

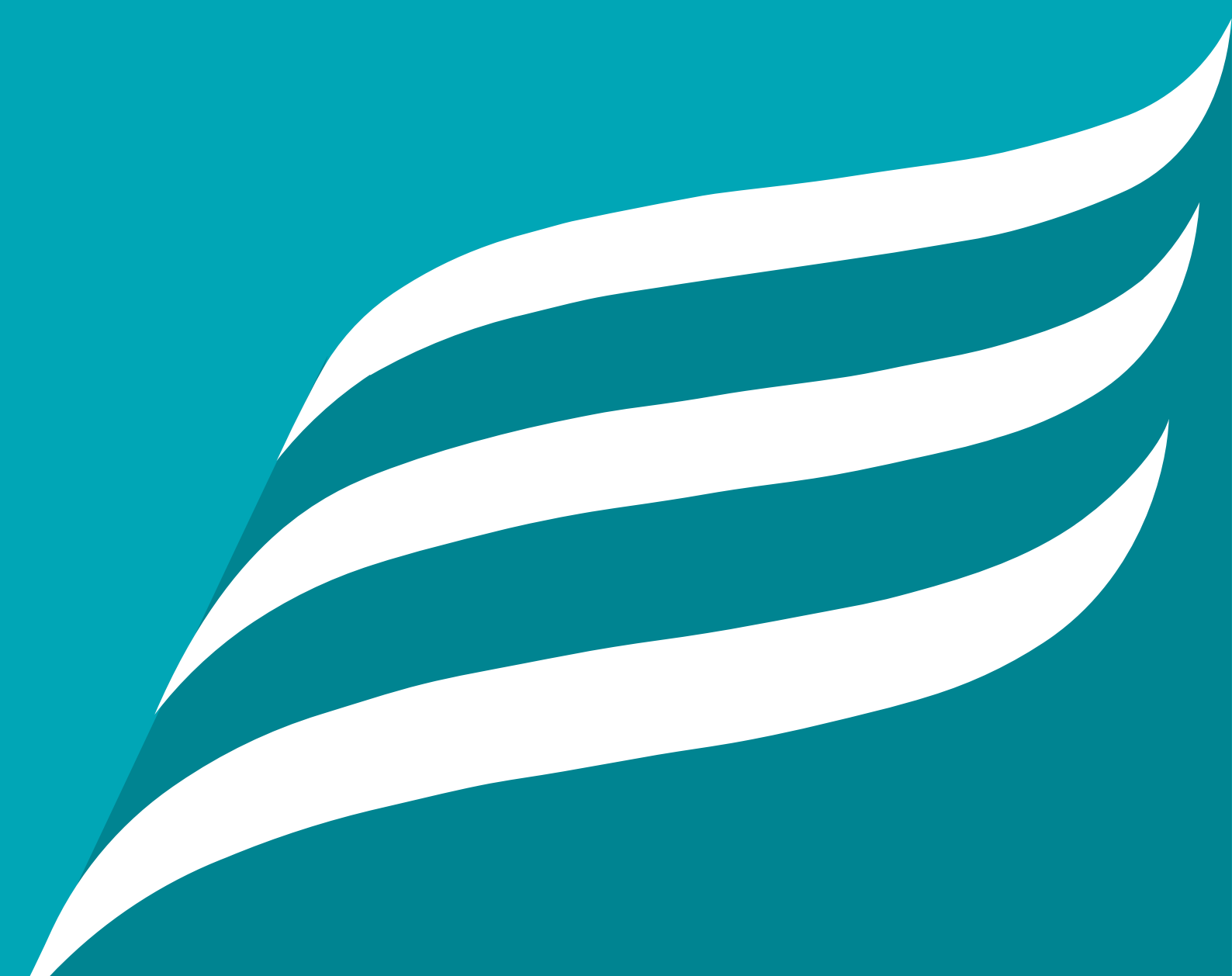
Appendix E
**Site Based Stormwater
Management Plan**



PEET LIMITED
Flagstone City CA5 North
Site-Based Stormwater Management Plan

00413_0007-REP-001-2

14 MAY 2026



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CONTENTS

1. Introduction	1
1.1 Site Characteristics	4
1.2 Project Purpose and Scope	4
1.3 Project Data and Guidelines	4
1.4 Performance Criteria	5
2. Stormwater Quality Management	6
2.1 Construction Phase	6
2.2 Operational Phase	6
2.2.1 Climate Data	6
2.2.2 Catchment Properties	6
2.2.3 Treatment System	9
2.2.4 Treatment Train and Sizing	9
2.3 MUSIC Modelling Results	10
2.4 Comparison to Stormwater IMP	10
3. Stormwater Quantity Management	12
4. Waterway Stability Management	13
5. Performance Criteria Compliance	15
6. Conclusion	16
7. Qualifications	17

Tables

Table 2.1: Adopted Water Quality Objectives	6
Table 2.2: Landuse Parameters	7
Table 2.3: Catchment Parameters.....	7
Table 2.4: Treatment Train Parameters.....	9
Table 2.5: MUSIC Model Results	10

Figures

Figure 1.1: Flagstone Zoning Plan (RPS, March 2025) (Approval Ref. DEV2025/209/25)	1
Figure 1.2: Flagstone CA5 North Study Area	2
Figure 1.3: Proposed ROL Lot Layout (RPS, March 2026)	3
Figure 2.1: MUSIC Modelling Catchments	8
Figure 2.2: MUSIC Model Layout.....	9
Figure 2.3: Masterplan Stormwater Quality Structures (Excerpt from SW IMP)	10
Figure 2.4: Comparison to Stormwater IMP Stormwater Quality Structures	11
Figure 4.1: Waterway Stability Design Objectives (Excerpt from SPP).....	13

1. INTRODUCTION

Engeny Australia Pty Ltd (Engeny) was engaged by Peet Limited (Peet) to prepare a Site-Based Stormwater Management Plan (SBSMP) for the proposed Context Area 5 (CA5) North development located in Flagstone, Queensland.

The CA5 North application area forms part of the overarching Flagstone City master-planned development in the Greater Flagstone PDA as indicated by the endorsed Flagstone Zoning Plan prepared by RPS below in Figure 1.1. The location of CA5 North within the Flagstone City Development is shown below in Figure 1.2.

The proposed ROL Lot Layout prepared by RPS for CA5 North is provided in Figure 1.3.

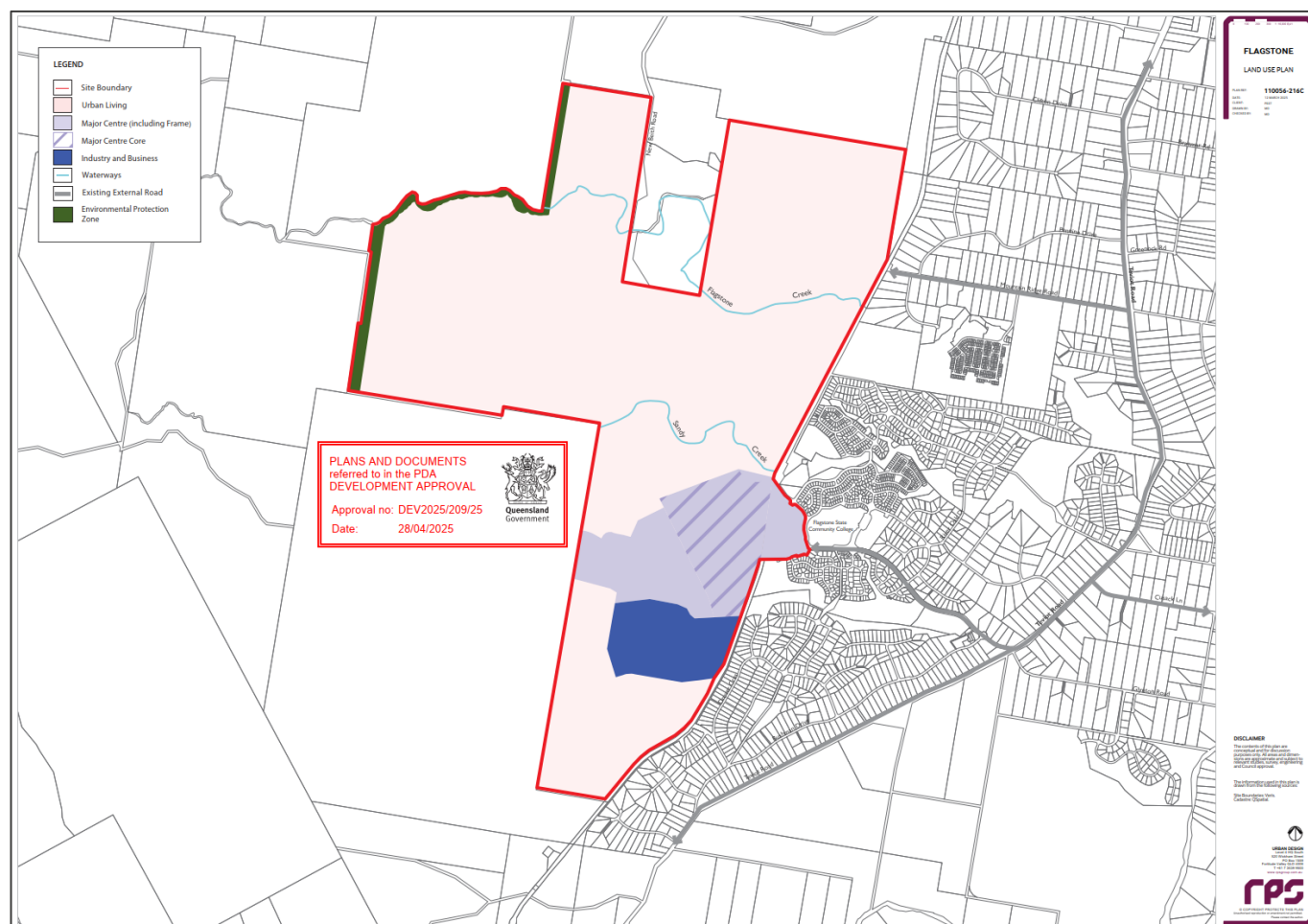


FIGURE 1.1: FLAGSTONE ZONING PLAN (RPS, MARCH 2025) (APPROVAL REF. DEV2025/209/25)

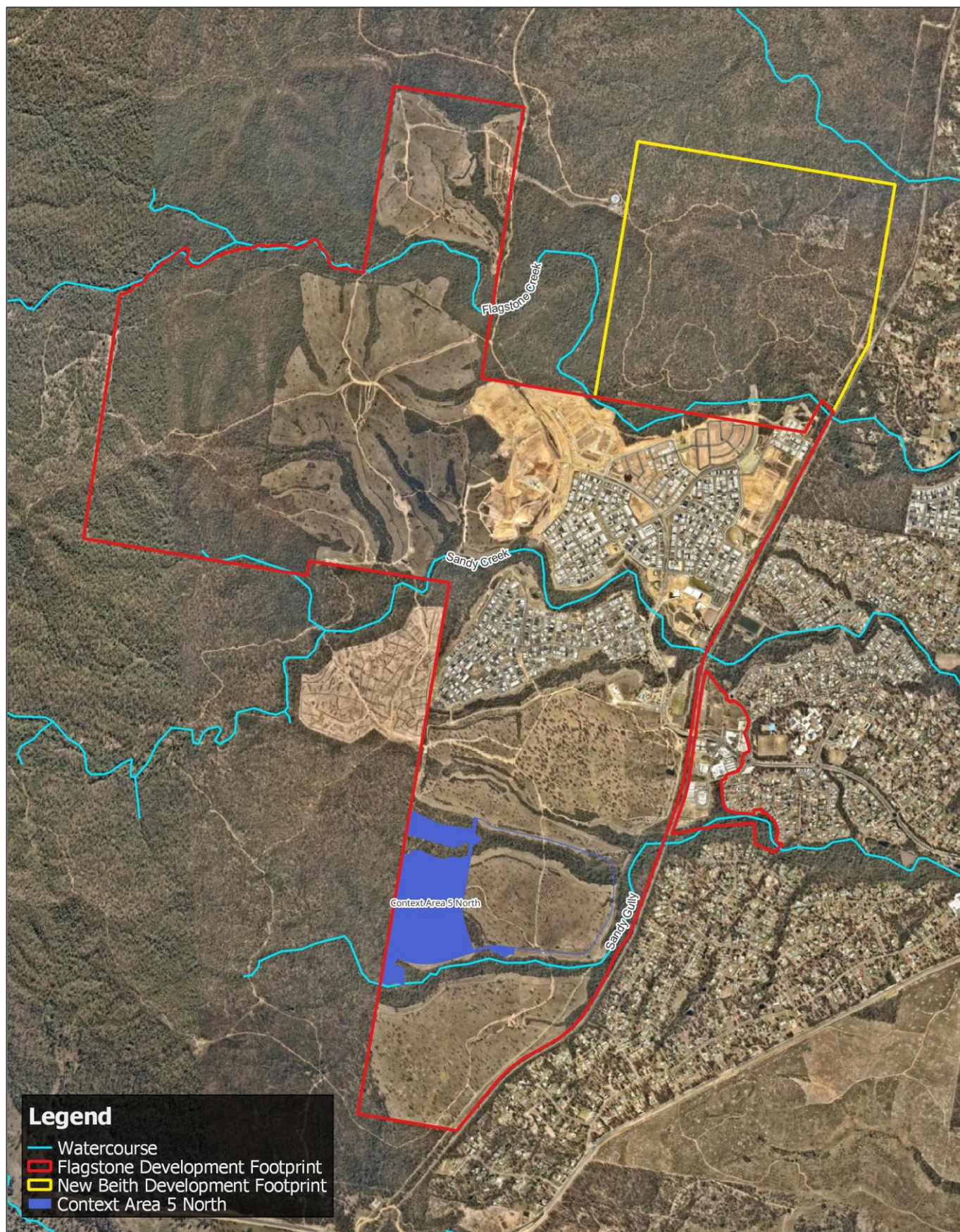
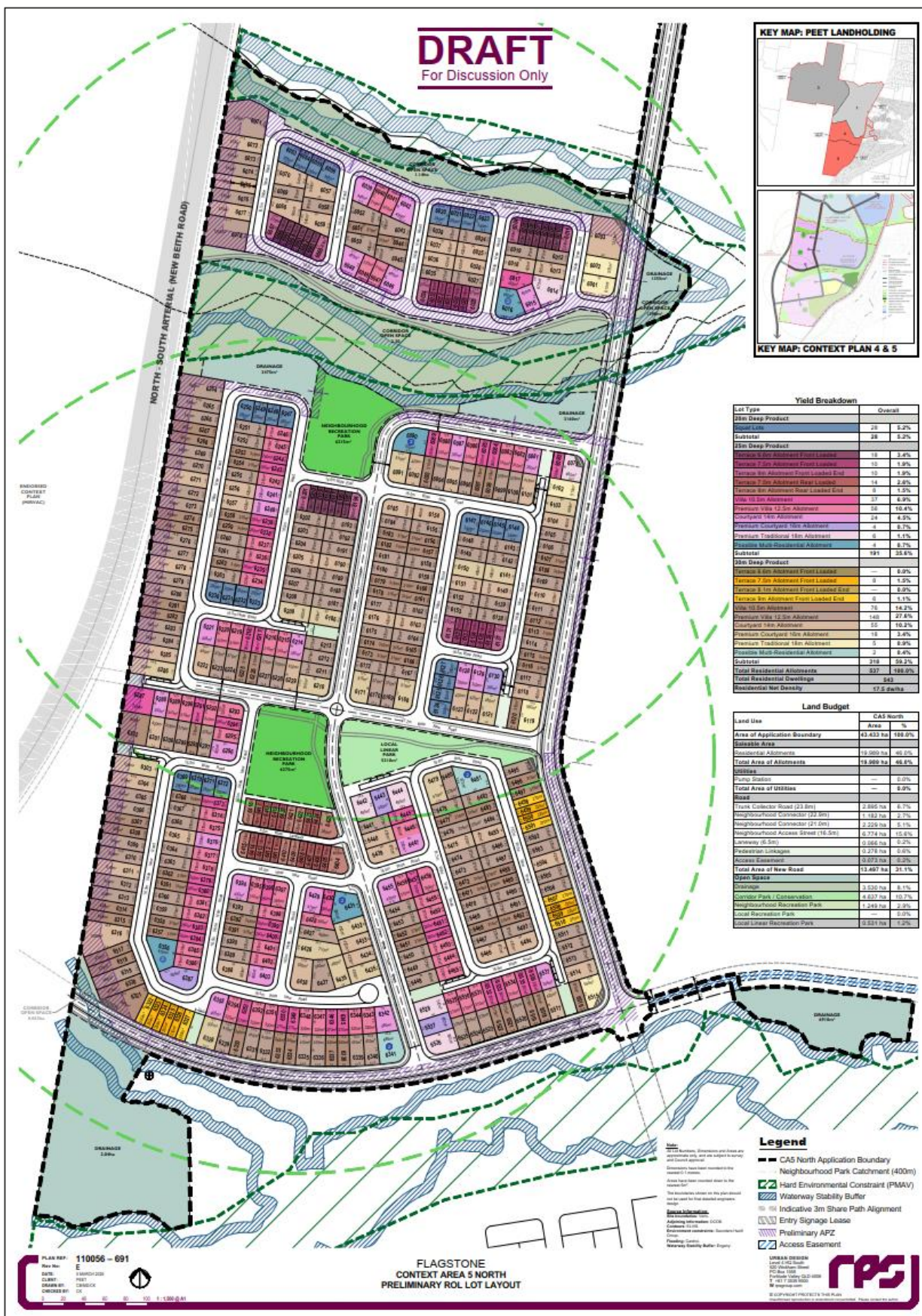


FIGURE 1.2: FLAGSTONE CA5 NORTH STUDY AREA



1.1 Site Characteristics

The CA5 North development is proposed to create the following:

- 537 residential allotments (543 residential dwellings) covering 19.989 ha.
- 13.497 ha of new roads.
- 0.531 ha of local linear recreation park.

The development currently discharges runoff to Sandy Gully and the tributaries of Sandy Gully and is proposed to generally maintain this condition in the Post-Development scenario.

1.2 Project Purpose and Scope

This SBSMP was developed to demonstrate how the proposed development will achieve the management objectives for stormwater quality, stormwater quantity, and waterway stability as outlined in the endorsed *Flagstone City Stormwater IMP (Engeny, November 2025) (Ref. QC4012_002-REP-007-2) (Approval Ref. DEV2012/209/6/16 dated 23 December 2025)* (referred to herein as the SW IMP).

The scope of the project included the following:

- Stormwater Quality:
 - Development of a Model for Urban Stormwater Improvement Conceptualisation (MUSIC) model to estimate pollutant loads generated by the proposed development in the Post-Development Scenario.
 - Development of a stormwater quality treatment train at each catchment outlet of the proposed development sized to achieve the required load-based reduction targets in the Post-Development Scenario.
- Stormwater Quantity:
 - Consideration of flooding requirements to ensure peak flows are mitigated downstream of the development.
- Waterway Stability:
 - Analysis of erosion risk in the Pre-Development and Post-Development scenarios for the 63.2%, 50%, 2%, and 1% AEP design storm events.
 - Determination of whether detention basins are required at development outlets to mitigate the 63.2% AEP to ensure the *State Planning Policy (DILGP, 2017)* (referred to as the SPP) requirements for waterway stability are met.
 - If required, sizing of detention basins to mitigate the 63.2% AEP at local development outlets.

1.3 Project Data and Guidelines

The following data was utilised for this assessment:

- Flagstone Context Area 5 North Urban Design layout (ref. 110056-691 Rev E) (RPS, 5 March 2026).
- Flagstone Context Area 5 civil catchments supplied by Colliers on 26 March 2026.
- Flagstone Context Area 5 Bulk Earthworks surface supplied by Colliers on 27 March 2026.
- Greenbank Thompson Road station (ID 40659) rainfall data.

The stormwater planning and associated modelling was undertaken in accordance with the following guidelines:

- Queensland Urban Drainage Manual (IPWEA, 2016).
- Australian Rainfall and Runoff (ARR) 2019 (Ball, et al, 2019).
- State Planning Policy (DILGP, 2016).
- MUSIC Modelling Guidelines (Water by Design, 2018).

1.4 Performance Criteria

The management objectives applicable to Flagstone City and CA5 North are outlined in the SW IMP for stormwater quality, stormwater quantity, and waterway stability. The performance targets for these management objectives from the SW IMP are summarised below:

- Stormwater Quality:
 - 80% reduction in total suspended solids.
 - 60% reduction in total phosphorus.
 - 45% reduction in total nitrogen.
 - 90% reduction in gross pollutants.
- Stormwater Quantity:
 - No increases to peak flows downstream of the Flagstone City development.
 - No development within the 1% AEP flood extent unless peak flows are appropriately mitigated to ensure no increases across the range of design events.
- Waterway Stability
 - Existing watercourses to be maintained for conveyance of stormwater runoff.
 - Consideration of existing waterway conditions and minimisation of disturbance.
 - Provision of adequate buffers between development and waterways.

The proposed CA5 North development was also designed with consideration of the *Flagstone City Total Water Cycle Management (Engeny, April 2025)* (referred to as the TWCMP).

2. STORMWATER QUALITY MANAGEMENT

2.1 Construction Phase

An Erosion and Sediment Control program and plan will be prepared for the construction phase of the development. This will be completed for the Site as part of the site contractor's management of the Site and is to be kept on Site and implemented for the duration of the construction phase.

2.2 Operational Phase

The load-based reduction targets required at the Site are outlined below in Table 2.1. These targets are in accordance with the SPP, Stormwater Quality and Flow Management Guidelines (LCC, July 2013), the Logan Planning Scheme (LCC, February 2023), and the SW IMP.

TABLE 2.1: ADOPTED WATER QUALITY OBJECTIVES

Pollutant	Minimum Load-Based Reduction Target (%)
Total Suspended Solids (TSS)	80
Total Phosphorus (TP)	60
Total Nitrogen (TN)	45
Gross Pollutants (GP)	90

2.2.1 Climate Data

Climate data for the catchment was sourced from the Bureau of Meteorology (BOM). Rainfall data was obtained from the Greenbank Thompson Road station (ID 40659) for the 10 years between 1980 and 1989 at six (6) minute intervals, resulting in a mean annual rainfall of 784 mm.

2.2.2 Catchment Properties

The proposed bioretention basin locations and associated contributing catchment areas for water quality treatment are outlined in Figure 2.1. A lumped catchment approach was adopted for the modelling and is considered appropriate based on inspection of aerial imagery and the intended use of the Site. The land use of the proposed development area was adopted as residential, with the fraction impervious percentage based on the lot density. The land use breakdown is provided in Table 2.2 and the modelled catchment parameters are provided in Table 2.3.

Rainfall-runoff and pollutant-export parameters were adopted from the recommended values identified in *MUSIC Modelling Guidelines (Water by Design, 2018)*.

TABLE 2.2: LANDUSE PARAMETERS

Land Use	Fraction Impervious (%)
Open Space and Recreation	10
Standard Residential Allotment (<30m deep product)	70
Multi Residential Allotment (25m deep product)	80
Multi-Residential Allotment (30m deep product)	85
Road	100

TABLE 2.3: CATCHMENT PARAMETERS

Catchment	Area (ha)	Fraction Impervious (%)
1	6.039	81.8
2	6.027	70.3
3	3.940	72.5
4	11.500	71.9
5	11.113	66.1



FIGURE 2.1: MUSIC MODELLING CATCHMENTS

2.2.3 Treatment System

Stormwater runoff from each catchment will be discharged into a bioretention basin at the catchment outlet upstream of the receiving waterway. Each bioretention basin is recommended to include a coarse sediment treatment device to ensure the long-term health and longevity of the vegetation within the basin.

2.2.4 Treatment Train and Sizing

The bioretention system has been modelled in MUSIC in accordance with the *MUSIC Modelling Guidelines (Water by Design, 2018)*. The treatment train produced in MUSIC is outlined in Figure 2.2.

Sizing of the coarse sediment inlet ponds and coarse sediment forebays was undertaken in accordance with the equations presented in the *Wetland Technical Design Guidelines (Water by Design, 2017)* for a design removal efficiency of 80%.

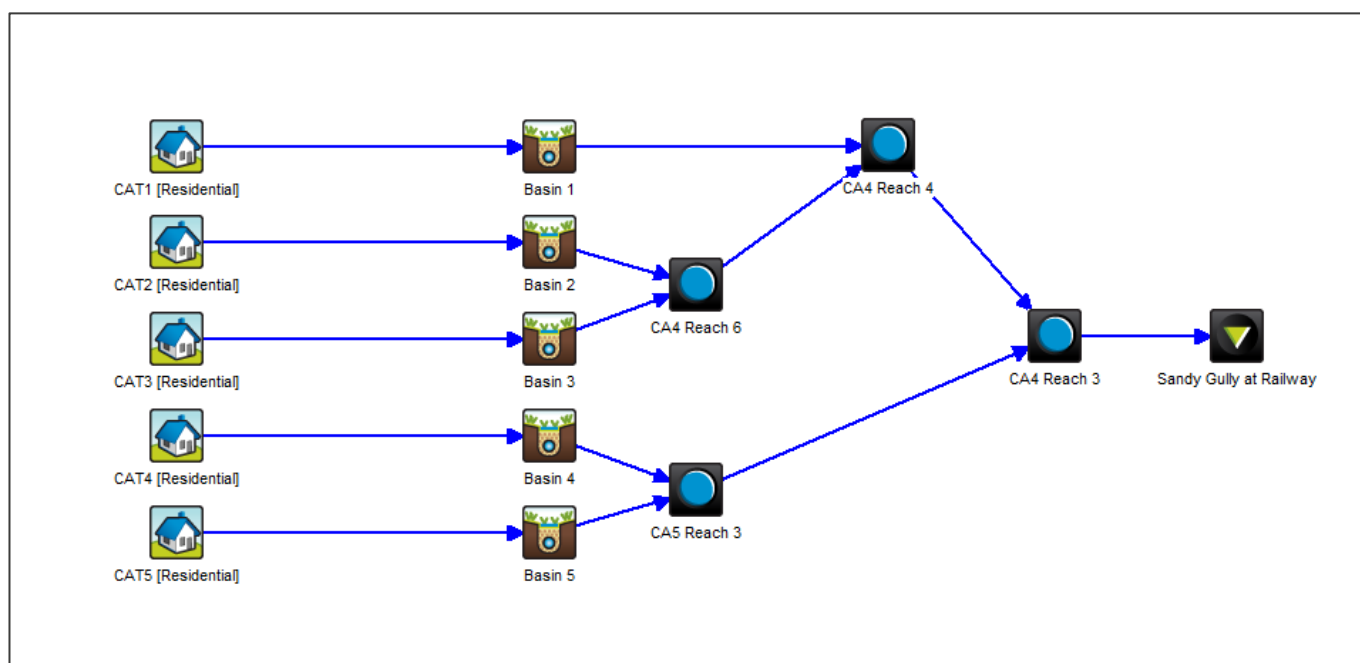


FIGURE 2.2: MUSIC MODEL LAYOUT

The details of the proposed treatment train are included in Table 2.4. It is proposed that all basins are constructed with a saturated zone depth of 0.45 m, filter media depth of 0.5 m, and extended detention depth of 0.3 m.

TABLE 2.4: TREATMENT TRAIN PARAMETERS

Basin	Filter Area (sqm)
1	430
2	400
3	270
4	760
5	670

It is recommended that the design of the bioretention basin outlets target a 5% AEP flood immunity as per the Guideline for satisfying the outcome of PO27 of the Logan City Council Planning Scheme. The civil consultant has confirmed that the concept design includes sufficient fall from the basin to the waterway such that the 5% AEP outlet immunity is achievable pending detailed design checks. Where sufficient fall does not exist, a non-return valve will be proposed to ensure the filter media is not affected.

2.3 MUSIC Modelling Results

Results of the MUSIC model is presented in Table 2.5. The results of the MUSIC modelling indicate that the load-based reduction targets have been achieved with the proposed treatment train. As such, the proposed treatment measures will be adopted for the Site.

TABLE 2.5: MUSIC MODEL RESULTS

Outlet Location	TSS Reduction (%)	TP Reduction (%)	TN Reduction (%)	GP Reduction (%)
CA4 Reach 6	82.6	60.6	48.9	100
CA4 Reach 4	81.9	60.4	48.5	100
CA5 Reach 3	81.5	60.1	48.2	100
CA4 Reach 3	81.6	60.3	48.3	100

2.4 Comparison to Stormwater IMP

There are several additional stormwater quality structures proposed for CA5 North than what is shown in the endorsed SW IMP (excerpt below in Figure 2.3). The additional devices are necessary to ensure the stormwater quality management objectives and performance targets can be met within the constraints of the Site. The proposed bioretention basin locations reflect the stormwater servicing and overall grading that can be achieved within CA5 North. It is noted that the SW IMP is an overarching planning document, and the proposed stormwater quality treatment strategy reflects the refinement of this strategy now that detailed design documentation has been prepared.

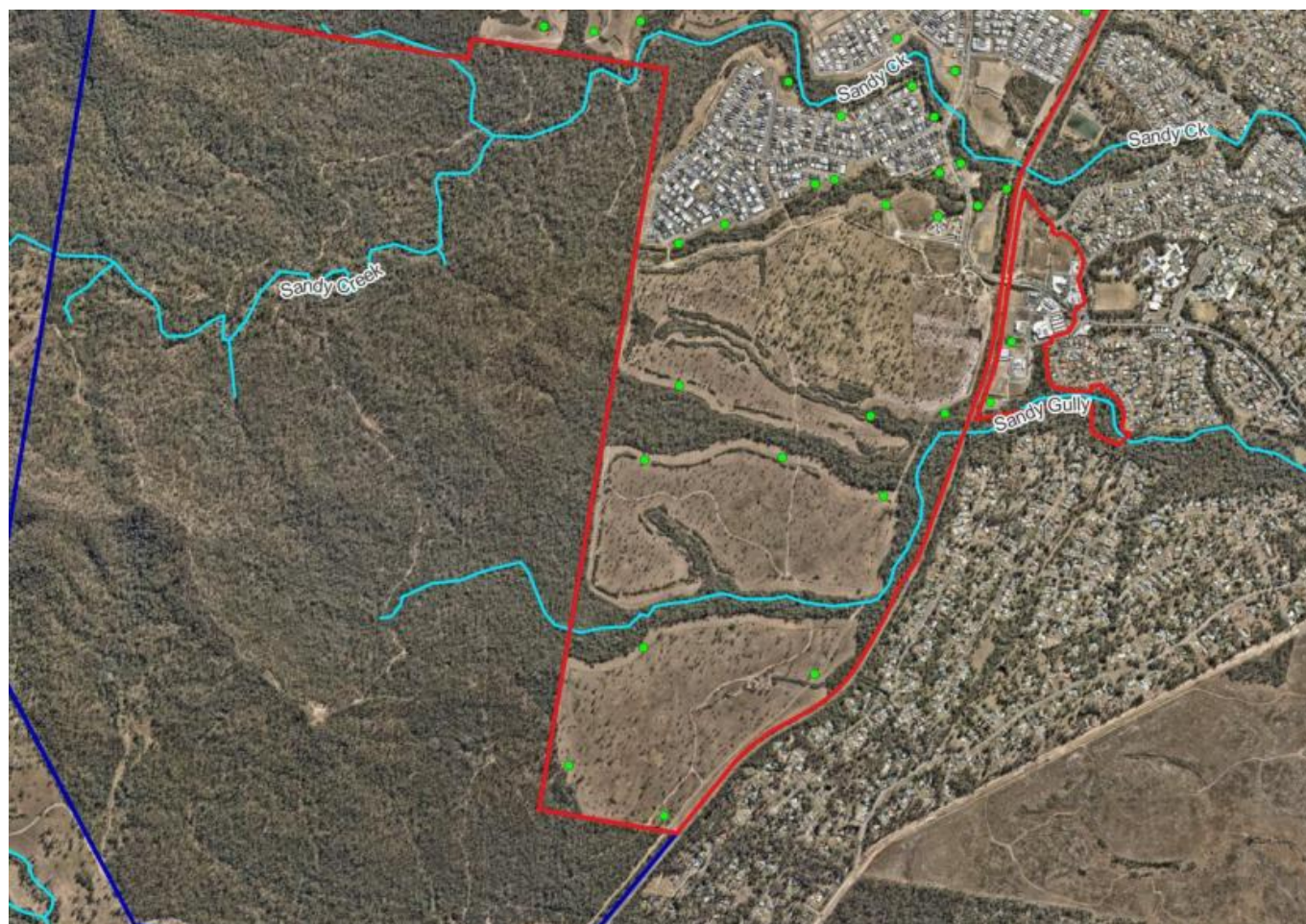


Figure 2.3: Masterplan Stormwater Quality Structures (Excerpt from SW IMP)

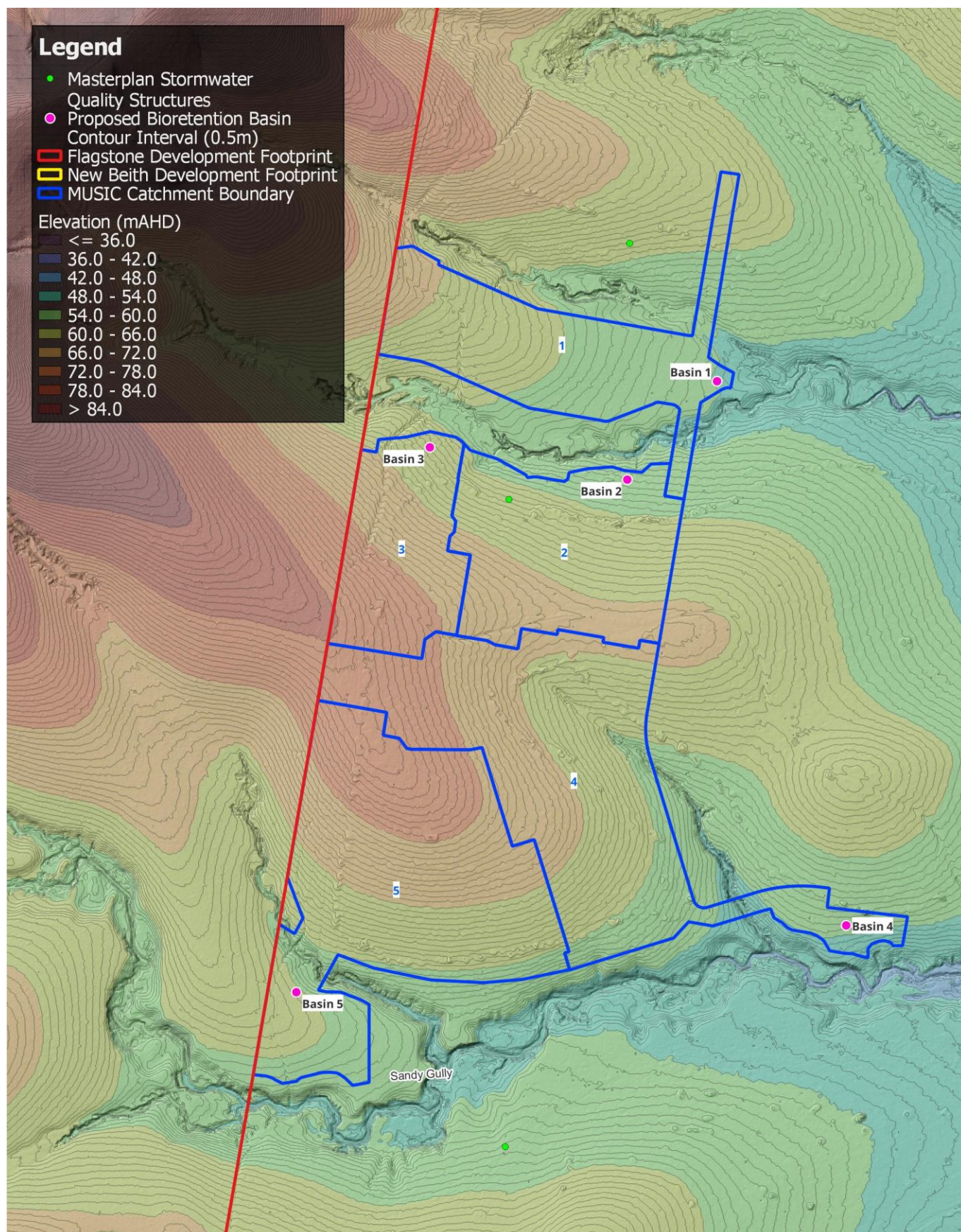


Figure 2.4: Comparison to Stormwater IMP Stormwater Quality Structures

3. STORMWATER QUANTITY MANAGEMENT

Stormwater quantity management is proposed to be achieved through a masterplan solution as outlined in the *Flagstone City Masterplan Flood Management Strategy (FMS)* (Engeny, April 2026) (Ref. QC4012_002-REP-001-7). It is proposed that the following structures are constructed to facilitate development of CA5 North in accordance with the Masterplan FMS report:

- Structure 4 on the Sandy Gully tributary – north of CA5 North and south of the CA4 Finger.
- Structure 5 on the Sandy Gully tributary – north of CA5 North and the CA4 Finger.
- Structure 7 on the Sandy Gully tributary – downstream of Structures 4 and 5.

The proposed structures and their sizing and location are generally consistent with the endorsed SW IMP, with some minor changes incorporated to ensure the new design information meets the relevant development objectives.

4. WATERWAY STABILITY MANAGEMENT

The *State Planning Policy (DILGP, July 2017) (SPP)* outlines design objectives relating to waterway stability as outlined in the excerpt below in Figure 4.1. The SPP specifies that the waterway stability management design objectives must be met by mitigating the 63.2% AEP peak flows in the post-developed scenario to the pre-development flows 'if development drains to an unlined waterway within or downstream of the site where a risk of increased erosion exists due to changes in hydrology'.

Climatic region	Design objectives				
	Reductions in mean annual load from unmitigated development (%)				
	Total suspended solids (TSS)	Total phosphorus (TP)	Total nitrogen (TN)	Gross pollutants >5mm	Waterway stability management
South East Queensland	80	60	45	90	Limit the peak 1-year ARI event discharge within the receiving waterway to the pre-development peak 1-year ARI discharge
Central Queensland (south)	85	60	45	90	
Central Queensland (north)	75	60	40 ¹⁵	90	
Cape York ¹⁴ , wet tropics and dry tropics	80	60 ¹⁶	40	90	
Western Queensland ¹⁴	85	60	45	90	

Notes:

- Mapping of climatic regions is available on the State Planning Policy Interactive Mapping System.
- In lieu of modelling, the default bio-retention treatment area to comply with load reduction targets for all Queensland regions is 1.5 per cent of the contributing catchment area.
- Water stability objective applies if development drains to an unlined waterway within or downstream of the site where a risk of increased erosion exists due to changes in hydrology. Local government may also require application of the waterway stability objective where there are planned future rehabilitation works to return a lined channel to a natural channel design.
- The SPP Water quality guidance material provides advice on the measures that demonstrate compliance with table B.

FIGURE 4.1: WATERWAY STABILITY DESIGN OBJECTIVES (EXCERPT FROM SPP)

All waterways within Flagstone City are unlined waterways, and these are intended to remain as natural channels with waterway works limited to those to provide stability and access. Detailed analysis of the waterways surrounding and downstream of the CA5 North development was undertaken to determine if waterway stability management objectives outlined in the SPP apply. The outputs from the Masterplan FMS TUFLOW model were used to determine whether the development will cause increased erosion risks to the waterway if the 63.2% AEP event is discharged unmitigated.

The *Waterway Stability Assessment – Flagstone CA5 (Engeny, May 2026)* (Ref. BNE00413_0010-REP-001-1) and *Waterway Stability Assessment – Flagstone CA4 (Engeny, May 2026)* (Ref. BNE00413_0013-REP-001-1) reports provide details of the waterway analysis undertaken to support the application. The analysis includes, but is not limited to:

- An on-site visual inspection of the waterways and their current condition.
- Interrogation of the Masterplan Scenario flood results including raster outputs of velocity, bed shear stress and stream power.
- Interrogation of the Baseline Scenario and Masterplan Scenario peak flows within the receiving waterways.
- Recommendation of specific works to both rectify existing unstable areas and ensure long term stability of at-risk areas.

It is noted that the online flood mitigation strategy proposed for the Flagstone City development will results in peak flow increases within the Site in all simulated events when comparing the Masterplan Scenario to the Baseline Scenario. The waterway stability works

recommended in the stability reports are sufficient to manage the waterway erosion potential caused by any increased peak flows. As such, with implementation of the recommended stability works, it is considered that the development proposal does not present a risk of increased erosion due to changes in hydrology, and the requirements of the SPP are satisfied without detention basins to mitigate the 63.2% AEP peak flows at the development outlets to the receiving waterway.

Please refer to the *Waterway Stability Assessment – Flagstone CA5 (Engeny, May 2026) (Ref. BNE00413_0010-REP-001-1)* and *Waterway Stability Assessment – Flagstone CA4 (Engeny, May 2026) (Ref. BNE00413_0013-REP-001-1)* reports for detailed analysis and reporting of the waterway stability requirements and how they are managed in relation to the SPP requirements.

5. PERFORMANCE CRITERIA COMPLIANCE

The performance criteria for the development relating to stormwater quality, stormwater quantity, and waterway stability was outlined in Section 1 of this report. The performance criteria are outlined in the endorsed SW IMP and are required to be achieved to facilitate development. The method for satisfying each of the relevant criteria for CA5 North is summarised below:

- Stormwater Quality:
 - The load-based reduction targets are achieved through the implementation of five (5) bioretention basins proposed at the outlet of each developed catchment.
- Stormwater Quantity:
 - Peak flow attenuation is achieved through the implementation of the *Flagstone City Masterplan Flood Management Strategy (FMS)* (Engeny, November 2025) (Ref. QC4012_002-REP-001-6). A revised FMS will be submitted with a later EDQ Pre-Lodgement Meeting (and with the CA5 North DA) for discussion and assessment.
- Waterway Stability:
 - There is no predicted increase to erosion downstream of the development as a result of changes in catchment hydrology, therefore Q1 detention basins are not required as outlined by the SPP.
 - Waterway stability buffers are proposed as outlined in the *Waterway Stability Assessment – Flagstone CA5* (Engeny, March 2026) (Ref. BNE00413_0010-REP-001-1) and *Waterway Stability Assessment – Flagstone CA4* (Engeny, March 2026) (Ref. BNE00413_0013-REP-001-1) reports.

6. CONCLUSION

The sections of this report above demonstrate how the proposed CA5 North development will achieve the necessary stormwater quality, quantity and waterway stability management objectives and performance targets outlined in the endorsed SW IMP. It is considered that the proposed measures outlined in Sections 2 to 4 are sufficient to meet the performance targets as demonstrated and summarised in Section 5.

7. QUALIFICATIONS

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- (b) Engeny has used reasonable endeavours to inform itself of the parameters and requirements of the project and has taken reasonable steps to ensure that the works and document is as accurate and comprehensive as possible given the information upon which it has been based including information that may have been provided or obtained by any third party or external sources which has not been independently verified.
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