR, resulting in less overtopping occurring in the 2014 model.



LEGEND

Sideling Creek Catchment Boundary

Cadastral Boundaries

Title:

2014 Sideling Creek Model versus 2012 Sideling Creek Model Peak Flood Level Difference - 5% AEP

Figure: 4-1

Rev: B

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

N

0 0.75 1.5km

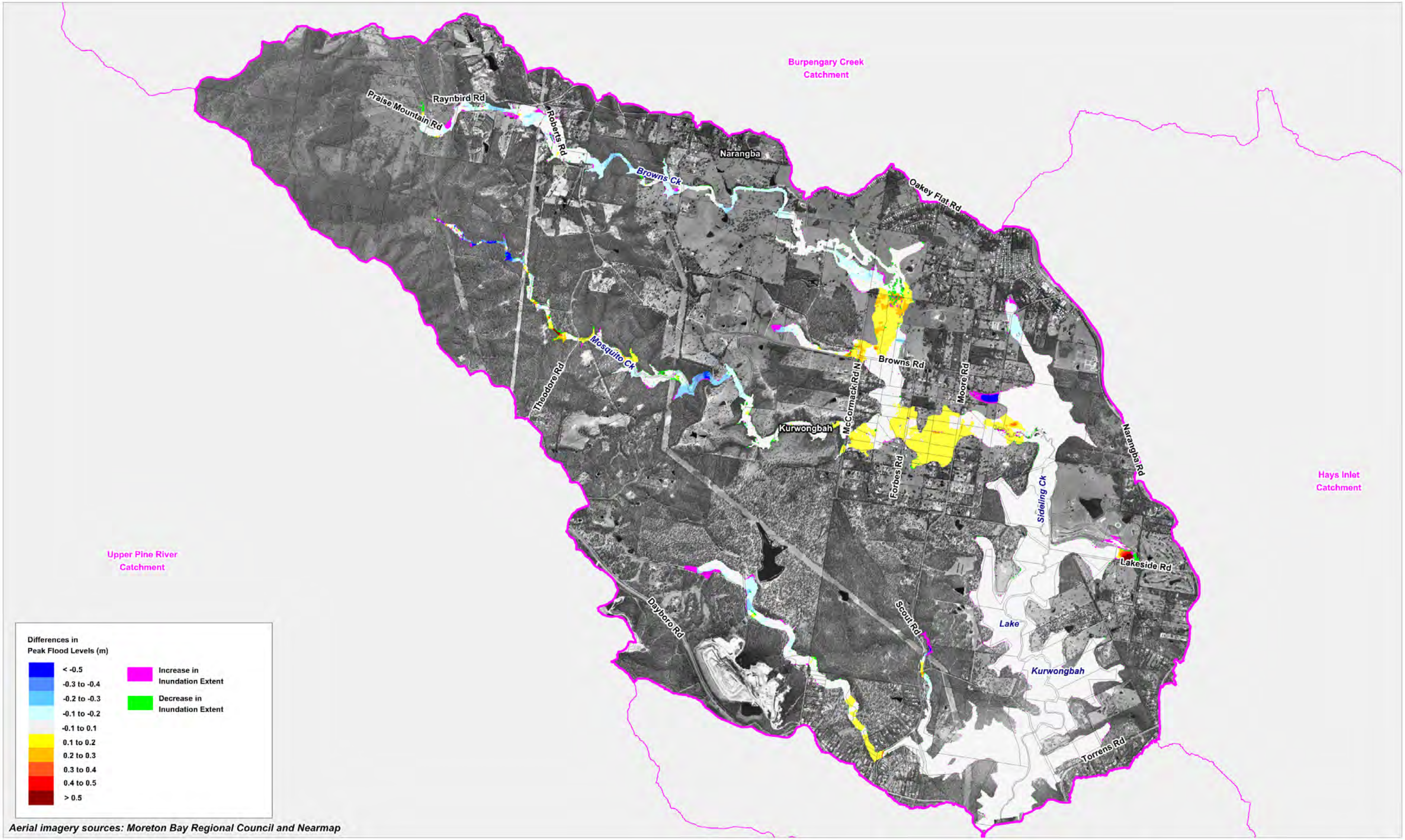
Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : I:\B20980_k_cmp_RFD_Maintenance\DRG\SID\FLD_005_152306_SID_Q20_model_comparison.WOR

"This page left intentionally blank"



LEGEND

Sideling Creek Catchment Boundary

Cadastral Boundaries

Title:

2014 Sideling Creek Model versus 2012 Sideling Creek Model Peak Flood Level Difference - 1% AEP

Figure **4-2**

Rev: **B**

N

0 0.75 1.5km

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : I:\B20980_k_cmp_RFD_Maintenance\DRG\SID\FLD_006_152306_SID_Q100_model_comparison.WOR

4.2 Verification

Verification against recorded rainfall and flood marks was not undertaken for the SID model because of limited historical event data.

4.3 Design Flood Behaviour

The following data were output by the model at 30 minute intervals as well as the peak values recorded during each simulation:

(1) Flood Levels (h flag);

(2) Flood Depth (d flag);

(3) Flood Velocity (v flag);

(4) Depth Velocity Product (Z0 flag);

(5) Hazard Categories adopted by Council (ZMBRC flag);

(6) Hazard Categories developed by the Queensland Reconstruction Authority (ZQRA flag);

(7) Steam Power (SP flag); and

(8) Inundation Times (no flag required).

The maximum velocity was used in combination with a ‘Maximum Velocity Cutoff Depth’ of 0.1m. Consequently, the model result files plot the maximum velocity for depths greater than 0.1m; for depths of less than 0.1m the velocity at the peak level is recorded in the TUFLOW output file. This approach is recommended so as to exclude any high velocities that can occur as an artefact of the modelling during the wetting and drying process.

TUFLOW can provide output relevant to the timing of inundation. In particular:

- The time that a cell first experiences a depth greater than the depth(s) specified; and
- The duration of time that a cell is inundated above the depth(s) specified.

A ‘Time Output Cutoff Depth’ of 0.1m, 0.3m and 1m were selected. This selection provides further flood information in the catchment, e.g.

- Establishing when areas are inundated with shallow depths of 0.1m;
- Considering pedestrian and vehicle safety (flood depth between 0.1m and 0.3m); and
- The duration and/or time of inundation for significant flood depths of 1m and more throughout the catchment.

This information can assist in emergency planning by highlighting which areas of the catchment are inundated early in the flood event and also highlighting which regions may be isolated for long durations.

Flood maps have not been provided in this report because the focus of this project is on digital data, rather than the provision of flood maps.

4.3.1 River and Creek

General patterns of flood behaviour that can be observed from the SID TUFLOW design event modelling include:

- Up to the 1% AEP event, the flood water is generally contained within the creeks in the upper reaches of the model (until around Browns Road). There is some overbank flow around Roberts Road along Browns Creek, which starts impacting on property in the 10% AEP event; and
- Overbank flow occurs around the floodplain area of Sideling Creek upstream of Lake Kurwongbah. This occurs to varying degrees in all events, typically between McCormack Road North and the inlet to the Lake, and upstream of Browns Road.

As the outflows from the SID model are used as inflow for the Lower Pine River model, careful review of the outflows from the downstream boundary was undertaken to ensure that the flow hydrographs were smooth.

A maximum ASCII grid was derived using the envelope of all critical storms (section 3.2.1) for each event and all the TUFLOW outputs listed in Section 4.3 above. Results for the 5%, 1% and 0.1% AEP events are available on Council's website (www.moretonbay.qld.gov.au/floodcheck) as PDF suburb maps or in the Flood Explorer interactive mapping tool.

4.3.2 Storm Tide

Not applicable.

4.4 Sensitivity Analysis Results

The 1% AEP MDS (as defined in Section 3.2.2) was used as a base case for the sensitivity analysis. The following sections provide a discussion of the impacts as a result of the sensitivity analyses. Maps of the impacts have not been provided as the focus of this project is on digital data, rather than the provision of flood maps.

A comparison of the MDS event with the 1% AEP design event (envelope of all durations) indicates that in the majority of the catchment the MDS results in very similar peak flood levels (within 0.1m) to the envelope of the 1% AEP design event flood levels. Only in the most upstream part of Mosquito Creek, within an undeveloped area, the MDS event over predicts peak flood levels by approximately 0.3m AHD.

4.4.1 Hydraulic Roughness Analysis

Increasing the Manning's 'n' by 20% has resulted in an increase in flood levels of between ±0.1m throughout the majority of the catchment. There are increases of up to 0.2m, which are mainly restricted to the upper catchments; Browns Creek, Mosquito Creek and the creek to the west of Scout Road. These impacts typically correspond to areas of Dense or Medium Dense Vegetation.

4.4.2 Structure Blockage Analysis

Blocking the culverts on a catchment wide scale has impacts of between ±0.1m. There are localised impacts surrounding some culverts. None of these impacts directly on property;

- Lakeside Road –
  - Increase in levels by up to approximately 0.75m upstream of the culverts.
  - Localised increase in levels directly downstream of the culverts by up to 0.2m.
- Culverts under Praise Mountain Road –
  - Increase in levels of up to 0.4m from the upstream culvert inlet to approximately 90m upstream of the culvert;
  - Increase in levels of up to 0.3m from approximately 90m upstream of the culvert to 170m upstream of the culvert;
  - Localised decrease in flood levels directly downstream of the culvert by up to 0.21m.
- Culverts under Forbes Road -
  - Very localised increase of approximately 0.21m approximately 6m upstream of the culvert;
  - Localised decrease of up to approximately 0.32m approximately 15m downstream of the culvert.

4.4.3 Climate Change and Downstream Boundary Conditions

R03 – Increase in rainfall intensity of 20%

A 20% increase in rainfall generally increases flood levels throughout the catchment by up to approximately 0.2m. There are larger increases in levels in the following locations:

- Increases of up to 0.3m within Lake Kurwongbah and along the creek to the west of Scout Road;
- Increases of up to 0.4m along Mosquito Creek; and
- Increases of up to 0.62m along Browns Creek.

No sensitivity testing was undertaken on the downstream boundary, as this catchment does not discharge to the ocean. Therefore storm tide or sea level rise will not impact upon this catchment.

4.4.4 Future Landuse Analysis

R08 – Increased vegetation in floodplain

Changing the landuse values (increasing the roughness of vegetation) typically changes the peak flood levels by ±0.1m throughout the catchment. There are localised larger increases in flood levels in the following locations:

- Increases of up to 0.2m along the creek to the west of Scout Road;
- Increases of up to 0.4m along Mosquito Creek;
- Increases of up to 0.3m along Browns Creek; and

- Increases of up to a maximum of 0.41m along Sideling Creek, between Lake Kurwongbah and the confluence of Sideling, Browns and Mosquito Creeks (typical range of up to 0.2m).

4.5 Model Limitations and Quality

Watercourses within the Sideling Creek catchment were represented in the 2D domain, for which the grid resolution is 5m. This may not allow adequate representation of the channel conveyance, particularly for smaller, more frequent flood events. In some instances, this limitation may lead to the model over or under estimating conveyance in the watercourses. The extent of this over or under estimation will vary according to local topographic features of the watercourses.

4.6 Model Specification and Run Times

Table 4-1 shows the SID TUFLOW model run times and memory (RAM) requirements for various design events and the 1% AEP MDS. The 6 hour storm duration was chosen, as it is the longest critical storm duration modelled. It should be noted that the model run time is partially dependent upon the machine's specifications and the other demands on the machine's CPU's (e.g. other models running simultaneously).

Table 4-1 Model Specification and Run Time Summary

Event	Approximate Model Run Time	Model RAM/Memory
1 EY 6 hour	17 hours	3.57 GB
10% AEP 6 hour	19 hours	3.57 GB
1% AEP 6 hour	17 hours	3.57 GB
0.2% AEP 6 hour	20 hours	3.57 GB
0.05% AEP 6 hour	20 hours	3.57 GB
1% AEP MDS	29 hours	3.57 GB

5 Conclusion

As part of the Regional Floodplain Database 2014 Model Maintenance Project, Council are updating all of the existing hydrologic and hydraulic models, due to the availability of more accurate data.

As a result, the hydrologic subcatchments within the Sideling (SID) Creek catchment were reviewed and found to be fit-for purpose. The initial losses within WBNM (hydrologic modelling software) for events up to and including the 5% AEP were changed from 0mm to 15mm.

The existing 5m TUFLOW model of SID were updated with LiDAR (elevation data collected in 2014), additional structures, improved representation of streams and roads, and additional bathymetry data for Lake Kurwongbah dam. As a result of these changes, namely the 2014 LiDAR, the downstream boundary required modification to ensure that the resulting outflows were stable.

The model was set up in a manner prescribed by Council specifically for the RFD project to ensure a consistent approach across the whole Local Government Area (LGA) and to enable the model and model outputs to be integrated into Council’s RFD. Minimal flood maps have been provided within the report, as requested by Council. The model and model outputs for all events have been provided in digital format. The outcomes of this work will be included into Council’s Flood Explorer, used in the automated provision of Council’s flood reports provided to the community and used by Council to analyse and assist with managing flood risk in the Sideling Creek catchment.

6 References

BMT WBM, 2014, *Lower Pine River Pilot Model Improvement Study – Final Report*

SKM, 2012a*, Boundary Conditions, Joint Probability and Climate Change*

SKM, 2012b, *MBRC Regional Floodplain Database Floodplain Parameterisation*

WorleyParsons, 2012, *Regional Floodplain Database – Hydrologic and Hydraulic Modelling Report Sideling Creek (SID)*

BMT WBM Bangalow	6/20 Byron Street, Bangalow 2479 Tel +61 2 6687 0466 Fax +61 2 66870422 Email bmtwbm@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Brisbane	Level 8, 200 Creek Street, Brisbane 4000 PO Box 203, Spring Hill QLD 4004 Tel +61 7 3831 6744 Fax +61 7 3832 3627 Email bmtwbm@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Denver	8200 S. Akron Street, #B120 Centennial, Denver Colorado 80112 USA Tel +1 303 792 9814 Fax +1 303 792 9742 Email denver@bmtwbm.com Web www.bmtwbm.com
BMT WBM London	International House, 1st Floor St Katharine's Way, London E1W 1AY Email london@bmtwbm.co.uk Web www.bmtwbm.com
BMT WBM Mackay	PO Box 4447, Mackay QLD 4740 Tel +61 7 4953 5144 Fax +61 7 4953 5132 Email mackay@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Melbourne	Level 5, 99 King Street, Melbourne 3000 PO Box 604, Collins Street West VIC 8007 Tel +61 3 8620 6100 Fax +61 3 8620 6105 Email melbourne@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Newcastle	126 Belford Street, Broadmeadow 2292 PO Box 266, Broadmeadow NSW 2292 Tel +61 2 4940 8882 Fax +61 2 4940 8887 Email newcastle@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Perth	Level 3, 20 Parkland Road, Osborne, WA 6017 PO Box 1027, Innaloo WA 6918 Tel +61 8 9328 2029 Fax +61 8 9486 7588 Email perth@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Sydney	Level 1, 256-258 Norton Street, Leichhardt 2040 PO Box 194, Leichhardt NSW 2040 Tel +61 2 8987 2900 Fax +61 2 8987 2999 Email sydney@bmtwbm.com.au Web www.bmtwbm.com.au
BMT WBM Vancouver	Suite 401, 611 Alexander Street Vancouver British Columbia V6A 1E1 Canada Tel +1 604 683 5777 Fax +1 604 608 3232 Email vancouver@bmtwbm.com Web www.bmtwbm.com