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Detailed Integrated Stormwater Management Report Roma Urban Land Development Area Bowen Street, Roma

October 2011



Detailed Integrated Stormwater Management Report

Roma Urban Land Development Area Bowen Street, Roma

Prepared For: Urban Land Development Authority

Prepared By: BMT WBM Pty Ltd (Member of the BMT group of companies)

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Title :	Detailed Integrated Stormwater Management Report - Roma Urban Land Development Area - Bowen Street, Roma
Author :	Paul Dubowski, Nigel Hardie and Anne Kolega
Synopsis :	This report builds on the <i>Bowen Street, Roma - Concept Stormwater Management Report</i> (BMT WBM, 2011) providing a detailed assessment of stormwater quantity and quality for the Roma Urban Development Area.

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SUMMARY

As part of the Urban Land Development Authority's (ULDA) affordable housing strategy a mixed-use urban development is proposed for Bowen Street, Roma located in the Maranoa Regional Council local government area. The site has a total area of 24ha and will consist of over 300 dwellings and three large parkland areas.

The aim of this report is to demonstrate the type of stormwater management systems required to meet the relevant stormwater quantity and quality objectives.

This report includes the following two elements:

- Water Quantity Assessment (Section 2)
- Water Quality Management Plan (Section 3)

Based on the Maranoa Regional Council's Planning Scheme Maps, the site is located well outside the 100 Year ARI Flood Event. Therefore, no flood impact assessment has been undertaken for this development.

The **Water Quantity Assessment** presented in this report provides an assessment of the proposed development on the site's hydrology. The hydrological modelling undertaken as part of the concept SMP showed that without mitigation:

- peak flow-rates would increase in areas downstream of the eastern portion of the site and therefore treatment is required for this sub-catchment
- peak flow-rates would not increase in areas downstream of the western portion of the site and therefore no treatment is required for this sub-catchment.

The recommended treatment for the eastern portion of the site detailed in the *Bowen Street, Roma - Concept Stormwater Management Report* (BMT WBM, 2011) "the concept SMP", includes a detention basin with a **storage volume of 4,800m³** (e.g. surface area of 4,000m² and 1.2m storage depth).

During the concept design stage, rainwater tanks, stormwater harvesting and bioretention systems had also initially been identified as potential stormwater management options. Stormwater harvesting was discounted from the preferred strategy and the impact from this decision on detention volume was assessed. Given the conservative approach to hydrologic modelling adopted during the concept design phase, the detention basin storage volume would not be affected by the removal of stormwater harvesting.

The **Water Quality Management Plan** included in this report provides a detailed stormwater quality assessment of the proposed development considering recommendation of the *Bowen Street, Roma - Concept Stormwater Management Report* (BMT WBM, 2011).

The stormwater quality objectives adopted at the concept design stage were derived from the *State Planning Policy 4/10 Guideline for Healthy Waters* (DERM, 2010), (the SPP). Although currently under review, these objectives remain the most current objectives in Queensland legislation and therefore have also been adopted for the site during the detailed design phase.

There were 3 driving factors for reviewing the models developed during the concept design stage including:

- The removal of stormwater harvesting from the stormwater treatment strategy
- There were changes in the sub-catchments areas modelled during the concept design stage as result of more detailed earthworks information being available at the detailed design stage
- A new version of the modelling software has become available allowing more accurate pollutant removal predictions.

The treatment train adopted in the detailed design models consists of domestic rainwater tanks sized to meet Queensland Development Code MP4.2 water savings targets and bioretention systems.

In order to meet the stormwater quality objectives, bioretention systems (in conjunction with rainwater tanks) would need to be sized at no less than 0.8% of the catchment area. Bioretention systems sized at less than 1% of a contributing catchment typically experience a range of operational problems and therefore **the recommended size of bioretention systems is 1% of the contributing catchment**. It is expected that hydrological management objectives would also be met by constructing these systems. The equivalent bioretention filter surface area required for treatment would include be:

- **1,844m² for the western catchment. This will be accommodated in the Stage 6 parkland**
- **922m² for the eastern catchment. This will be accommodated in the Stage 8 parkland.**

Although the ultimate size of the systems may be up to twice the size of the filter media (due to batters and associated design requirements), the systems will be passively integrated into the parklands. This will assist in minimising the visual effect of the systems and maximise recreation opportunities in the parks.

The ultimate design of both the detention basin and bioretention systems including the size, shape, location and configuration is subject to further design at the operational works phase.

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1 INTRODUCTION

1.1 Background & Project Description

As part of the Urban Land Development Authority's (ULDA) affordable housing strategy a mixed-use urban development is proposed for Bowen Street, Roma located in the Maranoa Regional Council local government area.

The development includes over 300 dwellings and three large parkland areas which will serve a variety of uses including integrated stormwater solutions. A commercial/community use precinct is also proposed along the eastern boundary which will support the hospital and other needs of local residents. The proposed layout is illustrated in Figure 1-1 while a lot plan is available in Appendix A.

1.2 Site Description

1.2.1 Site Location

The site is located approximately 1.5 kilometres west of the Roma Town Centre, directly south of the Roma Hospital. The 24 hectare site is bounded by Bowen Street to the south, McDowall Street to the north, Cottell Street to the east and rural residential land to the west. It is also dissected by Currey Street. The site is located within the Balonne River Catchment, which is within the Murray Darling Basin.

The location of the site is shown in Figure 1-2.

1.2.2 Existing Land Usage

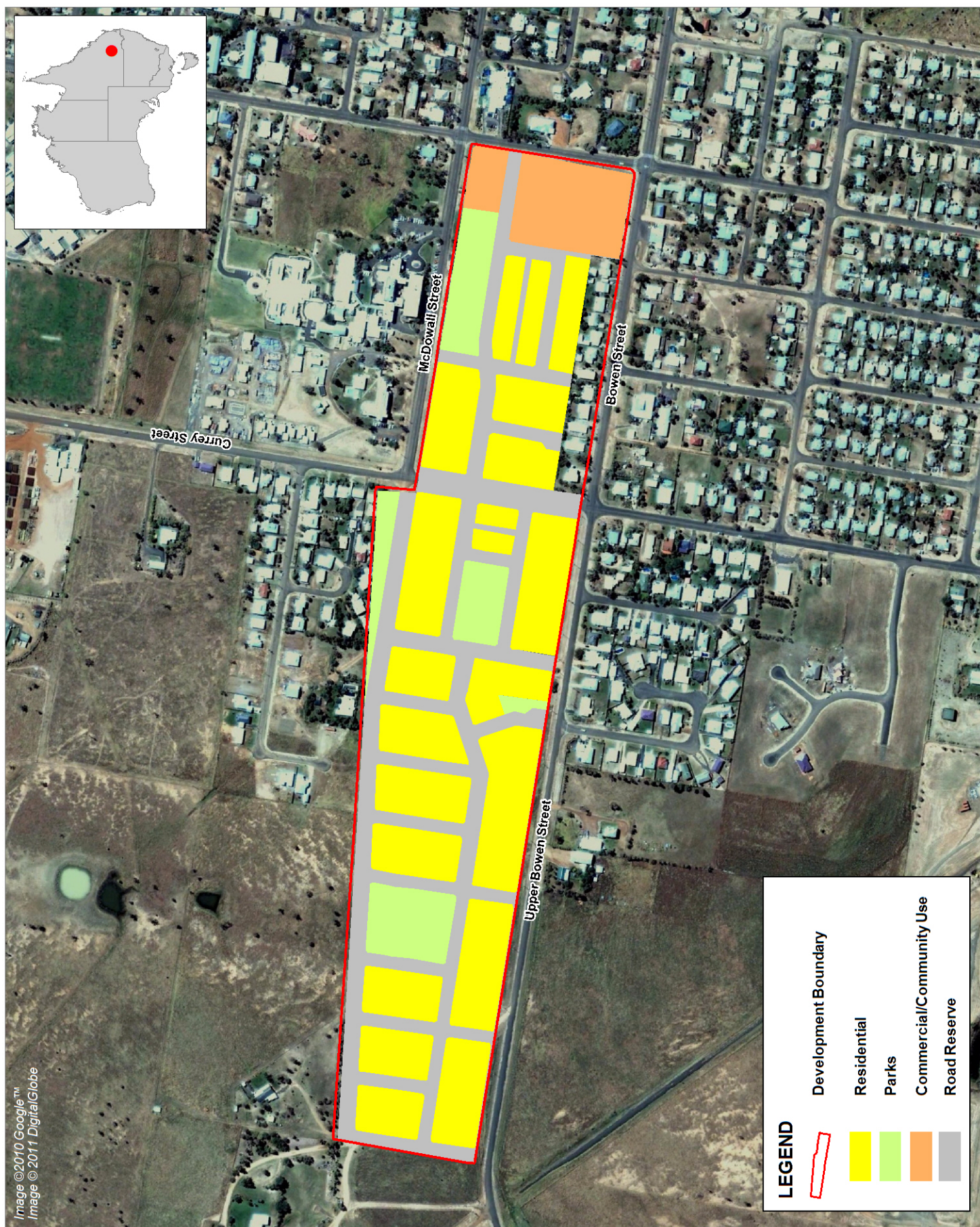
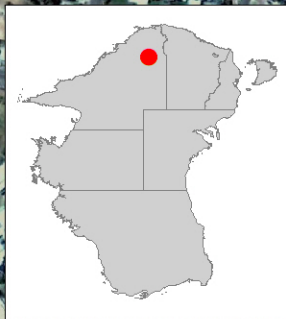
The site is predominantly rural and undeveloped, with residential lots within the eastern portion of the site.

1.2.3 Site Topography and Drainage

The existing topography of the site is predominantly flat with ground levels ranging from 313m AHD to 322m AHD. The highest elevation is approximately 322m AHD along the Currey Street ridgeline which dissects the site into two main sub-catchments. The eastern sub-catchment is divided into a smaller sub-catchment which drains away from the site in a south west direction and a larger sub-catchment which drains north to an open channel. The western sub-catchment drains to the north east into the existing stormwater network.

The existing topography is illustrated in Figure 1-3.

The proposed site topography will not vary significantly from the existing case with limited earthworks proposed.



Title:
Proposed Development Layout

Figure:
1-1

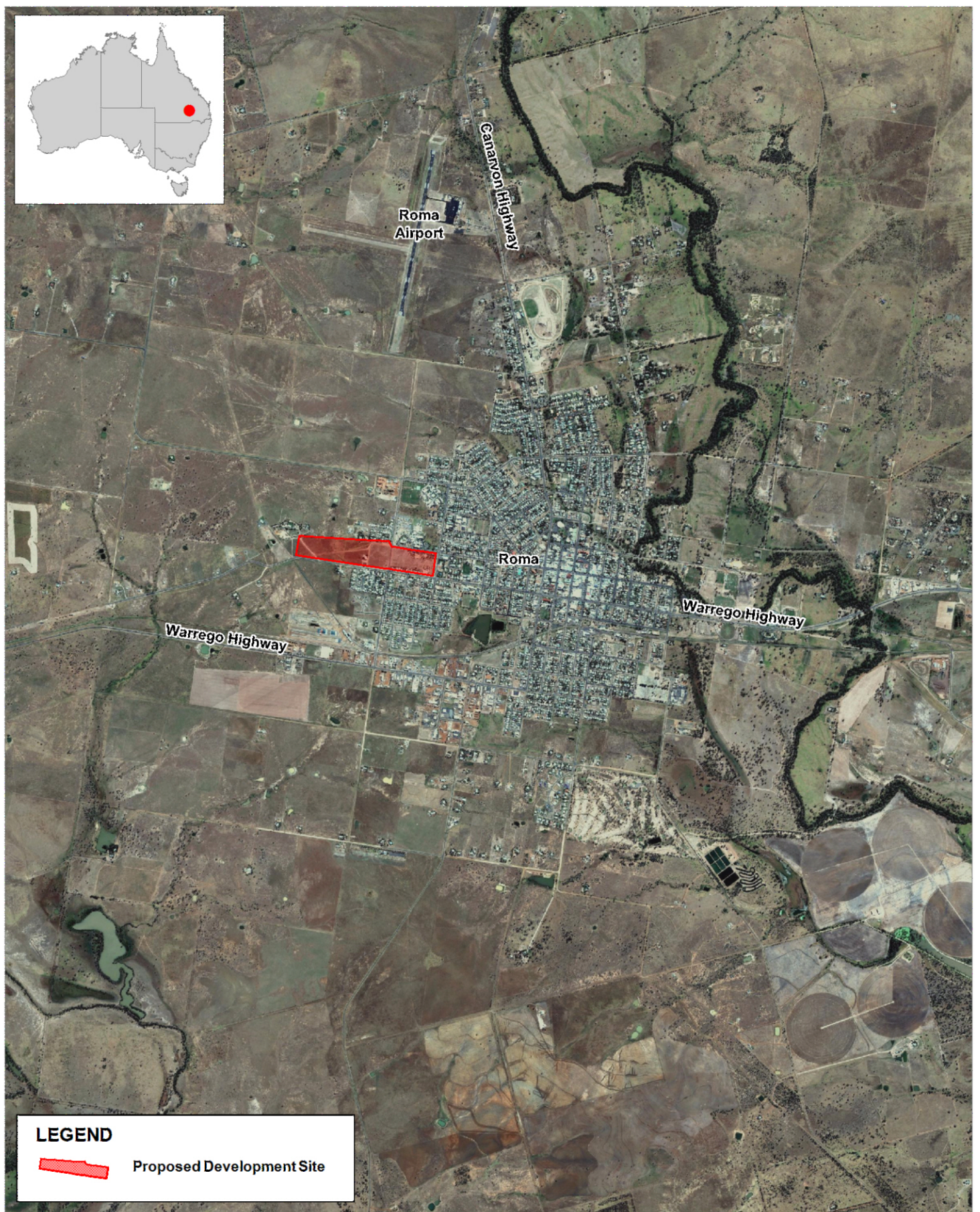
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Approx. Scale





LEGEND



Proposed Development Site

Title:
Location of Site

Figure:
1-2

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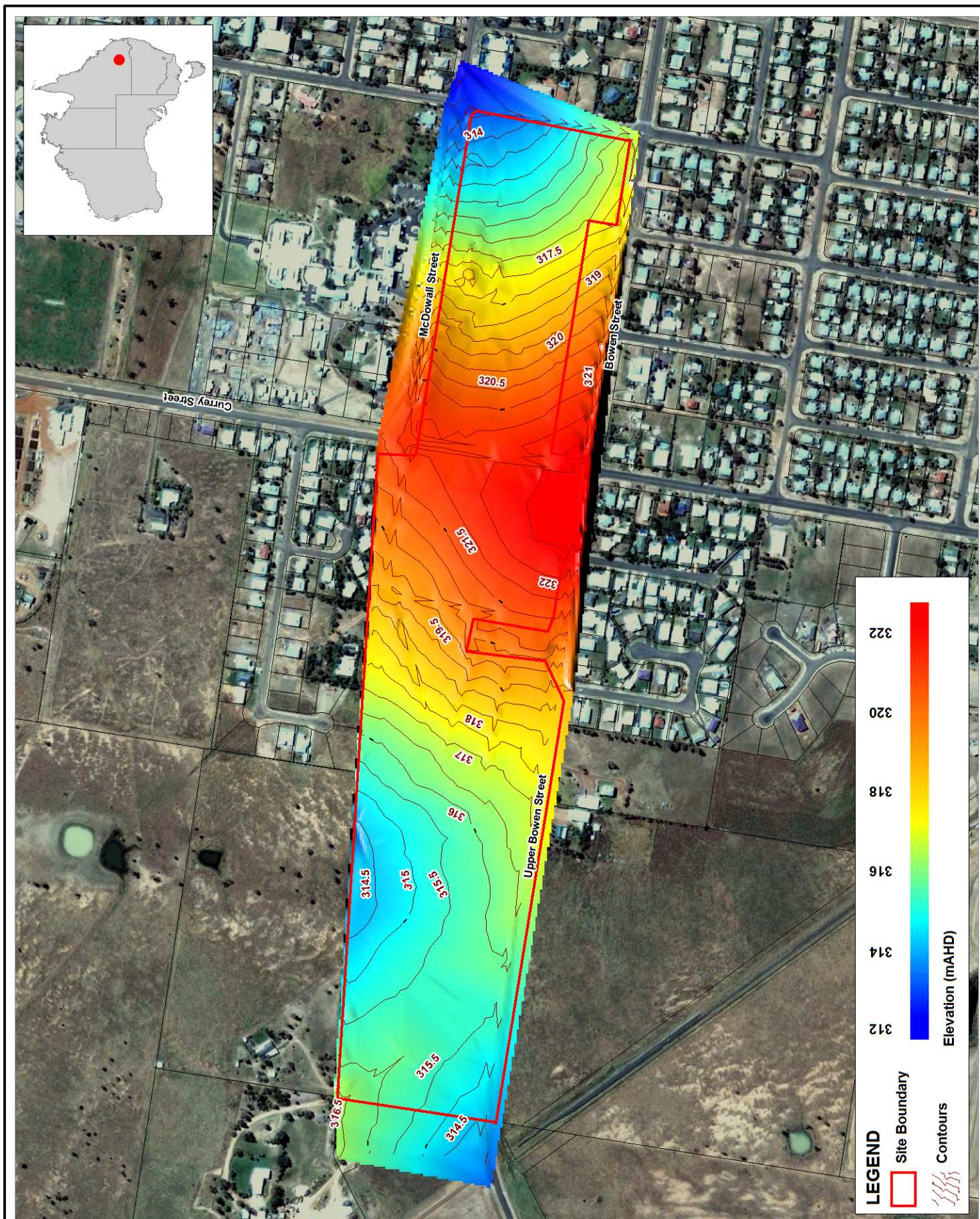


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Digital Elevation Model of Existing Site

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1.3 Scope of the Detailed Integrated Stormwater Management Plan

This Detailed Integrated Stormwater Management Plan provides a holistic approach to stormwater management for the proposed urban development during and after construction. The main elements of plan are:

- **Water Quantity Assessment (Section 2):** This section provides an assessment of the proposed development on site hydrology and provides recommendations as to how these impacts can be appropriately mitigated.
- **Water Quality Management Plan (Section 3):** This section provides a water quality assessment of the proposed development and explains how the proposed stormwater management strategy for the site will comply with the given water quality objectives.

Based on the Maranoa Regional Council's Planning Scheme Maps R6, the site is located well outside the 100 Year ARI Flood Event. Therefore, no flood impact assessment has been undertaken for this development.

2 WATER QUANTITY ASSESSMENT

2.1 Preamble

This section outlines the assessment of the proposed development on the site's hydrology and provides recommendations as to how these impacts can be addressed by further on-site works, such that the development complies with the requirements of the Maranoa Regional Council (MRC) Planning Scheme Policy.

Hydrologic modelling was initially undertaken during the concept design phase to assess the changes in peak flows and quantity of stormwater from the site in the existing and developed scenarios. Where further retention of flow is required to mitigate peak flows, the model has been utilised in the developed scenario to determine the extent of mitigation (i.e. sizing of a detention basin on site) needed to meet MRC requirements.

2.2 Operational Phase Stormwater Quantity Management Objectives

The MRC Planning Scheme reflects the following guidelines:

- State Planning Policy 1/03 – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide
- Queensland Urban Drainage Manual (Volume1 text, Volume 2 Design Charts)
- Australian Rainfall and Runoff (Volume 1, A guide to Flood Estimation).

The overall objective of the Planning Scheme in regards to flooding is that *“Residential development to be located in the Residential Zone clear of the flood inundated area of the 1 in 100 year event”*.

2.3 Hydrological Modelling

A hydrological assessment was undertaken to determine the flow behaviour across the site. The methodology and results were reported in the *Bowen Street, Roma - Concept Stormwater Management Report* (BMT WBM, 2011), hereafter referred to as “the concept SMP”. Hydrologic modelling of the site had been performed for three scenarios:

- *Existing*: current state of the site
- *Developed (with no mitigation)*: as existing condition with the development but no mitigation
- *Developed (with mitigation)*: as developed (with no mitigation) scenario, but with the inclusion of a detention basin in the eastern part of the site.

The hydrological modelling showed that without mitigation, peak flow-rates would increase in areas downstream of the eastern portion of the site but would not worsen in the western part of the site. A detention basin was subsequently required in the eastern portion of the site. No mitigation is required for the western catchment.

In order to addresses the stormwater management objectives **a detention basin with storage volume of 4,800m³ will be required** e.g. a basin with a surface area of 4,000m² and storage depth

limited to a maximum of 1.2m. This required detention basin will be integrated with recreational uses and stormwater quality treatment in the Stage 8 parkland area and is therefore subject to further design investigation at the operational works stage to maximise landscape integration.

The stormwater harvesting system identified in the concept SMP is no longer being adopted and therefore the impact from removing this system on the detention was checked as part of this detailed design report.

This review found that the modelling for design flood events allowed for conservative assumptions, i.e. the stormwater harvesting and rainwater tanks being full at the beginning of the flood event. Thus the design of the detention basin represents the necessary capacity needed to attenuate flooding without any of the water savings measures noted above. No change to the design of the detention basin is therefore recommended as a result of the exemption from water savings requirements.

2.4 Stormwater Quantity Conclusion

The hydrological modelling undertaken as part of the concept SMP showed that without mitigation:

- peak flow-rates would increase in areas downstream of the eastern portion of the site and therefore treatment is required for this sub-catchment
- peak flow-rates would not increase in areas downstream of the western portion of the site and therefore no treatment is required for this sub-catchment

The recommended treatment for the eastern portion of the site includes a detention basin with a storage volume of 4,800m³ (e.g. surface area of 4,000m² and 1.2m storage depth). This basin will be integrated with recreational uses and stormwater quality treatment systems in the Stage 8 parkland area.

There will be no changed required detention volume as a result of not adopting stormwater harvesting due to the conservative hydrological modelling adopted at the concept design phase.

3 WATER QUALITY MANAGEMENT PLAN

3.1 Preamble

This section provides a detailed assessment of the stormwater quality and receiving water hydrology management. This section explains how the proposed stormwater management strategy for the site will comply with the given stormwater management objectives.

3.2 Operational Phase Stormwater Quality Management Objectives

3.2.1 Stormwater Quality

The *State Planning Policy 4/10 Guideline for Healthy Waters* (Department of Environmental and Resource Management (DERM), 2010), hereafter referred to as “the SPP for Healthy Waters”, provides stormwater quality performance criteria for the operational phase of the development. The objectives listed in this guideline for “Western Districts” which had been adopted in the concept SMP are provided in Table 3-1.

The pollution reduction targets represent the mean annual stormwater pollutant load, comparing a developed (untreated) site to a developed (mitigated) site.

Table 3-1 Concept Pollutant Load Reduction Targets

Pollutant	Criteria
Total Suspended Sediment (TSS)	85 % reduction
Total Phosphorus (TP)	70 % reduction
Total Nitrogen (TN)	45 % reduction
Gross Pollutants (GP)	90 % reduction

These objectives were developed by DERM using MUSIC (Model for Stormwater Improvement Conceptualisation) Version 3 in accordance with the methodology outlined the document: “*Urban Stormwater: Queensland Best Practice Environmental Management Guidelines 2009: Technical Note: Derivation of Design Objectives*” (DERM, 2009). This methodology was in turn based on the document “*Water Sensitive Urban Design, Developing Design Objectives for Urban Development in South East Queensland* (Water by Design, 2007).

Since these objectives were developed, more current versions of the software were released. The most current version available is MUSIC Version 5 and the treatment performance of bioretention systems varies between these models. As a result, DERM have commenced reviewing the objectives for the State however this process is not expected to be completed until mid-2012. The objectives adopted in the concept SMP for Roma were therefore also adopted at the detailed design stage.

3.2.2 Hydrologic Management Objectives

The SPP for Healthy Waters also identifies hydrologic management objectives for frequent flow and waterways stability management. The hydrologic management objectives adopted for this site include:

- Limiting the post-development peak one-year average recurrence interval (ARI) event discharge within the receiving waters to the pre-development peak.
- Capturing and managing the first 15 mm of runoff from impervious surfaces where the total impervious surface is greater than 40%.

These objectives have also been adopted for the development as noted in the concept SMP.

3.3 Modelling Approach

3.3.1 Preamble

The performance of stormwater treatment strategies in managing stormwater pollutants (during the operational phase) has been assessed using the MUSIC as part of the concept design. Subsequent to this report a number of changes had occurred driving a need to undertake new modelling as part of detailed design. The main changes which occurred included:

- The removal of stormwater harvesting from the stormwater treatment strategy impacts on water quality results
- During the concept design stage the site was separated into 3 sub-catchments however during the detailed design phase it was confirmed that as a result of earthworks there would only be 2 sub-catchments (eastern and western). The revised sub-catchment layout for the proposed development is illustrated in Figure 3-1.
- An updated version of the MUSIC software had become available providing more reliable modelling predictions.

The modelling described in this report takes account of these changes and demonstrates how stormwater quality objectives will be achieved with a revised approach to treatment. The most current version of MUSIC (Version 5.0) has been used to model the site during the detailed design process.

3.3.2 Modelling Scenarios

There were 3 scenarios modelled including the following:

- *Base Case - Undeveloped Site.* The base case is an assessment of the undeveloped site in its current state represented by 'rural residential' parameters.
- *Developed Case - Unmitigated.* The developed case without mitigation is essentially an assessment of what would occur if the site were developed without any integration of stormwater treatment systems.
- *Developed Case - Mitigated.* This case is an assessment of the fully developed site with domestic rainwater tanks sized to meet Queensland Development Code MP4.2 water

savings targets and bioretention installed in each sub-catchment, sized to meet stormwater quality objectives.

For consistency, the unmitigated and mitigated scenarios have been modelled using identical source node parameters. The meteorological parameters, source node parameters and treatment node parameters adopted in these models are presented in Appendix B. Rainwater tanks are further discussed in Section 3.3.3 while bioretention systems are further discussed in Section 3.3.4.

Commercial/Community Use Areas

The commercial/community use areas have been excluded from the water quality assessment within this report. These areas will ultimately be developed separately, with ULDA acting as the assessment manager for applications made over this land. The ULDA will assess these applications against the “*Residential 30: Guideline to Deliver Diversity in New Neighbourhood Development*” (ULDA, 2010), which includes provisions for stormwater management. Developers of these allotments will therefore need to demonstrate to the ULDA compliance with the same best practices objectives outlined in Section 3.2, ensuring stormwater is treated to a suitable standard.

An appropriate planning mechanism is therefore in place to ensure the stormwater from the commercial sub-catchments will be treated to appropriate standards at a subsequent stage of the development process.