



## SITE BASED STORMWATER MANAGEMENT PLAN

Proposed Child Care Development  
Banya ELC Property One Pty Ltd ATF Banya ELC Property One Unit Trust  
Lot 8100 Musgrave Crescent, Banya

Prepared by:  
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**AMENDED IN RED**

By: **Brandon Bouda**

Date: **20/04/2026**



Approved by:  
**Mr John Williams**  
Director  
Cozens Regan Group Pty Ltd  
RPEQ 4536

**PLANS AND DOCUMENTS  
referred to in the PDA  
DEVELOPMENT APPROVAL**

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Date:  
**February 2026**

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**March 2026**

## DOCUMENT CONTROL RECORD

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**Document Name:** Site Based Stormwater Management Plan  
**Site Address:** Lot 8100 Musgrave Crescent, Banya

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## **EXECUTIVE SUMMARY**

This report examines and evaluates options for Stormwater Management during the construction and operational phase for the proposed childcare development at Lot 8100 Musgrave Crescent, Banya.

The strategies proposed in this report will provide short and long term community benefits with an Environmentally Sensitive Design emphasis.

The Water Sensitive Urban Design objectives are met by:

### **Erosion and Sediment Control**

Provision of sediment fencing and drainage structure protection during construction.

### **Stormwater Quality**

Stormwater produced by the development is accounted for in the overarching subdivision Stormwater Quality Management plan at source in pit capture device are proposed to address gross pollutants.

### **Stormwater Quantity**

The lawful point of Discharge is to be maintained post development. The lawful point of discharge is the stormwater drainage system located in Gowler Street at the Southern Boundary.

Peak stormwater flows are not proposed to be mitigated as previous subdivision development has been undertaken to allow for the full development of lots within the subdivision including this lot.

## 1.0 INTRODUCTION

### 1.1 GENERAL INTRODUCTION

Cozens Regan Group Pty Ltd has been commissioned by Banyu ELC Property One Pty Ltd ATF Banyu ELC Property One Unit Trust to prepare a Site Based Stormwater Management Plan for the proposed childcare development at Lot 8100 Musgrave Crescent, Banyu.

This Site Based Stormwater Management Plan is required to support a proposed change to an existing Material Change of Use application to Economic Development Queensland (EDQ). The proposed area of works is shown on the architectural site plan contained in Appendix A.

### 1.2 SCOPE OF PLAN

In accordance with Sunshine Coast City Council's Planning Scheme Policy the matters which have been addressed within the scope of this report are described below.

- Erosion and Sediment Control
- Stormwater Quality
- Stormwater Quantity
- Flooding and Overland Flow

### 1.3 SITE LOCATION

The subject site comprises of one lot described as Lot 8100 Musgrave Crescent, Banyu part of the Precinct 15 of the Aura West Master planned Subdivision. The site is bound by Western Drive to the east, Walsh Street and to the south and Gowler Street and Musgrave Crescent to the West. A small area of public reserve exists to the north with residential lots beyond. The subject site is shown in Figure 1 below.

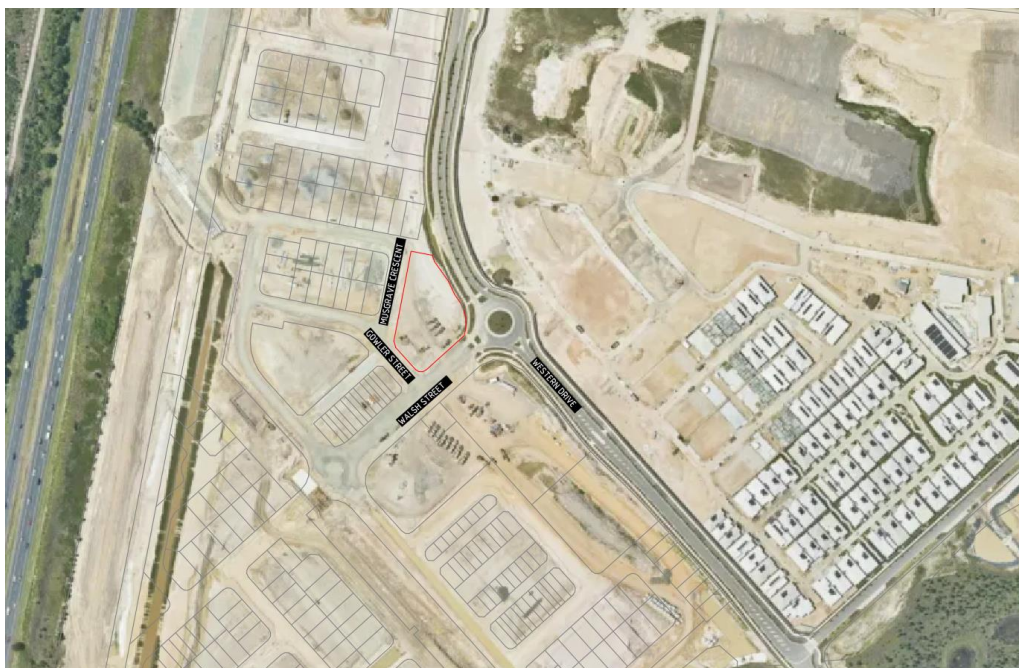


Figure 1 – Aerial Photograph (Metromap)

## **1.4 SITE DESCRIPTION**

The site is currently vacant due to its recent creation under the Aura West Subdivision .

The site falls from north to south with grade of approximately 1.1% towards the corner of Gowler Street and Walsh Street. The levels of the site range from RL 13.9m in the north west corner down to RL 13.6 m in the southern corner of the site.

The total site area is equal to 3,495m<sup>2</sup>.

An existing stormwater connection is provided on site with an existing field inlet in the southern corner connecting to the council drainage network in Gowler Street.

## **1.5 DESCRIPTION OF DEVELOPMENT**

The proposed development involves the construction of a proposed childcare development over the site including, a childcare building, carparking, outdoor play areas and landscaping.

This development will require minor earthworks and civil works to achieve this construction, services including stormwater, sewer, water supply are presently available at the site.

Refer Architectural Plans contained within Appendix A for more information in regard to the proposed development.

## 2.0 SEDIMENT AND EROSION CONTROL

### 2.1 OBJECTIVES

The objectives of this erosion and sediment control plan are:

- a) To ensure that the water quality of the receiving waters is not worsened by the site development.
- b) Minimise sediment transport in surface water runoff during the construction and operational stages.
- c) Provide a monitoring and maintenance programme for implementation during the construction phase.

### 2.2 POTENTIAL SEDIMENT GENERATION

The development will result in one catchment from which sediment can be generated. The area to be disturbed is approximately 0.3495 ha which is the entire site. While the potential exists for sediment to be generated during the construction phase, the potential sediment volume is dependent upon rainfall, site topography, the material type exposed, flow characteristics, and the construction practices and programme.

Control of the construction impacts is the primary objective for sediment and erosion control practices.

The management of erosion and sediment control for the development has been undertaken in accordance with Sunshine Coast Regional Council Planning Scheme and the referenced Best Management Practices for Sediment and Erosion Control.

Based on the expected potential for sediment generated, the provision of a series of sediment fence traps and stormwater pit protection measures are proposed. These provisions are considered adequate to control the mobilisation of sediment.

The installation of pollution control devices in the operational phase will decrease further the potential sediment loading; however, the effect of these is ignored.

### 2.3 CONSTRUCTION PHASE CONTROL MEASURES

The works proposed to control erosion are:

- a) Erect sediment and dust fences at the perimeter of the site. Sediment fences to be included on site safety fence, including hessian or approved dust control cloth.
- b) Remove from the site any material which is not required for rehabilitation of disturbed areas.
- c) Installation of stormwater drainage system.
- d) Preparation of building pads and pavement works and removal of surplus material off site.
- e) Exposed soils and stockpiles are to be watered, as required, to minimise soil losses as a result of wind.
- f) Place geo-textile field gully inlet filters and drainage structure protection around entry points to the drainage system until the pavement is complete or until grass is established.
- g) Finalised earthworks to be top soiled and seeded/hydro-mulched or landscaped as directed.
- h) Construct buildings.
- i) Geo-textile filters to be replaced with mesh filters until landscaping is complete and stabilised.
- j) Maintain all sediment devices and other interim controls regularly. Including the removal of accumulated sediment.

- k) Remove sediment fences and inlet filters including accumulated sediment after the establishment of the landscaping and grass cover.

## **2.4 MAINTENANCE**

The installation of erosion and sediment control devices requires maintenance of these devices to ensure their effectiveness in the control of potential environmental impact. Summary of the maintenance requirements for this project are detailed below.

The Contractor is responsible for the installation and maintenance of the sediment and erosion control measures during the construction phase and the defects liability period (normally six months).

Maintenance responsibilities for the establishment of vegetation, that is the requirement to irrigate the plants and grass used to generate ground cover lies with the Contractor initially but ultimately reverts to the owner once the defects liability period has expired.

Maintenance will require:

- a) Inspection of silt fences and drainage paths during construction and after any rainfall event.
- b) Clean out sediment build-up following each event that causes deposits.
- c) Clean up soil and sediment deposits promptly as they occur.
- d) Provide inlet protection where soil disturbance is to occur.

## **2.5 RESPONSES TO COMPLAINTS**

Complaints during this type of construction usually relate to noise and dust. Generally, the complaint is made known to the Contractor, the Principal, the Superintendent and/or the Council.

The Contractor shall keep a record of all complaints identifying the nature of the complaint and any remedial action taken to address such complaint. The Contractor shall act as soon as possible to remedy the problem, if the complaint is considered valid and reasonable. A complaints record shall be made available by the contractor for regular inspection by the Superintendent. For the purpose of direction by others, the Contractor's details are to be supplied to Council prior to commencement of the works.

Complaints relating to dust shall require the Contractor to immediately water the exposed earth surfaces and any soil stockpile areas as well as haul roads to control dust. Such watering shall occur immediately after the complaint is registered with the Contractor. Watering should continue periodically until conditions suit, or the works are completed to a state that prevents dust transport.

## **2.6 MONITORING**

The installation of the erosion and sediment control measures as detailed in this report and attached figures will ameliorate potential impact to water quality in the receiving waters. A monitoring program is proposed to ensure that the control measures achieve the desired goals. It is considered appropriate that only a visual monitoring program be required. Following rainfall events and prior to discharge water quality monitoring will be conducted on the any stored water to check suspended solids.

## **3.0 STORMWATER QUALITY ASSESSMENT**

### **3.1 WATER QUALITY TREATMENT TARGETS**

The proposed development is within Precinct 15 of the overarching master planned Aura west subdivision. The Aura Precinct 15 West Stormwater Water Quality Management plan by EGIS includes the assessment of the full stage of the subdivision which has been assessed in accordance with the Sunshine Coast Regional Council Planning Scheme Policy for development Works (PSPDW). The proposed site lot 8100 has been assessed as a childcare development in this approved stormwater management plan which includes subdivision wide bioretention basins to treat the parent catchments. The allowance for lot 8100 is outlined in the approved SWQMP in Section 3.3 page 4 which is attached as Appendix D.

The approved stormwater management plan includes provisions for rainwater tanks as noted in section 3.5.1 table 3-4 of the approved SWQMP. In accordance with the approved stormwater quality management plan a rate of 25KL/Ha has been specified for the childcare site resulting in a proposed tank size of 9KL on this basis. The approved stormwater quality management plan is provided as Appendix D. These provisions are deemed acceptable in accordance with the approved Masterplan SWQMP.

To address gross pollutant capture on site in accordance with the requirements of the State Planning Policy 2017 it is proposed to provide all field and ground level pits with Atlan Stormsacks or approved equivalent. The provision of stormsacks will capture and remove gross pollutants from runoff. The proposed device SQIDEP certification is provided in Appendix E for reference.

## 4.0 STORMWATER QUANTITY

### 4.1 LAWFUL POINT OF DISCHARGE

The proposed development is within Precinct 15 of the overarching master planned Aura west subdivision and the proposed site has been assessed in the approved stormwater management plan as being allocated for a childcare development. Existing connection to the downstream receiving stormwater network has been provided for the site in the form of a field inlet pit connecting to the street drainage in Gowler Street.

In accordance with Section 3 of the Queensland Urban Drainage Manual all development must address the 3 Point Lawful Point of Discharge Test.

*The criteria for determining the lawful point of discharge are:*

*(i) Will the proposed development alter the site's stormwater discharge characteristics in a manner that may substantially damage a third party property?*

It is the objectives of this stormwater quantity assessment to ensure that 'no worsening' occurs and therefore the answer to this test is no and thus no further steps are required to obtain tenure for a lawful point discharge (assuming any previous circumstances and changes were lawful).

Regardless of the requirement to obtain a Lawful Point of Discharge, the development will be provided a new piped drainage system which is to discharge into the existing Council piped drainage system located within the site at the Southern Boundary which is considered a Lawful Point of Discharge.

Refer to plan 250744 C04 Civil Works Plan for more information relating to the proposed connection to the Lawful Point of Discharge.

The receiving drainage network has been designed to cater for developed flows therefore sufficient capacity is expected to be available in the receiving stormwater system and no further assessment of provisions are considered necessary.

## **5.0 FLOODING AND OVERLAND FLOW**

The development site is not determined to be within a flood zone as identified by the Aura Flood Risk Management Report 2020 during the 1% AEP developed scenario flood event. Greater flood events may impact access to the site however as the site is in a master planned subdivision and the site does not provide habitable areas it is assumed that flood immunity up to the 1% AEP is sufficient.

The proposed design floor level of the building is R.L 13.500 which is above the surrounding roadways level directly adjacent to the surrounding boundaries. No further flood assessment has been undertaken on this basis.

## **6.0 QUALIFICATIONS**

This site-based stormwater management plan for Lot 8100 Musgrave Crescent, Banya has been prepared specifically for this development as requested by Banya ELC Property One Pty Ltd ATF Banya ELC Property One Unit Trust. Our analysis and approach is limited to the scope stated at the beginning of the report. As such third parties are not authorised to utilise this report without the written approval and advice from Cozens Regan Group Pty Ltd.

Cozens Regan Group Pty Ltd relied on the following supplied information in preparation of this report:

- Building and site layout supplied by Elevation Architecture.
- Survey information provided by EGIS Group.
- Rainfall data for Banya supplied by the Bureau of Meteorology.

The accuracy of this report is dependent on the accuracy of the information supplied.

While Cozens Regan Group Pty Ltd has taken every precaution to ensure the accuracy of the assessment it should be noted that the catchment is ungauged and as such future observed flows may vary from that predicted.

## **REFERENCES**

- The Sunshine Coast Planning Scheme Policy 2014 Planning Scheme Policy for Development Works
- State Planning Policy 4/10 – Healthy Waters
- Sunshine Coast Council – Flooding and Stormwater Management Guidelines September 2020
- Queensland Urban Drainage Manual 2016(Natural Resources and Water)
- Urban Stormwater – Queensland best practice environmental guidelines January 2009 (Environmental Protection Agency)
- Queensland Water Quality Guidelines Version 3 September 2009 (Department of Environment and Resource Management)
- Urban Stormwater Quality Planning Guidelines (Department of Environment and Resource Management 2010)

## **Appendix A**

### **ARCHITECTURAL SITE PLAN**



**ISSUE FOR DA**  
**NOT FOR CONSTRUCTION**



LEGEND

- B

FH

FI

MH
- Bollard

Fire Hydrant

Field Inlet

Refer to engineer's detail

Manhole
- SEW

W

SW
- Proposed Sewer Reticulation

Refer to engineer's detail

Proposed Water Reticulation

Refer to engineer's detail

Proposed Stormwater Reticulation

Refer to engineer's detail

Notes

1.
- Shade sail shown on plans are indicative only, location and extents are subjected to future playscape design and confirmation with childcare operator.



## Appendix B

Peak Discharge summary

Project Number:

250744

Description:

Stormwater Quantity Assessment

Designed:

JL

19/2/2026

Location:

Lot 8100 Musgrave Crescent , Banya

CATCHMENT: SITE

|                       |                     |   |
|-----------------------|---------------------|---|
| PRE-DEVELOPMENT tc    | Major               |   |
| A                     |                     |   |
| Length                | 90                  | m |
| Slope                 | 1.1                 | % |
| Hortons Roughness     | 0.035               |   |
| Equation              | (107nL^0.333)/S^0.2 |   |
| Time of Concentration | 16.46597487 min     |   |
| Adopted tc            | 16.0 min            |   |

|                             |         |   |
|-----------------------------|---------|---|
| Post Developmen             | Major   |   |
| Standard inlet time         | 5 min   |   |
| Channel/ Pipe Flow          |         |   |
| Flow length                 | 90      | m |
| Fall                        | 0.55    | m |
| Time of flow                | 2.5 min |   |
| Total time of Concentration | 7.5     |   |
| Adopted tc                  | 8.0 min |   |

Figure 4.5 QUDM

| CALCULATION OF INITIAL RUNOFF - QUDM Section 4.00 |           |            |
|---------------------------------------------------|-----------|------------|
|                                                   | PRE-DEV'T | POST-DEV'T |
| Catchment area (ha )                              | 0.350     | 0.350      |
| Impervious area (ha)                              | 0.000     | 0.225 Ha   |
| Fraction impervious                               | 0.0       | 0.6 %      |
| Intensity - 1 hr, 10 yr (mm/hr)                   | 72.0      |            |
| t <sub>e</sub> existing (min.)                    | 16.00     | IFD: Banya |
| t <sub>e</sub> post-developed (min.)              | 8.00      |            |

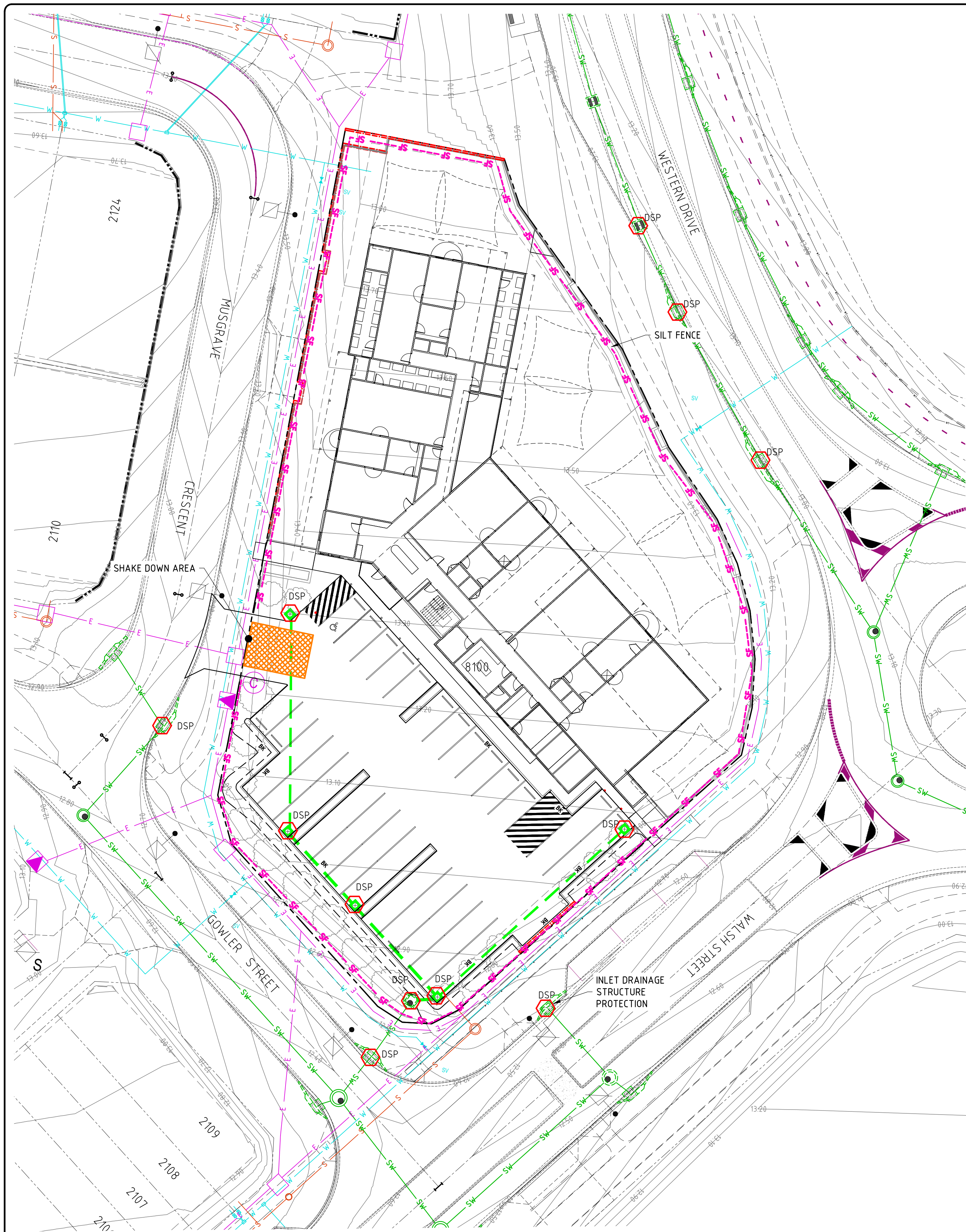
| ESTIMATION OF PEAK FLOWS |          |           |            |          |                  |           |            |          |                      |            |
|--------------------------|----------|-----------|------------|----------|------------------|-----------|------------|----------|----------------------|------------|
| ARI/AEP                  | Existing |           |            |          | Post development |           |            |          | Difference in runoff |            |
|                          | C        | I (mm/hr) | Q (m³/min) | Q (m³/s) | C                | I (mm/hr) | Q (m³/min) | Q (m³/s) | Increase (L/s)       | Increase % |
| 1EY                      | 0.56     | 83        | 2.70       | 0.045    | 0.66             | 109       | 4.20       | 0.070    | 25                   | 55.5%      |
| 0.5EY                    | 0.6      | 98        | 3.42       | 0.057    | 0.7              | 136       | 5.55       | 0.093    | 36                   | 62.3%      |
| 20%                      | 0.67     | 121       | 4.71       | 0.079    | 0.78             | 169       | 7.70       | 0.128    | 50                   | 63.3%      |
| 10%                      | 0.70     | 138       | 5.61       | 0.094    | 0.82             | 194       | 9.28       | 0.155    | 61                   | 65.3%      |
| 5%                       | 0.74     | 157       | 6.76       | 0.113    | 0.86             | 221       | 11.09      | 0.185    | 72                   | 64.1%      |
| 2%                       | 0.81     | 181       | 8.54       | 0.142    | 0.94             | 256       | 14.04      | 0.234    | 92                   | 64.4%      |
| 1%                       | 0.84     | 199       | 9.73       | 0.162    | 0.98             | 283       | 16.16      | 0.269    | 107                  | 66.1%      |

| APPROX. PEAK FLOWS LESS THAN Q1 |         |                |                  |       |
|---------------------------------|---------|----------------|------------------|-------|
| ARI                             | % of Q1 | Existing (L/s) | Post dev't (L/s) | % inc |
| 1 mth                           | 25%     | 11.2           | 17.5             | 55.5% |
| 2 mth                           | 40%     | 18.0           | 28.0             | 55.5% |
| 3 mth                           | 50%     | 22.5           | 35.0             | 55.5% |
| 4 mth                           | 60%     | 27.0           | 42.0             | 55.5% |
| 6 mth                           | 75%     | 33.7           | 52.5             | 55.5% |
| 9 mth                           | 90%     | 40.5           | 63.0             | 55.5% |
| 12 mths (Q1)                    | 100%    | 45.0           | 70.0             | 55.5% |

## Appendix C

### ENGINEERING PLANS

|                                   |            |
|-----------------------------------|------------|
| • Erosion & Sediment Control Plan | 250744/C02 |
| • Bulk Earthworks Plan            | 250744/C03 |
| • Civil Works Plan                | 250744/C04 |
| • Site Sections                   | 250744/C05 |



IMPORTANT NOTE:



ALL UNDERGROUND SERVICES SHOULD BE LOCATED ONSITE BY RELEVANT AUTHORITIES BEFORE ANY WORK IS COMMENCED.



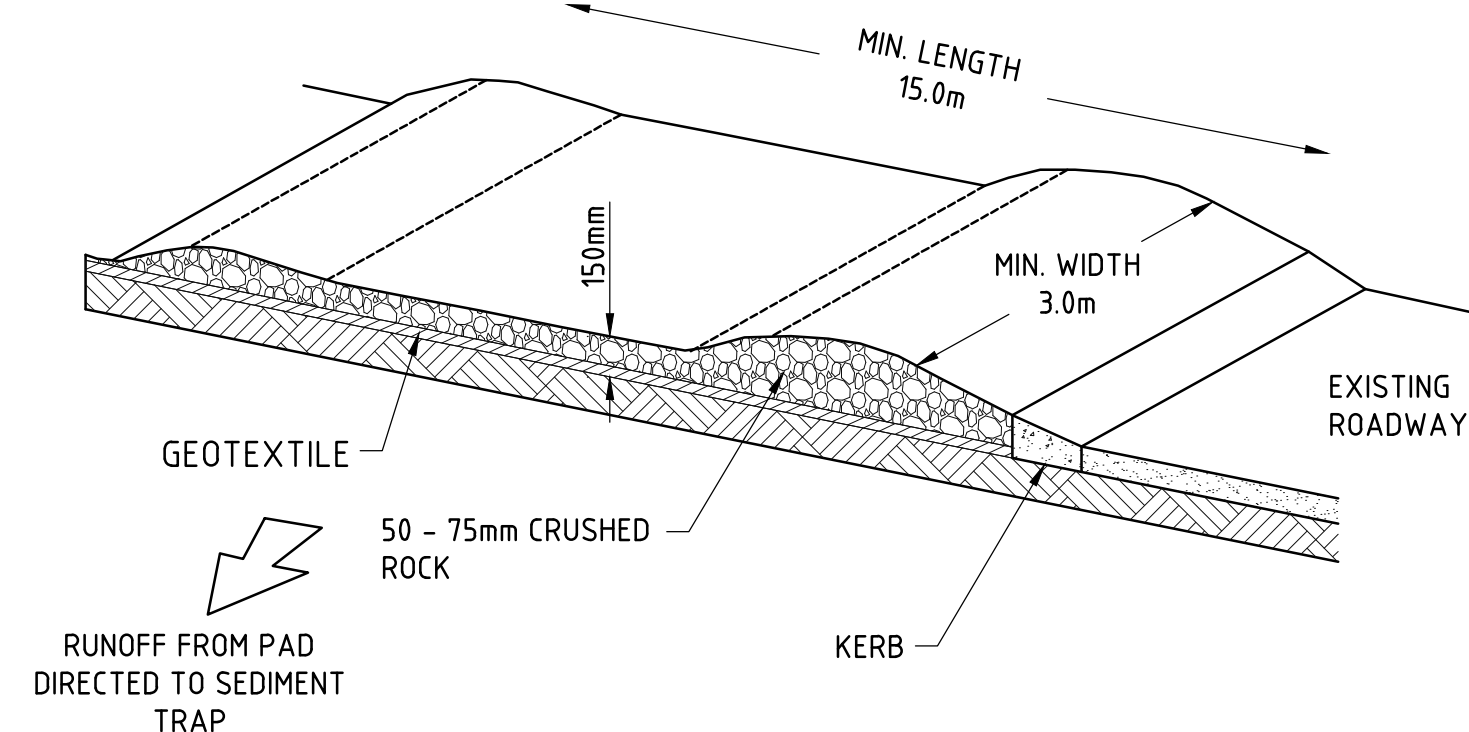
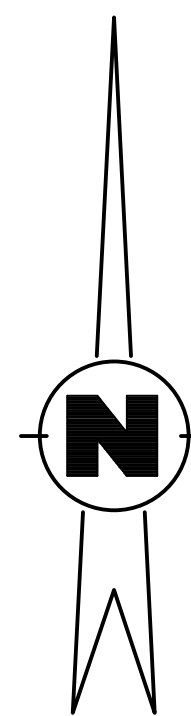
UNDER QUEENSLAND LEGISLATION, THE GENERAL BIOSECURITY OBLIGATION REQUIRES ALL REASONABLE STEPS TO BE TAKEN TO PREVENT THE SPREAD OF FIRE ANTS.

ALL SUSPECTED SIGHTINGS OF FIRE ANTS MUST BE REPORTED WITHIN 24 HOURS OF THEIR DISCOVERY (PH: 13 25 23). THE MOVEMENT OF FIRE ANTS IS PROHIBITED. FAILING TO COMPLY MAY INCUR PENALTIES. THE CONTRACTOR SHALL ACQUIRE THE NECESSARY PERMITS AND EDUCATION TO MOVE ORGANIC MATERIALS THAT MAY CONTAIN FIRE ANTS.

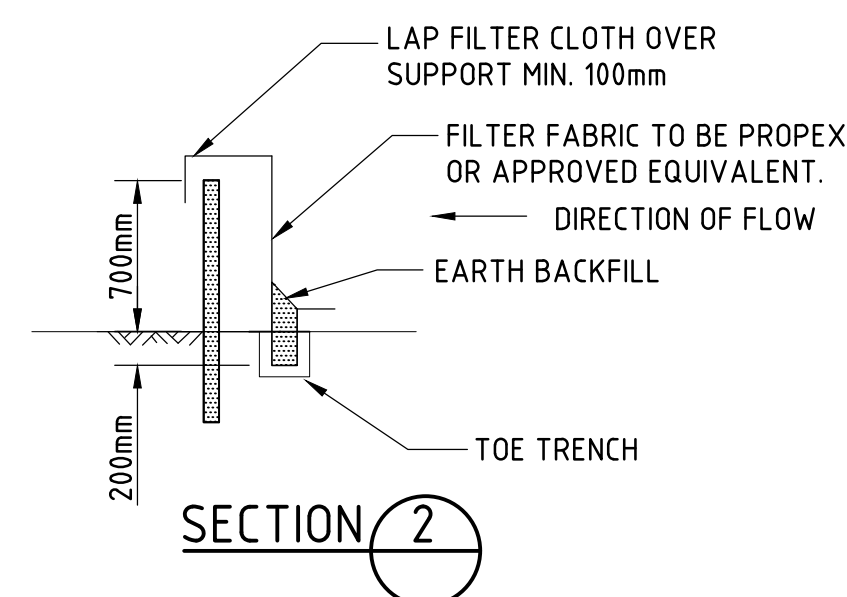
LEGEND

- SF SF DENOTES SILTATION FENCE REFER TO IPWEA STD DRG DS-040
- SHAKE DOWN AREA REFER TO IPWEA STD DRG DS-040
- DSP DENOTES DRAINAGE STRUCTURE PROTECTION REFER TO IPWEA STD DRG DS-041

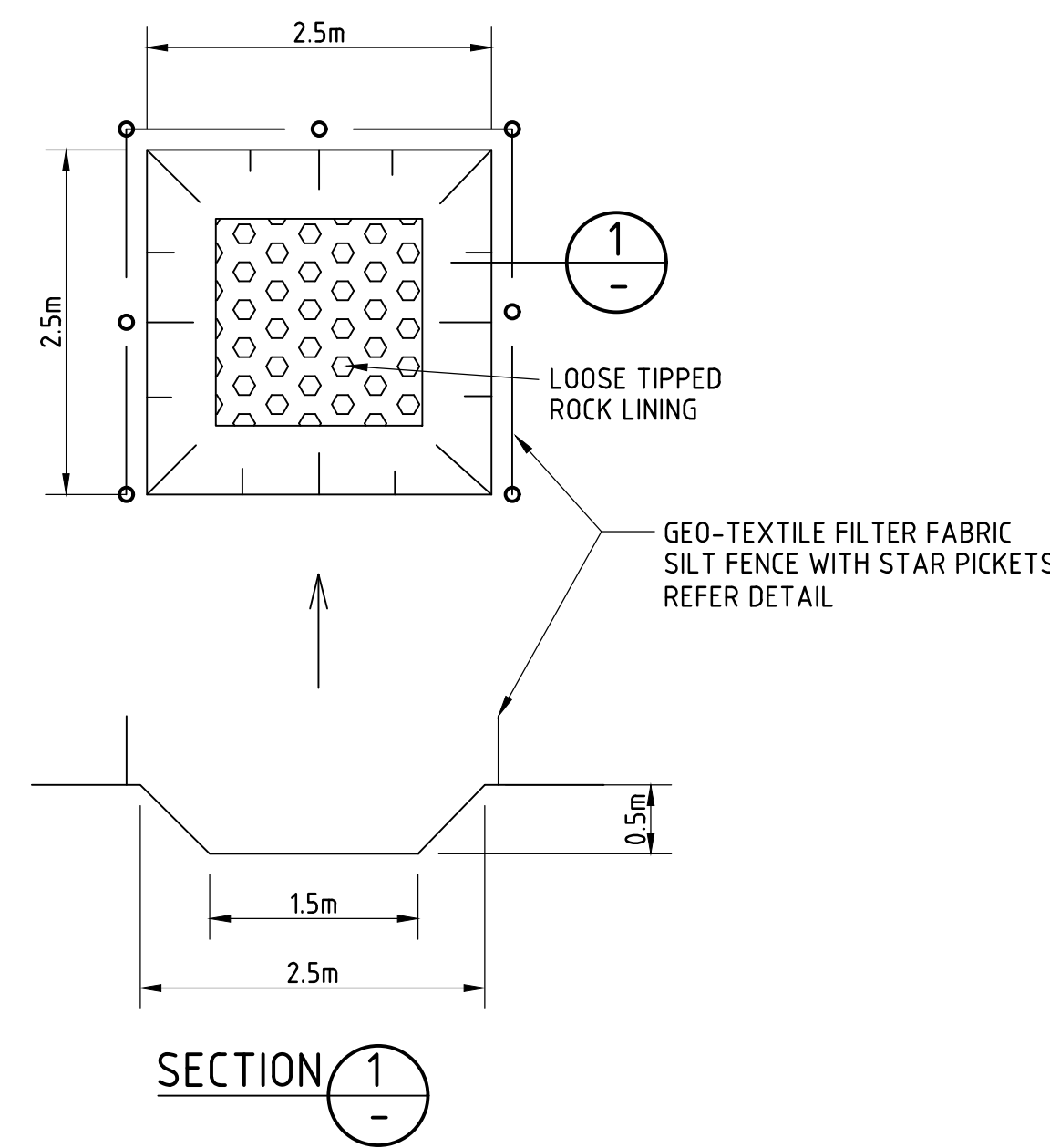
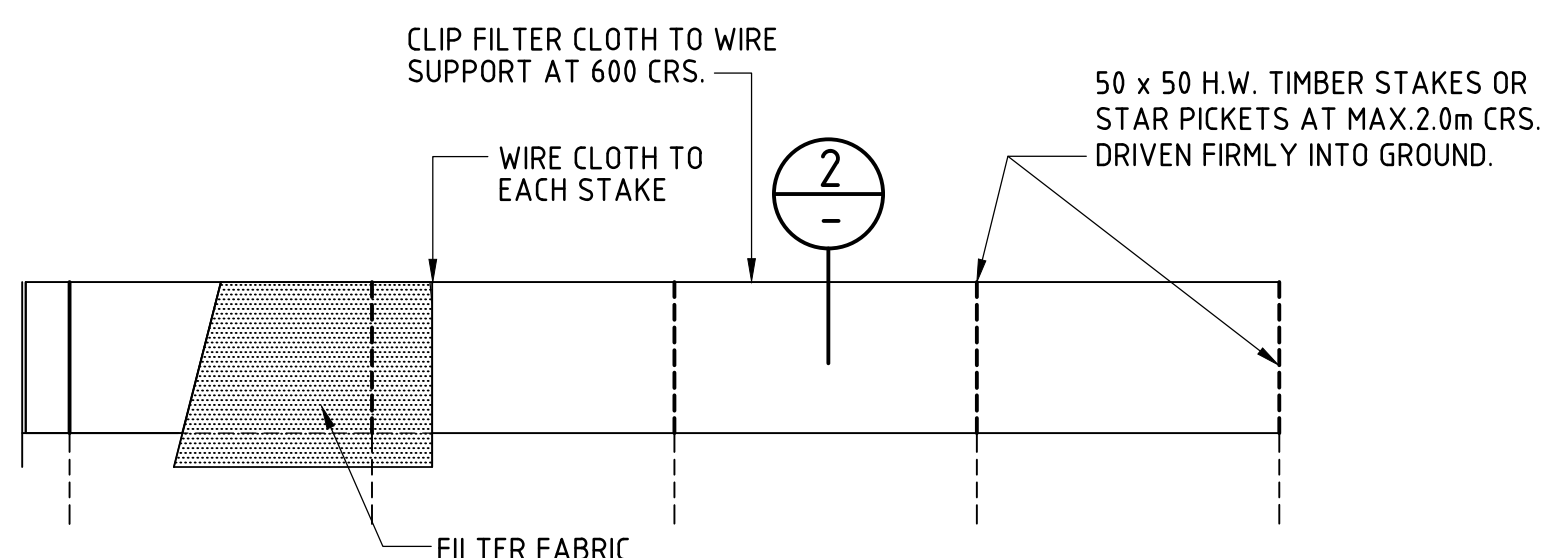
FOR SEDIMENT NOTES REFER DRG. C01



ROCK SHAKE DOWN AREA DETAIL  
SCALE N.T.S.



SEDIMENT FENCE DETAILS  
SCALE 1:50



SILTATION TRAP DETAILS  
SCALE 1:50

| No. | DATE  | ISSUE          | REVISED | CHECKED |
|-----|-------|----------------|---------|---------|
| P3  | 03/26 | UPDATE ISSUE   | JL      | J.A.W   |
| P2  | 02/26 | UPDATE ISSUE   | JL      | J.A.W   |
| P1  | 02/26 | ORIGINAL ISSUE | JL      | J.A.W   |

IN ASSOCIATION WITH

PRELIMINARY  
NOT FOR CONSTRUCTION

SCALE A  
SCALE B



DATUM AHD (U.N.O.) SCALES SHOWN ARE AT A1 SIZE



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DESIGNED J.L.  
DRAWN J.L.  
CHECKED J.A.W.  
APPROVED FOR AND ON BEHALF OF  
COZENS REGAN GROUP PTY LTD  
(NER No 540920)  
(RPEQ No 4536)

CLIENT BANYA ELC PROPERTY ONE PTY LTD ATF BANYA ELC PROPERTY ONE UNIT TRUST  
PROJECT PROPOSED EARLY LEARNING CENTRE  
LOT 8100 MUSGRAVE CRESCENT, BANYA QLD 4551  
EROSION & SEDIMENT CONTROL PLAN

JOB NO. 250744  
DRAWING NO. C02  
ISSUE P1P2P3

# LEGEND

- EXISTING CONTOUR
- EXISTING SURFACE LEVEL
- EXISTING WATER
- EXISTING STORMWATER
- EXISTING SEWER
- EXISTING TELSTRA
- EXISTING ELECTRICAL
- PROPOSED FINISHED SURFACE LEVEL
- PROPOSED FINISHED SURFACE GRADIENT
- AREA OF CUT
- AREA OF FILL
- TOP OF WALL LEVEL
- BOTTOM OF WALL LEVEL
- PROPOSED RETAINING WALL TO FUTURE DETAILED DESIGN

## BULK EARTHWORKS VOLUMES

|         | VOLUME (m³) |
|---------|-------------|
| CUT     | 258         |
| FILL    | 198         |
| BALANCE | 60 (CUT)    |

NOTE: VOLUMES ARE BASED ON NATURAL SURFACE TO FINISHED SURFACE. BUILDER IS TO ALLOW APPROPRIATE BOXOUT FOR BULK EARTHWORKS SURFACES

## IMPORTANT NOTE:

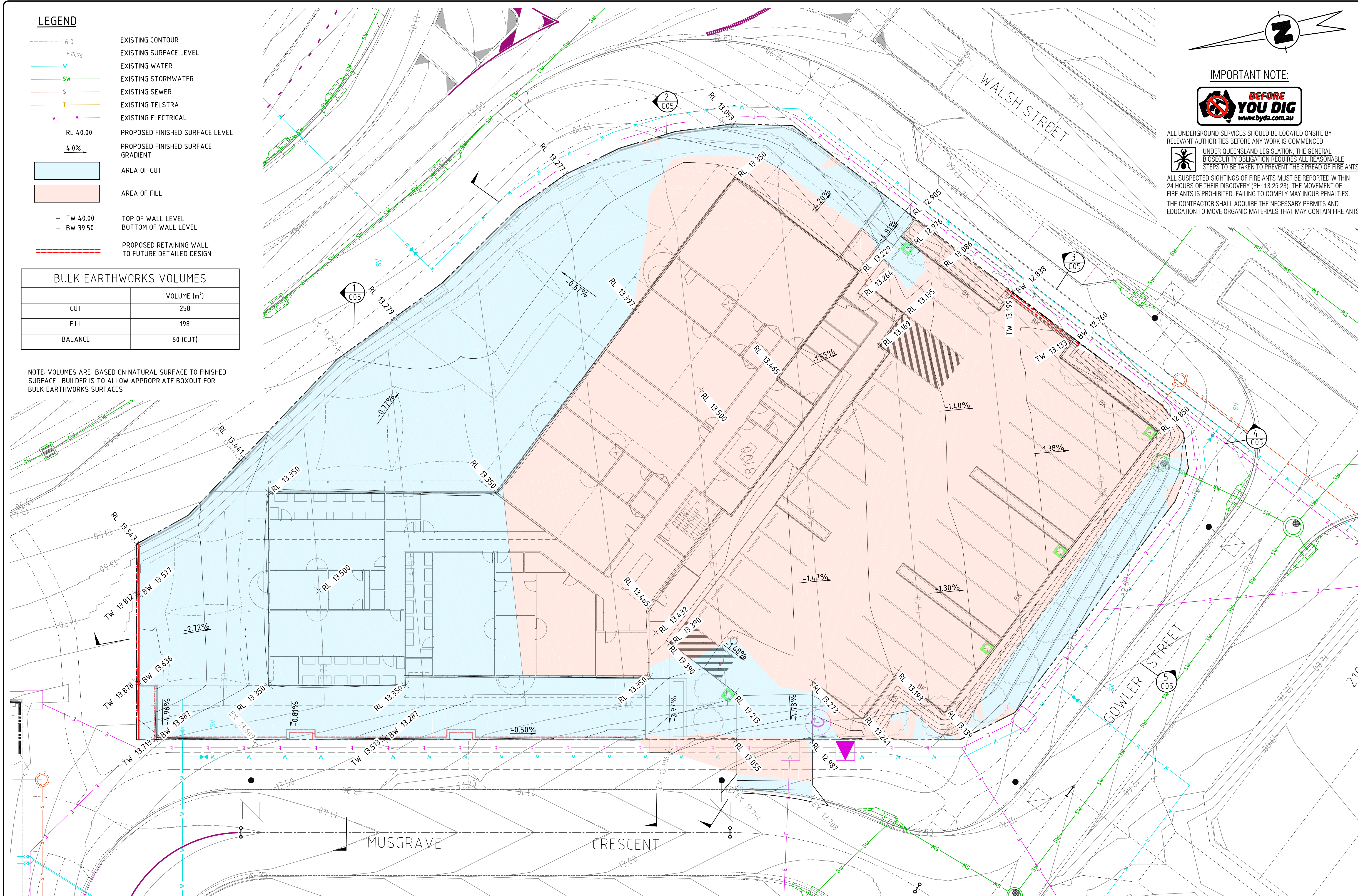


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UNDER QUEENSLAND LEGISLATION, THE GENERAL BIOSECURITY OBLIGATION REQUIRES ALL REASONABLE STEPS TO BE TAKEN TO PREVENT THE SPREAD OF FIRE ANTS.

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THE CONTRACTOR SHALL ACQUIRE THE NECESSARY PERMITS AND EDUCATION TO MOVE ORGANIC MATERIALS THAT MAY CONTAIN FIRE ANTS.



| No. | DATE  | ISSUE          | REVISED | CHECKED |
|-----|-------|----------------|---------|---------|
| P3  | 03/26 | UPDATE ISSUE   | JL      | J.A.W   |
| P2  | 02/26 | UPDATE ISSUE   | JL      | J.A.W   |
| P1  | 02/26 | ORIGINAL ISSUE | JL      | J.A.W   |

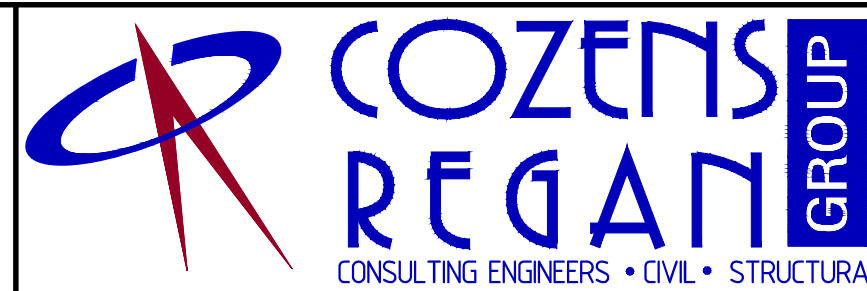
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SCALE B

DATUM AHD (I.N.O.)

SCALES SHOWN ARE AT A1 SIZE



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PROJECT  
PROPOSED EARLY LEARNING CENTRE  
LOT 8100 MUSGRAVE CRESCENT, BANYA QLD 4551  
BULK EARTHWORKS PLAN

JOB NO.  
250744  
DRAWING NO.  
C03  
ISSUE  
P1P2P3

# LEGEND

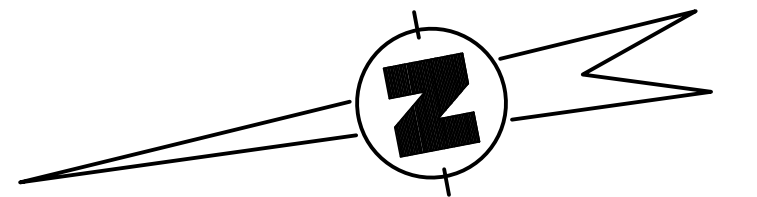
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- EXISTING TELSTRA
- EXISTING ELECTRICAL
- PROPOSED WATER CONNECTION
- PROPOSED SEWERAGE
- PROPOSED PRIVATE STORMWATER
- PROPOSED SURFACE FALL ARROW
- PROPOSED FINISHED SURFACE LEVEL
- BARRIER KERB
- ALL KERBS TO BE INSTALLED TO IPWEA STD DRG. RSD-200
- PROPOSED CARPARKING
- PROPOSED FOOTPATHS
- PROPOSED CROSSOVER
- PROPOSED LANDSCAPING

AMENDED IN RED

By: Brandon Bouda  
Date: 20/04/2026



All field inlet pits within trafficable areas are to be Class D per AS3996



## IMPORTANT NOTE:

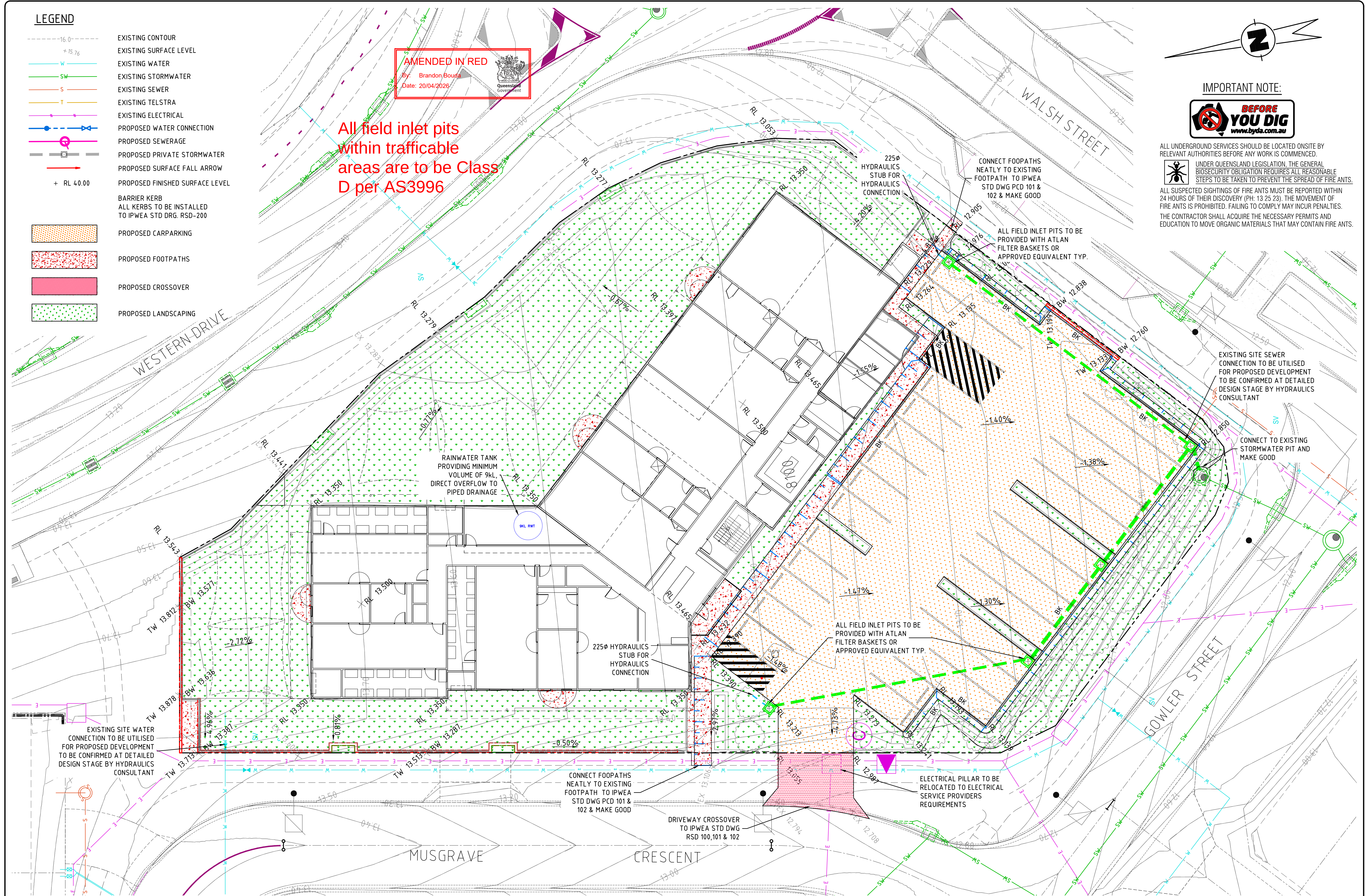


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| P3  | 03/26 | UPDATE ISSUE   | JL      | JAW     |
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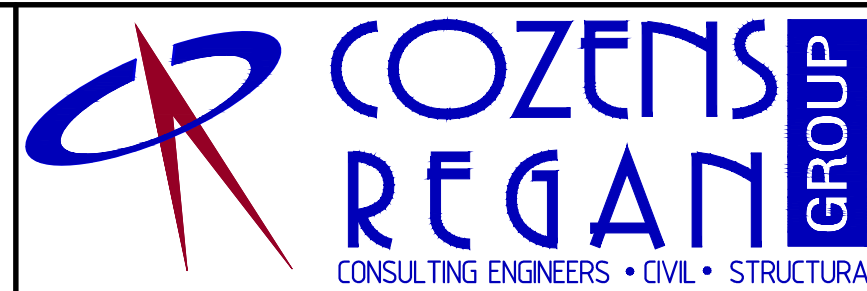
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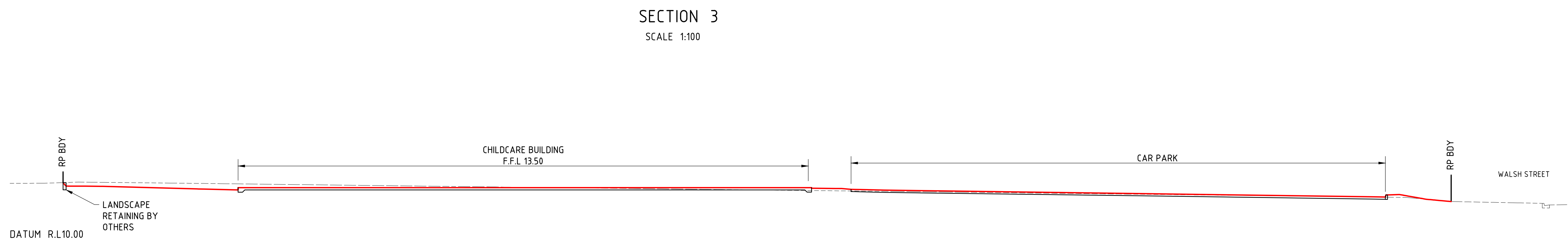
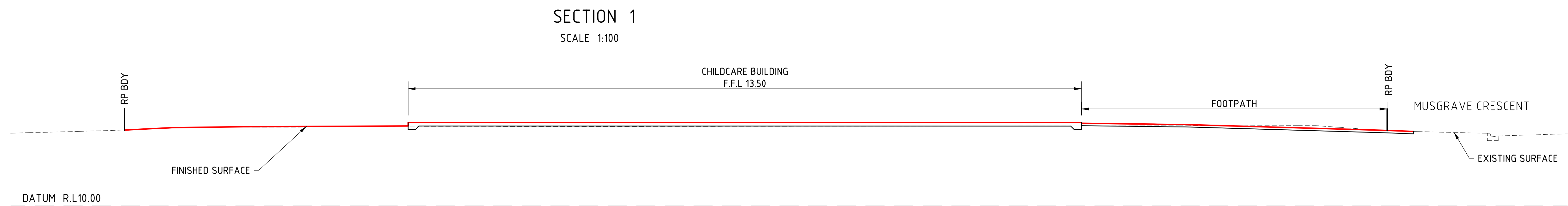


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LOT 8100 MUSGRAVE CRESCENT, BANYA QLD 4551  
CIVIL WORKS PLAN

JOB NO. 250744  
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ISSUE P1P2P3P4



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## **Appendix D**

APPROVED EGIS SWQMP

# STORMWATER QUALITY MANAGEMENT PLAN

## AURA PRECINCT 15 WEST

Prepared for **Stockland Development Pty Ltd**



## Document information

### GENERAL INFORMATION

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| <b>Approved by</b>             | Matthew Starr              |
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| D       | 17/06/2024 | Ben Gear      |
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| F       | 09/05/2025 | Jayden Walter |

| Version | Date       | Approved by   |
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| B       | 20/12/2023 | Matthew Starr |
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| D       | 17/06/2024 | Matthew Starr |
| E       | 18/12/2024 | Matthew Starr |
| F       | 09/05/2025 | Matthew Starr |



RPEQ 09485

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# 1 INTRODUCTION

Egis Consulting has been commissioned by Stockland Development Pty Ltd to prepare a Stormwater Quality Management Plan for Precinct 15 West of the Aura development, located within the on the north western side of Bells Creek South at the south western end of the overall Aura development. The proposed precinct is located within the Sunshine Coast Council local government area.

This report has been prepared to demonstrate that the Stormwater Quality Improvement Devices (SQIDs) proposed through the application area will achieve the required Water Quality Objectives (WQOs).

The development and refinement of this SQMP has been an iterative process, with previous report versions responding to requests and feedback from Economic Development Queensland (EDQ) as follows:

- Version C was prepared in response to the Request for Further Information #2 (RFI2) issued by EDQ on 13 March 2024.
- Version D addressed Item 3a of the Further Issues Letter issued on 11 June 2024, which required removal or further justification of Gross Pollutant Traps (GPTs 1, 2 and 12) from the treatment train. In response, the specified GPTs were removed from the stormwater strategy.
- Version E incorporated further changes to the stormwater quality management strategy, including the removal of GPTs and At-Source WSUD devices for water quality treatment of runoff from the catchments of the future childcare centre, centres, community and multiple residential sites (Lot 8100 to 8103) within the Precinct.

*The report (Revision F) has been prepared to address the latest information request from EDQ, received on 22 April 2025 (Ref: DEV2023/1445). Key updates in this version include.*

- *Figure 4-1 updated to include Catchment 37 to address Item1b.*
- *Table 4-4 summarised the sizing details of sediment basins incorporated into the MUSIC model for larger catchments upstream of end-of-line bioretention systems to address Item1d.*

## 1.1 Report Scope

The scope of this report is to:

- Identify the WQOs for the proposed development.
- Provide details of the SQIDs proposed within the Precinct 15 West Stormwater Quality Management Strategy.
- Document the methodology and results of MUSIC modelling undertaken that demonstrates the proposed strategy will achieve the required WQOs.
- Provide management and maintenance details of the construction and operational phases of the proposed SQIDs.

## 1.2 Previous & Other Documentation

Precinct 15 of the Aura development has been the subject of the following flooding and stormwater management related investigations:

- *Aura Development Stormwater Quality Management Plan* (DesignFlow & BMT, 2019). Report that identified and defined the stormwater quality management objectives for the overall Aura development.
- *Aura Precinct 15 Stormwater Quality Management Plan – Version 3* (DesignFlow, September 2022). Report documenting the Stormwater Quality Management Plan for Aura Precinct 15. This report is referred to in the PDA Decision Notice.
- *Memorandum – Aura Development Acoustic Bund South* (Egis Consulting, August 2023). Technical Memorandum documenting the hydrologic and hydraulic investigation and analysis of the overland flow path and inlet structure associated with the acoustic bund located adjacent to the Aura Development.

## 2 SITE DESCRIPTION

### 2.1 Location

Precinct 15 West is in the western part of Aura. The site is bound by the Bruce Highway to the west, the Precinct 15 East and Land Lease Community precinct to the east, future CAMCOS corridor to the North and Bells Creek South to the south. The West precinct forms part of the Caloundra South Priority Development Area (Aura). The Master Plan was approved by the (former) Urban Land Development Authority (ULDA reference No. DEV2011/200) now Economic Development Queensland (EDQ).

The location of Precinct 15 West is indicated in **Figure 2-1** below.

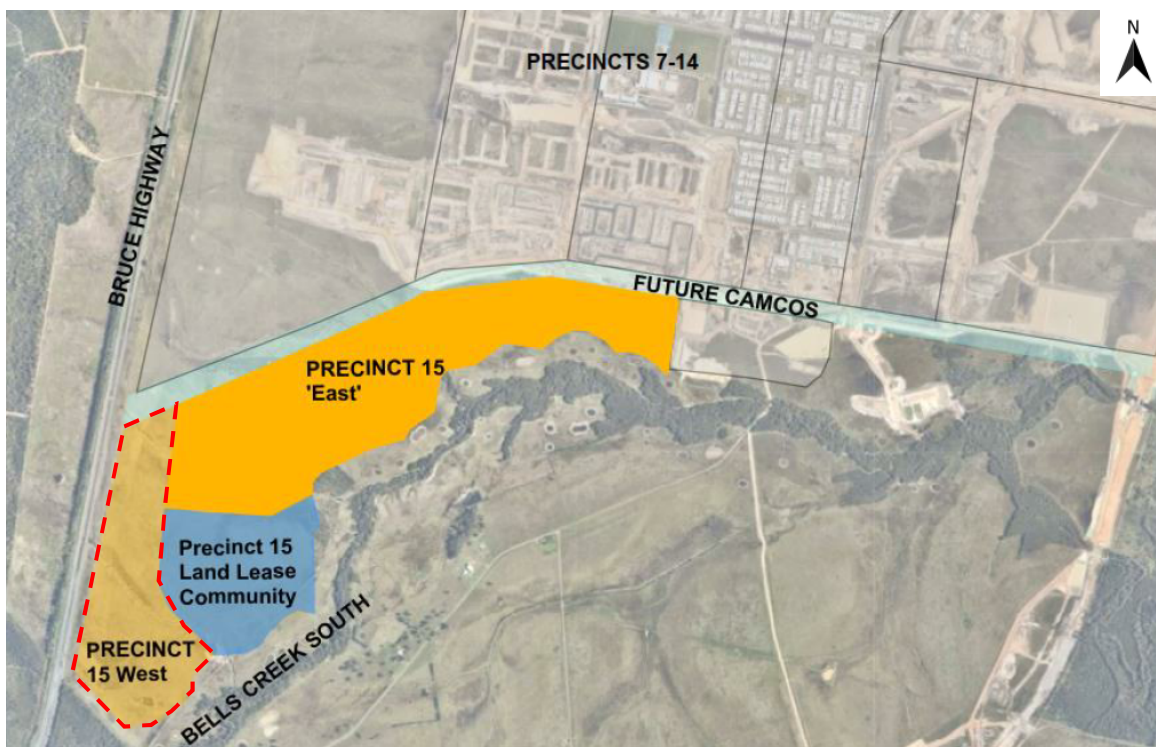


FIGURE 2-1      PRECINCT 15 WEST LOCATION

### 2.2 Topography & Features

The existing Precinct 15 West site is generally flat with less than 3m of fall across the 600m distance from the northern boundary of the site to the Bells Creek South.

### 2.3 Discharge Location

The existing and proposed runoff from the Precinct 15 West site discharges to Bells Creek South. It is noted that an overland flow path and inlet structure is proposed to be constructed within the site to convey runoff from external catchments (west of Bruce Highway) under an acoustic bund and through the site. For further details refer to the Egis Consulting *Memorandum – Aura Development Acoustic Bund South* (December 2023).

### 3 STORMWATER QUALITY MANAGEMENT

It is expected that the proposed development will increase the export of pollutants within stormwater runoff from the subject site. A stormwater management strategy employing suitable Stormwater Quality Improvement Devices (SQIDs) has been proposed to intercept and capture the pollutants so that the potential impacts on waterway downstream are mitigated.

This section discusses:

- The identification of key stormwater pollutants associated with the proposed development.
- The Water Quality Objectives (WQOs) identified for the catchment.
- Proposed measures to mitigate the increase in pollutant export; and
- Modelling of the proposed measures and comparison to the identified WQOs.

In response to the EDQ Further issues letter the stormwater management strategy and modelling has been updated.

#### 3.1 Pollutants of Concern

Typical key pollutants expected to be generated during the operational (post-construction) phase of the planned development are listed as follows, with those presented in capitals being the key pollutants to be targeted for treatment:

- LITTER
- SEDIMENT
- Oxygen demanding substances (possibly present)
- NUTRIENTS (N & P)
- Pathogens / Faecal coliforms
- Hydrocarbons
- HEAVY METALS (associated with fine sediments)
- Surfactants
- Organochlorines & organophosphates
- Thermal pollution
- pH altering substances

Only the key pollutants will be further addressed in this report; however, the treatment train developed will adequately mitigate the other pollutant loads. As heavy metals will predominately be associated with fine sediment, controls proposed to reduce total suspended solids will also adequately reduce loads of heavy metals.

#### 3.2 Water Quality Objectives

As documented within the *DesignFlow Aura Precinct 15 Stormwater Quality Management Plan (2022)* the WQOs for Precinct 15 are based on the catchment and waterway modelling previously undertaken and documented within the *DesignFlow & BMT Aura Development Stormwater Quality Management Plan (2019)*. These WQOs consider the High Ecological Value (HEV) of the receiving Pumicestone Passage waterway which has Ramsar wetland status.

The pollutant load reduction WQOs are stated in **Table 3-1** below.

| POLLUTANT      | TABLE 3-1 WATER QUALITY OBJECTIVES |                       |                     |                       |
|----------------|------------------------------------|-----------------------|---------------------|-----------------------|
|                | TOTAL SUSPENDED SOLIDS (TSS)       | TOTAL PHOSPHORUS (TP) | TOTAL NITROGEN (TN) | GROSS POLLUTANTS (GP) |
| Load Reduction | 95%                                | 89%                   | 68%                 | 90%                   |

Source: DesignFlow

### 3.3 Stormwater Quality Management Strategy

The initial stormwater quality management strategy for Precinct 15 West deviated from the current 'end of line' treatment strategy applied through Aura. In place of 'end of line' devices Precinct 15 West incorporates an area of at-source bioretention systems to meet the prescribed water quality objectives.

In response to the initial EDQ RFI (dated 20 November 2023) the stormwater quality management strategy was updated to include 'end of line' bioretention basins to capture and retain pollutant for part of the proposed development. This was documented within Version B.

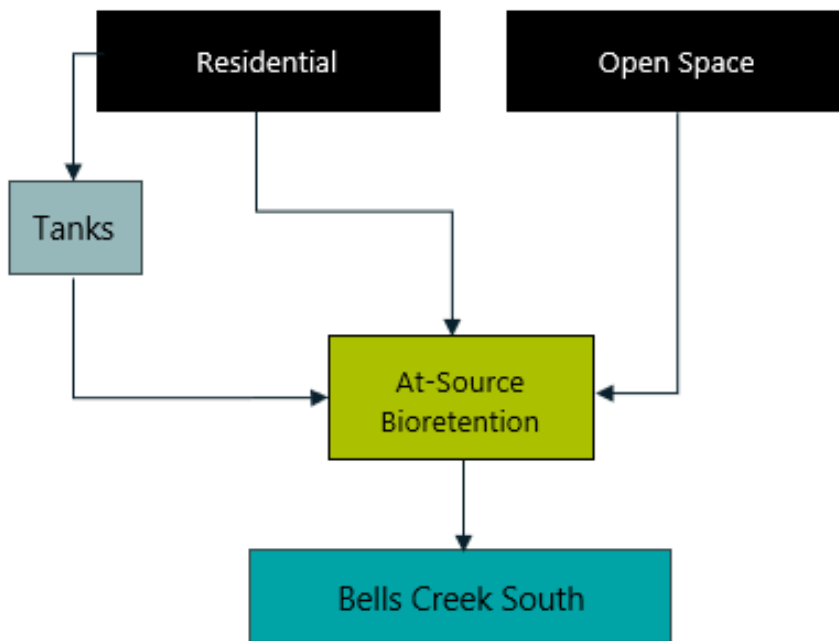
RFI2 was received from EDQ following the submission of Version B. In response to RFI2 the following changes to the strategy were made:

- The at-source bioretention in Catchments 16, 17, and 24 have been removed. Instead, the runoff from these catchments now drains to the end-of-line bioretention CAT\_12\_BIO. This addresses Item 1a of RFI2.
- Allowance for treatment of the catchments for the future childcare centre, centres, community and multiple residential sites (Lot 8100 to 8103) have been included in the strategy. As the configuration of development on these lots is unknown at this time and will be subject to their own Development Approval, only preliminary sizing of rainwater tanks have been identified (refer to Table 3-4). In addition to rainwater tanks to capture and treat runoff from roof areas, runoff from these catchments is now proposed to be treated by the end-of-line bioretention basin (CAT\_12\_BIO). As noted above, as the configuration of development on these lots is unknown at this time, it is recommended that future development applications on these lots undertake their own stormwater quality investigations to confirm that the overall Precinct 15 development will maintain achieving the required WQO's.
- The bioretention tree pit in the Catchment 10 has been removed. CAT\_GPT\_10 remains to treat the stormwater from the Catchment 9, 10 and 11 before draining into the Bells Creek South. This addresses Item 1c of RFI2.
- A sensitivity analysis of different GPT configurations has been conducted to determine the impact of removing Gross Pollutant Traps (GPTs). This analysis assessed the effectiveness of GPTs in pollutant reduction and concluded that GPT devices were not required in the overall stormwater quality management strategy. The undertaking of this sensitivity analysis addressed Item 1d of RFI2 in previous revisions of this report.
- The at-source bioretention pod treating runoff from just the linear park (CAT\_37\_BIO) has been removed and the runoff of this catchment (CAT\_37) will bypass the treatment and drain into the Bells Creek South. This addresses Item 1e of RFI2.
- The at-source bioretention CAT\_10\_BIO, from CAT\_12\_BIO to CAT\_24\_BIO and CAT\_37\_BIO have been removed. An end-of-line bioretention basin (CAT\_12\_BIO) is now proposed in their place to meet the Water Quality Objectives. Refer to Figure 3-3 for further details. This addressed Items 1f and 1g of RFI2. In addition to the dot point above, the at-source bioretention CAT\_03\_BIO to CAT08\_BIO, CAT\_25\_BIO, CAT\_26\_BIO, CAT\_28\_BIO and CAT\_33\_BIO have been removed. The end-of-line bioretention basins (CAT\_02\_BIO and CAT\_12\_BIO) are now proposed to be larger to meet the Water Quality Objectives.
- To address Item 3a of the EDQ Further Issues Letter the Gross Pollutant Trap (GPT;'s) 1, 2 and 12 have been removed from the strategy. Refer to **Figure 3-3** for the updated layout of the proposed stormwater quality improvement devices.

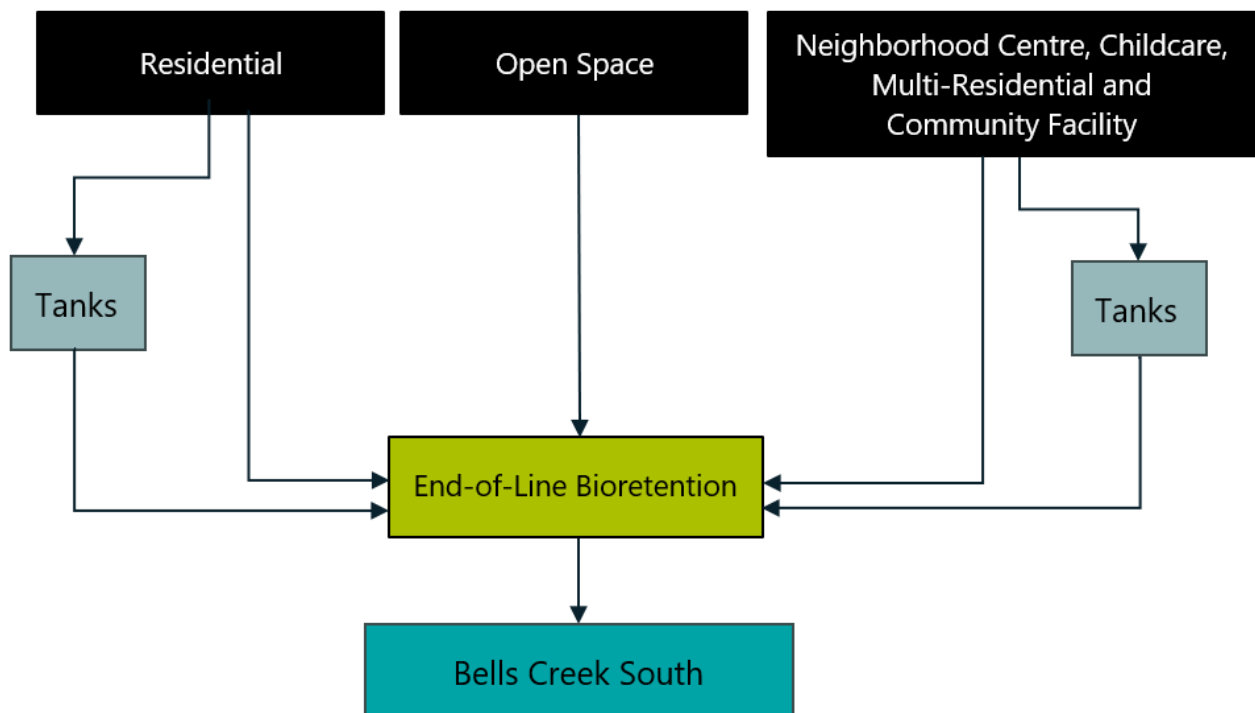
The strategy has influenced the urban design principles by:

- Limiting street leg lengths.
- Centrally located bioretention within road medians.
- 'Park fronted' terraces out letting directly to treatment devices.
- Consolidated at-source devices within the streetscape using a combination of smart urban design, locally widened road reserves and one-way cross fall roads; and

To illustrate the proposed treatment strategies **Figure 3-1** and **Figure 3-2** are provided below.



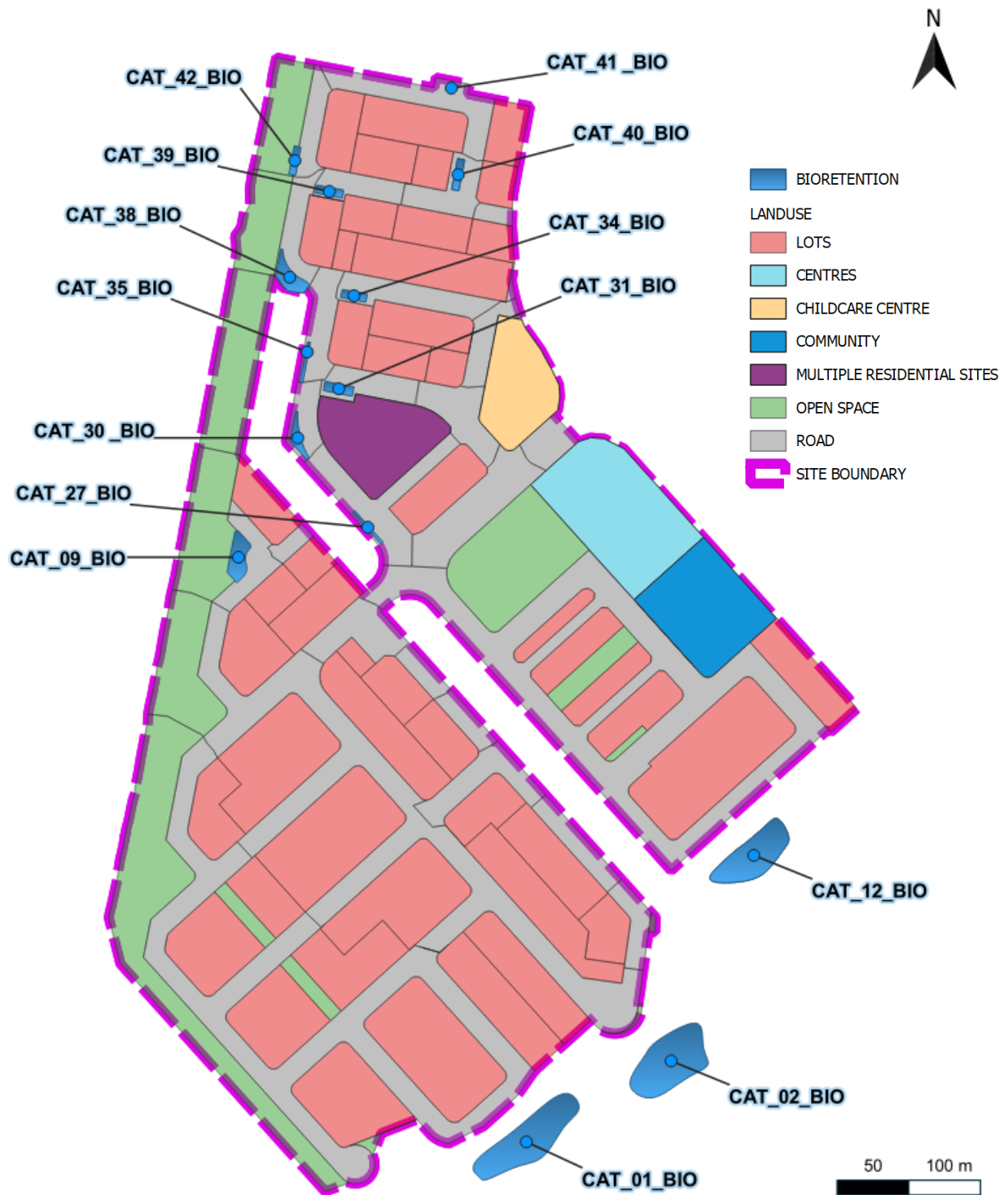
**FIGURE 3-1** PRECINCT 15 WEST AT-SOURCE STORMWATER QUALITY MANAGEMENT (UPDATED)



**FIGURE 3-2** PRECINCT 15 WEST END-OF-LINE STORMWATER QUALITY MANAGEMENT

Although the strategy differs from previous strategies across Aura, the same types of stormwater quality improvement devices are proposed to manage stormwater pollutants. **Section 3.4** discusses these devices in detail.

**Figure 3-3** below provides an overview of the proposed stormwater quality improvement devices and land use characteristics.



**FIGURE 3-3 STORMWATER QUALITY IMPROVEMENT DEVICE LAYOUT (UPDATED)**

Note the bioretention areas shown in **Figure 3-3** are the filter media area, they do not include batters etc. The integration of SQIDs into the development layout has been coordinated and considered from a bottom-up approach, with water quality driving urban design principals. Through the detailed design process amendments and refinements to SQID areas and catchment will be made as earthworks and final coordination occurs.

### 3.4 Stormwater Quality Improvement Devices

**Table 3-2** below table summarises the proposed stormwater quality improvement devices proposed within Precinct 15 West.

TABLE 3-2

SUMMARY OF STORMWATER TREATMENT DEVICES (UPDATED)

| DEVICE                     | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>RAINWATER TANKS</b>     | <p>To reduce the volume of stormwater runoff requiring treatment, rainwater tanks are proposed for residential land uses. As per Stockland's water conservation policy tanks are to be plumbed for toilet, cold laundry tap, outdoor uses and other non-potable demands. The integration of rainwater tanks is critical to ensure pollutant reductions targets are achieved, <b>Table 3-3</b> outlines the rainwater tank requirements for Precinct 15 West.</p> <p>Rainwater tanks will also be provided within the future childcare centre, centres, community and multiple residential sites (Lot 8100 to 8103).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>BIORETENTION PODS</b>   | <p>At-source bioretention systems (i.e. bioretention pods, bioretention basin) are proposed to capture stormwater runoff from residential, roads and open space land uses.</p> <p>The key constraints for at-source bioretention that need to be considered are:</p> <ul style="list-style-type: none"> <li>■ The verge profile.</li> <li>■ The location of footpaths.</li> <li>■ The location of other services (crossings, lights, car parking bays, etc); and</li> <li>■ The extended detention depth (level differences).</li> </ul> <p>Within Precinct 15 West where possible roads will incorporate one-way crossfall, this allows a single consolidated bioretention pods. This methodology allows for the footpath to be placed in the high-side verge, alleviating any potential conflicts.</p> <p>Bioretention systems utilise sandy loam soil based media to filter runoff. Sediment particles and suspended solids are trapped within vegetation and on the surface of the filter media while micro-organisms and vegetation remove dissolved nutrients (nitrogen and phosphorus) through biological uptake processes. Subsoil drainage provided below the filter media allows for the treated runoff to discharge from Bioretention systems where it is connected local stormwater drainage systems.</p> <p>The final design of the bioretention systems is to be in accordance with the Water by Design <i>Bioretention Technical Design Guidelines</i> (2014).</p> |
| <b>BIORETENTION BASINS</b> | <p>In response to the EDQ IRR at-source bioretention systems within the southern part of the Precinct (CAT_01 and CAT_02) have been replaced by two end of line bioretention basins, located between the southeastern esplanade road and Bells Creek.</p> <p>In response to the EDQ RFI2, bioretention tree pits were replaced by an additional end-of-line bioretention system, CAT_12_BIO, proposed in catchment CAT_12, located between the southeastern esplanade road and Bells Creek. This CAT_12_BIO aims to treat all the east-south catchment but exclude neighbourhood centre and the community facility area. These neighbourhood centre and the community facility area will have their own local stormwater treatment facility to meet SPP water quality objective during the future development approval stage.</p> <p>The final design of the bioretention systems is to be in accordance with the Water by Design <i>Bioretention Technical Design Guidelines</i> (2014).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

GPT devices have been removed from the above table as they are no longer adopted in the stormwater quality management strategy.

## 3.5 Stormwater Quality Improvement Device Design Approach

### 3.5.1 Rainwater Tanks

Integration of rainwater tanks are critical to Stockland's water conservation and the stormwater quality strategy in Precinct 15 West and ensures pollutant reductions targets are achieved. **Table 3-3** below outlines the rainwater tank requirements for Precinct 15 West, the requirements are consistent with the rainwater tank specifications provided in *Aura Development Stormwater Quality Management Plan* (DesignFlow & BMT, 2019) and *Aura Precinct 15 Stormwater Quality Management Plan* (DesignFlow, 2022). To ensure compliance with this Stormwater Quality Management Plan these requirements have been written into the Plan of Development.

**TABLE 3-3 RAINWATER TANK REQUIREMENTS**

| LANDUSE                                                                                                                                                                                                        | ROOF AREA                                                                                                                | TANK SIZE                                                  | CONNECTIONS                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Residential</b><br>Detached/attached dwellings<br>(Lot >300m <sup>2</sup> )                                                                                                                                 | 50% roof area drains to tank                                                                                             | 5kL per dwelling                                           | Tanks are to be connected to and supply to the following: <ul style="list-style-type: none"> <li>■ Toilets</li> <li>■ Laundry cold</li> <li>■ Outdoor taps</li> </ul> |
| <b>Residential</b><br>Detached/attached dwellings<br>(Lot = 225 – 300m <sup>2</sup> )                                                                                                                          | 50% roof area drains to tank                                                                                             | 3kL per dwelling                                           | Tanks are to be connected to and supply to the following: <ul style="list-style-type: none"> <li>■ Toilets</li> <li>■ Laundry cold</li> <li>■ Outdoor taps</li> </ul> |
| <b>Residential</b><br>Detached/attached dwellings<br>(Lot <225m <sup>2</sup> )                                                                                                                                 | No Tanks                                                                                                                 |                                                            |                                                                                                                                                                       |
| <b>Residential</b><br>Medium density dwellings                                                                                                                                                                 | 75% roof must connect / drain to tank.<br>If multiple buildings then 50% of total roof area must connect / drain to tank | 1KL per dwelling                                           | Tanks are to be connected to and supply to the following: <ul style="list-style-type: none"> <li>■ Toilets</li> <li>■ Laundry cold</li> <li>■ Outdoor taps</li> </ul> |
| <b>All non-residential</b><br>Uses including but not limited to: <ul style="list-style-type: none"> <li>• Commercial</li> <li>• Retail</li> <li>• Industrial</li> <li>• School</li> <li>• Community</li> </ul> | 50% roof must connect / drain to tank.<br>If multiple buildings then 50% of total roof area must connect / drain to tank | 1KL per toilet or urinal or<br>25KL/ha<br>Minimum 5KL size | Tanks are to be connected to and supply to the following: <ul style="list-style-type: none"> <li>■ Toilets</li> <li>■ Laundry cold</li> <li>■ Outdoor taps</li> </ul> |

To address Item 1b of the EDQ RFI2, preliminary sizing of rainwater tanks was undertaken for the future childcare centre, centres, community and multiple residential sites, based on the following:

- A volume of 25KL/ha for the future childcare centre, centres and community sites (Lots 8100, 8102 and 8103).
- For the multiple residential site (Lot 8101) a volume of 1KL per dwelling (with single toilet) and assuming a density of 40 dwellings per hectare.

The preliminary minimum rainwater tank sizes for the future childcare centre, centres, community and multiple residential sites are summarised in **Table 3-4** below.

| <b>SITE</b>                 | <b>LOT</b> | <b>LOT AREA (ha)</b> | <b>RAINWATER TANK SIZE (KL)</b> |
|-----------------------------|------------|----------------------|---------------------------------|
| <b>CHILDCARE CENTRE</b>     | 8100       | 0.347                | 9                               |
| <b>MULTIPLE RESIDENTIAL</b> | 8101       | 0.423                | 11                              |
| <b>CENTRES</b>              | 8102       | 0.691                | 18                              |
| <b>COMMUNITY</b>            | 8103       | 0.497                | 13                              |

### 3.5.2 Bioretention Systems

At source bioretention systems (pods and small basins) are integrated into the Precinct 15 West urban layout to capture and treat stormwater flows generated by the development. The systems are to be located in consolidated locations to minimize the number of cells required, systems are generally positioned at side boundaries of lots, within open space or drainage lots. The following criteria are key design requirements:

- Roads are to incorporate one-way cross fall pavement.
- Street leg lengths have been limited to 120m to ensure stormwater flow depths are in accordance with the LGIA design requirements, meaning bioretention systems can be located at the end of streets (no mid-block systems).
- Lots at street ends orientated to front intersecting road, allowing the long side of the lot to provide area of bio within the road reserve, thus avoiding potential conflict with driveways.
- Road typologies that include central medians have been inverted with bioretention systems placed within the central median.

At-source bioretention treatment has been removed from the entry road into Precinct 15. As such, this is now proposed to be a crowned road and inverted roads are no longer proposed within the Precinct.

- Footpaths are located on the opposite side of the road reserve to bioretention systems.
- Services are to avoid bioretention systems but may pass underneath with appropriate protection as required by the service provider.
- Filter media is a minimum of 1m wide.
- Batters are maximum of 1 in 2.
- Filter media is set 1m minimum from invert of kerb; and
- Extended Detention Depth varies depending on location of systems, constrained roadside systems will have 200mm EDD and unconstrained systems will have 300mm EDD.

Contained within Appendix E of *Engineering Services Report Aura Precinct 15 'West'* (Egis, 2024) typical details of proposed bioretention systems are provided.

### 3.5.3 Park Requirements

To accommodate the required bioretention basin areas, stormwater quality improvement devices have been included within parks/open space. To ensure the open space remains creditable, criteria specified within the Caloundra South Local Government Infrastructure Agreement must be achieved. These criteria are:

- Max grade 1:4, 1:6 preferred for maintenance requirements.
- Land provided for stormwater treatment facilities for the park are to have a minimal impact on the park's functionality.
- Additional land provision for integrated stormwater treatment facilities for adjoining road areas can be co-located with park treatment facilities also to have no impact on park function.
- Max. 5% of total park area in one location.
- Where possible, stormwater treatment facilities are to be integrated with planting areas and form part of the overall vegetated area.

### 3.5.4 Frog Buffer Requirements

End of line bioretention basins are proposed to be located within the frog buffer along Bells Creek South. The following criteria is required to be met and is sourced from *Aura Precinct 15 Stormwater Quality Management Plan* (DesignFlow, 2022).

- No more than 40% of the frog buffer can be used for stormwater management devices, including drainage channels. Stormwater Management Devices must be placed uniformly along the length of the frog buffer to ensure no restriction to the overall connectivity of Wallum Sedgefrog Habitat within the Frog Zone and Frog Buffer.
- Where Stormwater management is located within the Frog Buffer, an average minimum setback of 20m is required between all edges of each stormwater management measure and the frog zone boundary. This set back distance does not apply to stormwater outlet drainage channels.
- The stormwater management measures must be set back 30m from the created Frog Ponds within the Frog Zone and Frog Buffer. Drainage channels and swales from the stormwater management measures to the creek can be closer than 30m.
- The final locations of the stormwater management devices will be determined during detailed design. The location will consider the proposed Wallum Sedgefrog Habitat ponds, foraging habitat and overall habitat connectivity to ensure compliance with Key Performance Criteria 5, listed in Table 6.2a with in the Wallum Sedgefrog Management Plan and Table 8.2a with the Acid Frog Management Plan.

### 3.5.5 End of Line Concept Designs

The proposed configurations of the end of line bioretention devices were developed with acknowledgement of the surrounding constraints, available area and contributing catchments. Survey of Bells Creek South has been undertaken to determine the standing water and associated bank levels to allow the concept designs to be developed. As illustrated on drawing 3058-DA038 contained within Appendix E of the *Precinct 15 West Engineering Services Report* (Egis, 2023) the end of line bioretention basin filter media level is located ~1.8m above the standing water level is Bells Creek South.

Initial grading of batters, access tracks and bunds have been undertaken to ensure compliance with the requirements outlined in Section 3.5.5 and Section 3.5.6. The final size and location of the end of line systems will be determined through detailed design processes to ensure upstream catchments changes, stormwater network design and any other development constraints are captured.

In response to the EDQ RFI2, an additional end-of-line Bioretention Basin CAT\_12\_BIO was proposed to capture and treat runoff from the east south part of the precinct (CAT\_12) including the neighbourhood centre and community facility. This basin will incorporate the following key design attributes:

- Pre-treatment of inflows by a Gross Pollutant Trap.
- Filter Media depth of 500mm to reduce overall basin depth and better enable under-drainage to freely discharge to Bells Creek.
- Batters are maximum of 1 in 4, with provision of vehicular maintenance access into each basin; and
- Extended Detention Depth of 300mm.

## 4 STORMWATER QUALITY MODELLING

Stormwater quality modelling of the proposed Precinct 15 West development has been undertaken using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) Version 6.3.0. MUSIC enables the user to conceptualise the transfer of pollutants through a stormwater drainage system and provides an aid in quantifying the effectiveness of the proposed stormwater quality management strategy. MUSIC only provides quantitative modelling for Total Suspended Solids (TSS), Total Phosphorous (TP), Total Nitrogen (TN) and Gross Pollutants (GP).

### 4.1 Modelling Methodology

The MUSIC model was setup generally in accordance with the Healthy Land and Water *MUSIC Modelling Guidelines* (2018) and utilising information sourced from the *DesignFlow Aura Precinct 15 Stormwater Quality Management Plan – Version 3* (2022). Subsequent sections discuss the model configuration adopted for the analysis.

The updated layout of the MUSIC model is presented in **Appendix A** (`..\SF\P15_West_SWQMP_Nov2024\MUSIC\AuraP15_WQ_Model_update_241217_pref.sqz`).



FIGURE 4-1 MUSIC SOURCE NODE CATCHMENTS & LANDUSE(UPDATED)

## Meteorological Data

Six minutes pluviographic data was sourced from the Bureau of Meteorology (BOM) for the Caloundra WTP Station (No. 40496).

The 13 year period from 1st January 1997 to 31st December 2009 has been adopted for the rainfall duration as per the *Aura Precinct 15 Stormwater Quality Management Plan* (2022). The mean annual rainfall for this period is 1,348mm. Monthly evapotranspiration data for the 13 year period was sourced from the *MUSIC Modelling Guidelines* (2018) and entered into the MUSIC Model. The annual evapotranspiration value adopted was 1,618mm.

## Source Node Configuration

Within the MUSIC model source nodes represent the catchments of the proposed development. Runoff and pollutants (contained within the runoff) are generated by the source nodes.

The split catchment source node approach has been adopted in accordance with Section 3.3.2 of the *MUSIC Modelling Guidelines*, which divides each catchment into different surface types. Roof, Road and Ground source nodes have been utilised. Roof source nodes represent the dwelling roofs, road reserve source nodes represent road and road verge area, while ground nodes represent the ground area of each lot and open space areas (i.e. drainage reserve, acoustic bunded areas).

The MUSIC model catchment delineation and surface types that have been adopted for configuring source nodes are presented on **Figure 4-1** above and in **Table 4-1**.

**TABLE 4-1 MUSIC SOURCE NODE AREAS (HA)**

| CATCHMENT NAME | ROOF TO RWT | ROOF BYPASSING RWT | ROAD  | GROUND | OPEN SPACE |
|----------------|-------------|--------------------|-------|--------|------------|
| CAT_01         | 0.765       | 0.853              | 1.371 | 0.666  | 0.995      |
| CAT_02         | 0.835       | 0.888              | 1.247 | 0.721  | 0.325      |
| CAT_03         | 0.042       | 0.042              | 0.089 | 0.036  | 0.005      |
| CAT_04         | 0.083       | 0.083              | 0.107 | 0.071  | 0.000      |
| CAT_05         | 0.051       | 0.051              | 0.170 | 0.044  | 0.000      |
| CAT_06         | 0.049       | 0.049              | 0.065 | 0.042  | 0.000      |
| CAT_07         | 0.044       | 0.044              | 0.057 | 0.038  | 0.000      |
| CAT_08         | 0.076       | 0.076              | 0.172 | 0.065  | 0.000      |
| CAT_09         | 0.080       | 0.080              | 0.133 | 0.068  | 0.357      |
| CAT_10         | 0.000       | 0.000              | 0.037 | 0.000  | 0.000      |
| CAT_11         | 0.025       | 0.025              | 0.000 | 0.021  | 0.000      |
| CAT_12         | 0.290       | 0.742              | 1.483 | 0.298  | 0.665      |
| CAT_25         | 0.000       | 0.175              | 0.289 | 0.019  | 0.000      |
| CAT_26         | 0.000       | 0.000              | 0.086 | 0.000  | 0.000      |
| CAT_27         | 0.000       | 0.000              | 0.271 | 0.000  | 0.000      |
| CAT_28         | 0.023       | 0.023              | 0.163 | 0.020  | 0.000      |
| CAT_30         | 0.000       | 0.000              | 0.101 | 0.000  | 0.000      |
| CAT_31         | 0.039       | 0.039              | 0.126 | 0.034  | 0.000      |
| CAT_33         | 0.000       | 0.000              | 0.101 | 0.000  | 0.000      |
| CAT_34         | 0.170       | 0.170              | 0.183 | 0.146  | 0.000      |
| CAT_35         | 0.052       | 0.052              | 0.147 | 0.045  | 0.000      |

| CATCHMENT NAME | ROOF TO RWT  | ROOF BYPASSING RWT | ROAD         | GROUND       | OPEN SPACE   |
|----------------|--------------|--------------------|--------------|--------------|--------------|
| CAT_37         | 0.000        | 0.000              | 0.000        | 0.000        | 0.369        |
| CAT_38         | 0.041        | 0.041              | 0.126        | 0.035        | 0.217        |
| CAT_39         | 0.075        | 0.075              | 0.103        | 0.064        | 0.000        |
| CAT_CC         | <b>0.087</b> | <b>0.087</b>       | <b>0.104</b> | <b>0.069</b> | <b>0.000</b> |
| CAT_MD         | <b>0.074</b> | <b>0.074</b>       | <b>0.127</b> | <b>0.148</b> | <b>0.000</b> |
| CAT_12MD       | <b>0.297</b> | <b>0.297</b>       | <b>0.356</b> | <b>0.238</b> | <b>0.000</b> |
| CAT_40         | 0.096        | 0.096              | 0.137        | 0.083        | 0.000        |
| CAT_41         | 0.110        | 0.110              | 0.225        | 0.095        | 0.000        |
| CAT_42         | 0.048        | 0.048              | 0.102        | 0.041        | 0.218        |
| CAT_44         | 0.027        | 0.027              | 0.031        | 0.023        | 0.000        |

The development type of CAT\_CC and CAT\_12MD is commercial. The development type of CAT\_MD is residential 40 dwellings/ha. The surface-type splits for road, roof and ground follow the Table 3.4 of MUSIC Guideline 2018.

The following is noted regarding the source node configuration:

- Area for road and open space nodes have been delineated for each catchment. Area of roofs has been calculated based on the proportion of allotment area as summarised in **Table 4-2** below. Remaining allotment area has been adopted as ground area.

| TABLE 4-2 ROOF AREA ASSUMPTIONS                               |                       |
|---------------------------------------------------------------|-----------------------|
| DWELLING TYPE                                                 | ROOF AREA             |
| Detached/Attached Dwellings (Lot >300m <sup>2</sup> )         | 70% of Allotment Area |
| Detached/Attached Dwellings (Lot = 225 - 300 m <sup>2</sup> ) | 70% of Allotment Area |
| Detached/Attached Dwellings (Lot <225 m <sup>2</sup> )        | 90% of Allotment Area |

- Where bioretention systems are proposed within a catchment the source node area has been adjusted to account for the area of the bioretention system.
- Fraction impervious values have been adopted generally in accordance with Table 3.6 of the *MUSIC Modelling Guidelines*.
- Urban residential type rainfall runoff and split catchment pollutant export parameters as per Tables A1.2 and B1.3 of the MUSIC Modelling Guidelines have been adopted.

#### 4.1.1 Drainage Link Configuration

No routing was adopted for drainage links within the MUSIC model. This assumes flows and associated pollutants from all parts of the catchment arrive at the treatment nodes at the same time. This is conservative as it means that MUSIC may overestimate the overflow volumes.

#### 4.1.2 Treatment Node Configuration

Rainwater Tank, Sediment Basin, Bioretention Basin and Generic treatment nodes have been configured generally in accordance with Section 4.2 of the *MUSIC Modelling Guidelines*. A summary of the configuration, including details of deviations where required, are provided in the following sections.

##### 4.1.2.1 Rainwater Tank & Stormwater Harvesting Nodes

**Table 4-3** below summarises the treatment node configuration adopted.

**TABLE 4-3 RAINWATER TANK NODE CONFIGURATION**

| PARAMETER                         | ADOPTED VALUE                                                                                                                              | NOTES                                                                                                                                                                                                                                                         |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>High Flow Bypass</b>           | 100 m <sup>3</sup> /s                                                                                                                      | Default                                                                                                                                                                                                                                                       |
| <b>Low Flow Bypass</b>            | 0 m <sup>3</sup> /s                                                                                                                        | Default                                                                                                                                                                                                                                                       |
| <b>Volume Below Overflow Pipe</b> | 4 kL per detached dwelling allotment > 300m <sup>2</sup><br>2.4 kL per detached dwelling allotment 225 m <sup>2</sup> to 300m <sup>2</sup> | 5,000 litre tanks with 80% utilisation specified for larger detached dwelling allotments.<br>3,000 litre tanks with 80% utilisation specified for smaller detached dwelling allotments.                                                                       |
| <b>Depth Above Overflow</b>       | 200 mm                                                                                                                                     | Default                                                                                                                                                                                                                                                       |
| <b>Surface Area</b>               | 2.5 m <sup>2</sup> per detached dwelling                                                                                                   | Surface area based on tank height of 2m.                                                                                                                                                                                                                      |
| <b>Overflow Pipe Diameter</b>     | 90 mm per outlet                                                                                                                           | Standard uPVC pipe diameter adopted.                                                                                                                                                                                                                          |
| <b>Annual Demand</b>              | 384 mm per square metre                                                                                                                    | Calculated based on irrigation rate of 538 mm per year with 70% of ground area within lot irrigated on PET minus rain distribution.                                                                                                                           |
| <b>Daily Demand</b>               | 190 L per day per dwelling                                                                                                                 | Calculated based on detached dwellings having three bedrooms (2.8 EP) with rainwater used for toilet flushing and laundry, adopting half with full water saving fixtures and appliances and remaining adopting standard water saving fixtures and appliances. |

Updates were made to the configuration of the Rainwater Tank treatment nodes in response to items raised in the EDQ RFI.

With regards to the changes please note:

- **Table 4-3** specifies how the rainwater tank treatment nodes have been configured in MUSIC, not the actual configuration of the treatment device. A condition can be included in the approval to state that rainwater tanks are to be installed with a suitable first flush device.
- Item 16(f) of EDQ RFI states that *“individual rainwater tanks for standard residential lots must incorporate a conservative factor to ensure the MUSIC model is modelled conservatively”* and *“at the end-of-life of the rainwater tank or water pump, some property owners may elect not to replace their rainwater tanks or pumps”*. Therefore, the configuration of Rainwater Tank node volume has been updated to assume only 80% of residential lots have functioning rainwater tank, by reducing the size of each tank node volume by 20%.
- Annual irrigation demand has adopted 70% of ground area in accordance with the MUSIC modelling Guidelines (2018). Irrigation distribution has also been updated to account for no irrigation when rainfall occurs (i.e. PET minus rain now adopted).
- The depth above overflow value of 200mm has been adopted in accordance with the MUSIC Modelling Guidelines.
- Given the potential for property owners to not replace rainwater tanks or pumps (as stated in Item 16(f) of the EDQ RFI) the potential for property owners to replace full water saving appliances and fixtures (when broken) with standard (less water conserving) appliances and fixtures would also be expected. Furthermore, the likelihood (and frequency) of water efficient appliances and fixtures being replaced by standard options would also be higher (say 50%). Therefore, the daily demand value has been updated to account for the potential for 50% of full water saving fixtures and appliances being replaced by standard appliances and fixtures over time.

#### 4.1.2.2 Sediment Nodes

**Table 4-4** below summarises the sediment basin node configuration adopted.

**TABLE 4-4 SEDIMENT BASIN NODE CONFIGURATION (UPDATED)**

| PARAMETER                           | ADOPTED VALUE         | NOTES                                                                                                                                                                          |
|-------------------------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Low Flow Bypass</b>              | 0 m <sup>3</sup> /s   | Default                                                                                                                                                                        |
| <b>High Flow Bypass</b>             | 100 m <sup>3</sup> /s | Default                                                                                                                                                                        |
| <b>Inlet Pond Volume</b>            | 450 m <sup>3</sup>    | Sized to remove coarse sediment (> 125 µm) during 1 year ARI storm (for conceptual design, assume 5% macrophyte area). As Constructed<br>Wetlands Technical Design Guidelines. |
| <b>Surface Area</b>                 | 300 m <sup>2</sup>    | Calculated as per Constructed<br>Wetlands Technical Design Guidelines.                                                                                                         |
| <b>Extended Detention</b>           | 0.05 m                | As per Constructed<br>Wetlands Technical Design Guidelines.                                                                                                                    |
| <b>Permanent Pool Volume</b>        | 450 m <sup>3</sup>    | 1.5 m x surface area as per Constructed<br>Wetlands Technical Design Guidelines.                                                                                               |
| <b>Initial Volume</b>               | 450 m <sup>3</sup>    | Equal to permanent pool volume                                                                                                                                                 |
| <b>Exfiltration Rate</b>            | 0                     | As per MUSIC Modelling Guidelines                                                                                                                                              |
| <b>Evaporative loss as % of PET</b> | 75                    |                                                                                                                                                                                |
| <b>Equivalent pipe diameter</b>     | 600 mm                | Calculated as per Constructed<br>Wetlands Technical Design Guidelines.                                                                                                         |
| <b>Overflow weir width</b>          | 2 m                   | As per MUSIC Modelling Guidelines                                                                                                                                              |

#### 4.1.2.3 Bioretention Nodes

The breakdown of bioretention filter area and the coverage (i.e. filter area as a percentage of the catchment area treated) along with extended detention depth, is summarised in **Table 4-5** below.

**TABLE 4-5 STORMWATER CATCHMENT AND BIORETENTION SYSTEM AREAS**

| BIORETENTION<br>DEVICE ID | CATCHMENT AREA<br>(m <sup>2</sup> ) | BIORETENTION AREA<br>(m <sup>2</sup> ) | COVERAGE<br>(%) | EXTENDED DETENTION<br>DEPTH (mm) |
|---------------------------|-------------------------------------|----------------------------------------|-----------------|----------------------------------|
| CAT_01_BIO                | 46,494                              | 1,906                                  | 4.1%            | 300                              |
| CAT_02_BIO                | 56,651                              | 2,324                                  | 4.1%            | 300                              |
| CAT_09_BIO                | 7,175                               | 359                                    | 5.0%            | 200                              |
| CAT_12_BIO                | 63,348                              | 2,229                                  | 3.5%            | 300                              |
| CAT_27_BIO                | 2,705                               | 60                                     | 2.2%            | 200                              |
| CAT_30_BIO                | 1,013                               | 145                                    | 14.3%           | 200                              |
| CAT_31_BIO                | 2,379                               | 135                                    | 5.7%            | 200                              |
| CAT_34_BIO                | 6,691                               | 101                                    | 1.5%            | 200                              |
| CAT_35_BIO                | 2,959                               | 57                                     | 1.9%            | 200                              |
| CAT_38_BIO                | 4,609                               | 301                                    | 6.5%            | 200                              |
| CAT_39_BIO                | 3,177                               | 108                                    | 3.4%            | 200                              |
| CAT_40_BIO                | 5,200                               | 110                                    | 2.7%            | 200                              |
| CAT_41_BIO                | 5,400                               | 174                                    | 2.7%            | 200                              |
| CAT_42_BIO                | 4,583                               | 95                                     | 2.1%            | 200                              |
| <b>Average Coverage</b>   |                                     |                                        | <b>4.3%</b>     |                                  |

The at-source bioretention CAT\_03\_BIO to CAT08\_BIO, CAT\_25\_BIO, CAT\_26\_BIO, CAT\_28\_BIO and CAT\_33\_BIO have been removed. The end-of-line bioretention basins (CAT\_02\_BIO and CAT\_12\_BIO) are now proposed to be larger to meet the Water Quality Objectives, as indicated in **Table 4-4** above.

Other bioretention node configuration properties are presented below in **Table 4-6**.

**TABLE 4-6 BIORETENTION NODE CONFIGURATION**

| PARAMETER                                     | ADOPTED VALUE                                    | NOTES                                                                                                                                                    |
|-----------------------------------------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>High Flow Bypass</b>                       | 100 m <sup>3</sup> /s                            | Default                                                                                                                                                  |
| <b>Low Flow Bypass</b>                        | 0 m <sup>3</sup> /s                              | Default                                                                                                                                                  |
| <b>Extended Detention Depth</b>               | Variable                                         | Refer to                                                                                                                                                 |
| <b>Surface Area</b>                           | Variable                                         | Based on average of filter area and area at top of extended detention depth, assuming batters of 1 in 4 from filter surface to extended detention depth. |
| <b>Filter Area</b>                            | Variable                                         | Refer to                                                                                                                                                 |
| <b>Unlined Filter Media</b>                   | 0.1                                              | Assumes filter is lined                                                                                                                                  |
| <b>Saturated Hydraulic Conductivity</b>       | 200 mm/hr                                        | As per MUSIC Modelling Guidelines                                                                                                                        |
| <b>Filter Depth</b>                           | 500 mm                                           | As per MUSIC Modelling Guidelines                                                                                                                        |
| <b>TN Content of Filter Media</b>             | 400 mg/kg                                        | As per MUSIC Modelling Guidelines                                                                                                                        |
| <b>Orthophosphate Content of Filter Media</b> | 30 mg/kg                                         | As per MUSIC Modelling Guidelines                                                                                                                        |
| <b>Exfiltration Rate</b>                      | 0 mm/hr                                          | Assumes no exfiltration                                                                                                                                  |
| <b>Based Lined</b>                            | Yes                                              | Assumes no exfiltration                                                                                                                                  |
| <b>Vegetation Properties</b>                  | Vegetated with Effective Nutrient Removal Plants |                                                                                                                                                          |
| <b>Overflow Weir Width</b>                    | Variable                                         | Based on filter area divided by 10 as per MUSIC Modelling Guidelines                                                                                     |

## 4.2 Modelling Results

The results of the MUSIC model are summarised in **Table 4-7** below.

**TABLE 4-7 MUSIC MODELLING RESULTS**

| Pollutant                     | WQO<br>(Load Reduction) | Source Load<br>(kg/year) | Residual Load<br>(kg/year) | Pollutant<br>Reduction |
|-------------------------------|-------------------------|--------------------------|----------------------------|------------------------|
| <b>Total Suspended Solids</b> | 95%                     | 34,800                   | 1,780                      | 94.9%                  |
| <b>Total Phosphorus</b>       | 89%                     | 71.0                     | 6.63                       | 90.7%                  |
| <b>Total Nitrogen</b>         | 68%                     | 432                      | 125                        | 71.2%                  |
| <b>Gross Pollutants</b>       | 90%                     | 4,520                    | 28.2                       | 99.4%                  |

MUSIC model file [AuraP15\\_WQ\\_Model\\_update\\_241217\\_pref.sqz](#) | filepath [\\legis.racine.local\bu\\_batiment\CAL\05\\_Projects\BNE\21\000307.11 - Aura Precinct15 DA\6\\_Model\SF\P15\\_West\\_SWQMP\\_Nov2024\MUSIC\](#)

The results confirm that the proposed stormwater quality management strategy achieves a reduction in pollutant export to meet the required WQOs.

It is understood that, based on review of the model results by Design Flow, the TSS Pollutant Reduction of 94.8% is appropriate for compliance.

## 5 CONSTRUCTION, OPERATIONAL MANAGEMENT & MAINTENANCE OF SQIDS

The following details management and maintenance requirements for the construction and operation phases of the SQIDs proposed.

### 5.1 Construction & Establishment Phases

Construction of the development and the following building works has the potential to mobilise large quantities of litter and sediment in runoff. Therefore a staged construction and establishment method for SQIDs is recommended.

#### 5.1.1 Bioretention Systems

Construction of the development and the building works has the potential to mobilise large quantities of sediment in runoff. For Bioretention Systems to perform as designed there is a need to protect filter media and pod vegetation during this phase of the development. Therefore, a staged construction and establishment method for construction of the Bioretention System will be followed.

It is proposed to follow an installation procedure for each Bioretention System generally in accordance with *Option 1 of the Staged Construction and Establishment Methodology* as outlined in *Table 3.6* and *Section 3.8.1* of the *Water by Design Construction and Establishment Guidelines* (2011). A summary of this methodology is presented below.

1. Civil Works (Functional Installation) – Initially the Bioretention System will be used for erosion and sediment control. Once most of the civil construction works are complete, earthworks and shaping to create the layout and functional elements of the Bioretention Systems will be undertaken. The installation of functional elements (e.g. inlets, outlets structures, subsoil drainage, transition layers and filter media) shall be undertaken as per the methodology detailed in *Section 3.9.1* in the *Water by Design Construction and Establishment Guidelines* (2011). Prior to the commencement of the Building Phase, sediment fences will be erected around the perimeter of the Bioretention System to avoid the entry of sediment. Laying a temporary filter cloth (or 25mm thick layer of coarse sand and 25mm of topsoil) over the Bioretention System shall protect the Bioretention Systems during both the Civil Works and the Building Phase.
2. Building Phase (Building Construction) – During this phase the Bioretention Systems shall continue to operate. Sediment fences shall remain around the perimeter of the Bioretention System (both around the filter media and the top of batter) to restrict sediment inflow. Clear indications of the restriction of traffic to the Bioretention systems shall also be displayed.
3. Landscape Establishment (Operational Establishment) – when the Building Phase is 80% complete, the temporary protective measures and accumulated sediments within the Bioretention System will be removed. The Bioretention System shall be planted with vegetation and landscaping as proposed. Sufficient watering and removal of weeds following planting shall be undertaken in accordance with *Section 3.9.3* of the *Water by Design Construction and Establishment Guidelines* (2011).

### 5.2 Operational Phase

#### 5.2.1 Rainwater Tanks

The inspection and maintenance of Rainwater Tanks are to be undertaken by each separate property owner in accordance with relevant manufacturers guidelines. Sunshine Coast Council provide guidance for plumbing approval, installation and use of rainwater tanks.

Visit <https://www.sunshinecoast.qld.gov.au/development/building/rainwater-tanks> for further information.

#### 5.2.2 Bioretention Systems

The following sections outline the proposed procedures and methodology for the Operational Phase management as well as the maintenance of the Bioretention Systems proposed as part of the development.

The following methodology will be followed through the operational phases of the Bioretention Systems. The information provided in this section will be incorporated into the detailed design. General requirements, health and safety and yearly reviews for the Bioretention Systems are also provided.

No monitoring of water quality is proposed. The level of operational management and the maintenance proposed is considered best practice and if followed will ensure SQIDs will operate to their design intent.

#### 5.2.2.1 Inspection Requirements

During Operational Phase, regular inspections of the Bioretention Systems are required to ensure vegetation establishes and the properties of the filter media remain effective.

Checklists have been developed for the Bioretention Systems. The condition and maintenance carried out will be recorded on the checklist at the time the inspection and/or maintenance is undertaken. A copy of the checklist is presented in **Appendix B**.

Maintenance personnel should also be encouraged to report and document changes in vegetation type within the Bioretention Systems. Photographic documentation and mapping of vegetation types are to be recorded annually to determine changes in vegetation over time. Photographs of each device are to be taken at the same location annually.

Through these procedures a reliable maintenance database can be developed and used to determine if the maintenance undertaken is ensuring the SQID is functioning as intended.

Except for periods of extended wet weather, mosquitoes are unlikely to be an issue - as surface water within the Bioretention Systems is not expected to remain for more than two days.

#### 5.2.2.2 Weed Removal

Maintenance personnel will need to identify species of both terrestrial and semi-aquatic weeds common to the area. As the Bioretention Systems are "dry" SQIDs, aquatic weed infestation is unlikely. When weeds have been identified they are to be removed by hand immediately or eradication methods scheduled before the infestation becomes larger and more difficult to control. It should be noted that herbicides should not be used in the removal of invasive weeds as this has negative impacts on downstream water quality.

#### 5.2.2.3 Replanting

Replanting of vegetation is to be carried out to replace dead or damaged vegetation, vegetation that has been removed by scour or erosion, or vegetation that is being re-planted following tilling or the replacement of filter media. Removed vegetation should be replaced by plants of similar size and species, or as indicated on the appropriate Landscaping Plans.

#### 5.2.2.4 Filter Inspection & Replacement

Fine sediment and silt may accumulate within the filter media of the Bioretention Systems over time. Removal of sediment and silt trapped within the filter media is expected to be the costliest maintenance requirement for Bioretention Systems.

It is recommended that a visual inspection of the infiltration properties be undertaken at least three times per year with more frequent inspections no greater than three months apart between October and May. This is to determine whether built-up fine sediment and silt has reached a point where the filter media has become clogged.

The infiltration properties of the filter media within the Bioretention Systems needs to be checked after a period of significant rainfall event, which is defined as a 24 hour period with rainfall greater than 100mm, or a shorter period with an average rainfall intensity greater than 50mm/hr. This is an ideal period to assess the infiltration properties as water should not pond for an extended period. Therefore inspections should occur 24 to 72 hours after an appropriate rainfall event.

In the event that isolated boggy patches occur within the Bioretention Systems then the subsoil drainage pipes could be blocked. If this is not the case and no other blockages have been observed, then surface of the media

is to be tilled (raked and aerated) to a depth of 100 to 150mm. This will require temporarily removing and storing the surface vegetation prior to tilling the surface. Should the infiltration properties be improved then the removed vegetation and coarse aggregate layer can be replanted. Should tilling prove unsuccessful or if an infiltration check indicates filter media to be clogged, then the top portion of the filter media is to be replaced as follows:

1. Removal of surface vegetation and coarse aggregate layer and store for re-establishment.
2. Remove the top 150mm of filter media and dispose of in an approved manner.
3. Till the remaining filter media to a further depth of 300mm.
4. Place a new layer of appropriate filter media as per the specification (refer to **Appendix C**), free from organic matter, clay and silt; and
5. Replant the removed vegetation.

If blockages occur frequently, a filter media with a higher saturated hydraulic conductivity should be considered. Reassessing the species and planting density of vegetation is also an option. Unless changes to the filter media specification are made through a review of the SQID performance, the filter media to be used for the Bioretention Systems is to be a Sandy Loam as per the FAWB *Guidelines for Filter Media in Biofiltration Systems (Version 3.01, 2009)* presented in **Appendix C**.

#### 5.2.2.5 Subsoil Drainage Inspection & Cleanout

The build-up of fine sediment and silt within the subsoil drainage pipes is unlikely as it will be trapped by the filter media. However, the subsoil drainage is to be checked annually for blockages that may be caused by foreign matter entering through cleanout inspection openings or by small fauna. This can be done by either:

- Observing the condition of the subsoil drain through the cleanout and inspection openings located towards the downstream end of a subsoil drainage pipe.
- Observing the amount of sediment and silt flushed into the downstream field inlet when water is pumped into the upstream end of the subsoil drainage line (through a cleanout and inspection opening).

If a considerable amount of sediment and silt is observed or carried into the downstream inlet, then each subsoil drainage line must be flushed out with high pressure water.

Water is to be pumped into each subsoil drainage pipe through the upstream cleanout inspection opening until all sediment has been ejected from the pipe. To collect the water and ejected sediment within the downstream pit a temporary barrier is to be placed over the downstream pipe opening (such as sand bags) and a pump used to draw the water, sediment and silt out of the pit and irrigated onto areas of open space away from each basin. This will ensure the sediment and silt does not enter the downstream waterway.

If frequent issues occur with the subsoil drainage system, CCTV checking could be undertaken to identify any damage subsoil drainage.

#### 5.2.2.6 Monitoring

Visual monitoring of bioretention systems is proposed as part of the inspection and maintenance requirements for the Systems. Visual inspections will occur at least three times per year with more frequent inspections to occur no more than three months apart between October and May. Inspection should be made not less than 24 hours and not more than 72 hours after the cessation of rainfall if the total rainfall on any day exceeds 100mm.

### 5.3 General Requirements

#### 5.3.1 Yearly Review of Maintenance Management Plan

Each year a review is to be carried out to determine if the programmed inspection and maintenance (including checklists) is ensuring SQIDs are functioning as intended. The review should include an assessment of the maintenance database to determine whether the programmed inspections and maintenance is effective. Information on the database should be assessed to determine whether any noticeable changes are evident in

vegetation, presence of fauna and operational efficiency of any structures or features of the device. This will further provide indicators as to whether sufficient information is being recorded for management purposes.

### 5.3.2 Maintenance Personnel Safety (OH&S)

The *Workplace Safety Regulation* 2011 requires that all reasonably practicable steps be taken to protect an employee's health in a workplace. Organisations involved in the inspection and maintenance of the SQIDs should therefore:

- Have a documented occupational health and safety policy in place.
- Ensure all staff and maintenance personnel are aware of and abide by the policy; and
- The policy provides a mechanism for review and improvement.

As part of the policy personnel involved in the maintenance of the SQIDs are to have sufficient resources (such as personnel protective equipment, training etc.) to carry out the task in a safe manner.

### 5.3.3 Public Safety

The safety of the public in the area of the SQID being maintained also needs to be ensured. Notices to inform the staff and public accessing the site regarding the SQID maintenance needs to be circulated prior to the scheduled date. Temporary signage and safety barriers need to be erected around maintenance work areas prior to the works commencing and are not to be removed until all works have finished.

## 6 CONCLUSION

Egis Consulting has prepared this Stormwater Quality Management Plan for Precinct 15 West of the Aura development to support the proposed Development Application for Reconfiguration of a Lot over the western portion of the subject site known as Aura Precinct 15 'West'.

Version C was prepared in response to the Request for Further Information 2 (RFI2) issued by Economic Development Queensland (EDQ) dated 13 March 2024.

Version D has been prepared to address Item 3a of the Further Issues EDQ Letter dated 11 June 2024, which requires the removal of Gross Pollutant Traps (GPT 1, 2 and 12) from the treatment train, or further justification for their inclusion. To address the item GPT's 1, 2 and 12 have been removed.

Version E has been prepared to address changes to the stormwater quality management strategy, which includes removal of GPTs and At-Source WSUD devices for water quality treatment of runoff from the catchments of the future childcare centre, centres, community and multiple residential sites (Lot 8100 to 8103) within the Precinct.

*This Version F has been prepared to address the new information request from EDQ dated 22 April 2025 (Reference: DEV2023/1445), which included further clarification and documentation requirements. In this version, the SQMP has been updated to:*

- *Update MUSIC source node catchments & land use to include Catchment 37 label in Figure 4-1;*
- *Provide sizing details of sediment basins incorporated into the MUSIC model for larger catchments upstream of end-of-line bioretention systems in Table 4-4.*

This report has therefore:

- Identified the pollutants of concern and pollutant load reduction Water Quality Objectives to be achieved.
- Proposed an updated stormwater quality management strategy utilising the following stormwater quality improvement devices:
  - Allotment scale Rainwater Harvesting and reuse.
  - Bioretention systems, being bioretention pods and basins.

*Preliminary sizing of rainwater tanks have been identified for the future childcare centre, centres, community and multiple residential sites (Lot 8100 to 8103).*

*As the configuration of development on future childcare centre, centres, community and multiple residential sites is unknown at this time, it is recommended that future development applications on these lots undertake their own stormwater quality investigations to confirm that the overall Precinct 15 development will maintain achieving the required WQO's.*

- As discussed in Version B, litter baskets and stormwater harvesting have been removed from the strategy.
- Presented MUSIC modelling methodology and results, now including the future childcare centre, centres, community and multiple residential sites (Lot 8100 to 8103), demonstrating the proposed strategy will achieve a reduction in pollutant export to achieve the identified water quality objectives.
- Incorporated removal of GPT's 1, 2, and 12 from the MUSIC model, the results of which do not significantly impact the pollutant reductions (i.e. Water Quality Objectives are still achieved).
- Identified the operational management and maintenance requirements for SQIDs during both construction and operational phases of the development.
- The previous Version D of this report has addressed Item 3a of the EDQ Further Issues Letter. This revision continues to address this item.
- The previous Version E of this report has addressed changes to the stormwater quality management strategy, which includes removal of GPTs and At-Source WSUD devices for water quality treatment of runoff from the catchments of the future childcare centre, centres, community and multiple residential sites (Lot 8100 to 8103) within the Precinct. This revision continues to address this item.

## 7 RECOMMENDATIONS

Egis recommends that the stormwater quality management plan proposed within this report is approved and adopted for detailed design phase of the development.

## 8 REFERENCES

DesignFlow & BMT (2019), *Aura Development Stormwater Quality Management Plan*.

DesignFlow (2022), *Aura Precinct 15 Stormwater Quality Management Plan – Version 3*.

Egis Consulting (2023), *Memorandum – Aura Development Acoustic Bund South*.

Egis Consulting (2023), *Engineering Services Report Aura Precinct 15 'West'*.

Queensland Department of Infrastructure, Local Government and Planning (2017), *State Planning Policy*.

Healthy Land and Water (2018), *MUSIC Modelling Guidelines*.

Water by Design (2011), *Construction and Establishment Guidelines*.

FAWB (2009), *Guidelines for Filter Media in Biofiltration Systems (Version 3.01)*.

## Appendix E

### ATLAN FILTER BASKET SQUIDEP CERTIFICATE



## Stormwater Quality Improvement Device Evaluation Protocol (SQIDEP)

# VERIFICATION CERTIFICATE

### Applicant Information

|                   |                                                                                |
|-------------------|--------------------------------------------------------------------------------|
| Applicant Name    | Atlan Stormwater                                                               |
| Applicant Address | 130 Sandstone Place, Parkinson, QLD 4115                                       |
| Website           | <a href="http://www.atlan.com.au">www.atlan.com.au</a>                         |
| Contact Email     | <a href="mailto:Andy.hornbuckle@atlan.com.au">Andy.hornbuckle@atlan.com.au</a> |

### Verified Technology

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Title      | Atlan Stormsack                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| SQIDEP Pathway     | Field Evaluation via reviewed QAPP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Reviewed Documents | <p>The following documents form the basis of this independent evaluation:</p> <ol style="list-style-type: none"><li>Stormsack detailed performance report (Stormsack DPR) (Issue 2)<br/>Drapper, D., Waldron, S., &amp; Nyakas, L. (2024). SQIDEP Detailed Performance Report – Stormsack (Issue 2), Drapper Environmental Consultants, Crestmead, Queensland, Australia</li><li>Hydraulic Performance (Treatable Flowrate) Lab Testing report (Issue 1), 5 July 2024<br/>Drapper, D., Nyakas, L. (2024). Hydraulic Performance (Treatable Flowrate) Lab Testing report (Issue 1), Drapper Environmental Consultants, Crestmead, Queensland, Australia</li><li>ATLAN Stormsack Device Lab Testing Report (Issue 3), 5 July 2024<br/>Drapper, D.; Nyakas, L. ATLAN Stormsack Device Lab Testing Report (Issue 3); Drapper Environmental Consultants: Crestmead, Queensland, Australia, 2024.</li><li>StormSack Performance Assessment, Report Number: MHL2325, Manly Hydraulics Laboratory, November 2014.</li></ol> |

## Technology Information

| <b>Applicant's<br/>Verified<br/>Performance<br/>Claims (ER)</b> | <table border="1"> <thead> <tr> <th colspan="2">Parameter</th></tr> </thead> <tbody> <tr> <td>Total suspended solids</td><td>45%</td></tr> <tr> <td>Total phosphorus</td><td>47%</td></tr> <tr> <td>Total nitrogen</td><td>25%</td></tr> <tr> <td>Total petroleum hydrocarbons</td><td>Not claimed</td></tr> <tr> <td>Gross pollutants</td><td>100 %</td></tr> </tbody> </table> <p>IEP's comments: Nil.</p> <p>IEP's recommendations: All performance claims are considered compliant up to the treatment flow rate for the applicable device. Verified flow rates are included in the table below:</p> <table border="1"> <thead> <tr> <th>Size of Stormsack (Pit dimensions) (mm)</th><th>TFR for MUSIC modelling – high flow bypass in litres per second</th></tr> </thead> <tbody> <tr> <td>450 x 450</td><td>10</td></tr> <tr> <td>600 x 600</td><td>25</td></tr> <tr> <td>600 x 900</td><td>32</td></tr> <tr> <td>900 x 900</td><td>39</td></tr> <tr> <td>1200 x 900</td><td>50</td></tr> <tr> <td>1200 x 1200</td><td>65</td></tr> </tbody> </table> | Parameter |  | Total suspended solids | 45% | Total phosphorus | 47% | Total nitrogen | 25% | Total petroleum hydrocarbons | Not claimed | Gross pollutants | 100 % | Size of Stormsack (Pit dimensions) (mm) | TFR for MUSIC modelling – high flow bypass in litres per second | 450 x 450 | 10 | 600 x 600 | 25 | 600 x 900 | 32 | 900 x 900 | 39 | 1200 x 900 | 50 | 1200 x 1200 | 65 |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--|------------------------|-----|------------------|-----|----------------|-----|------------------------------|-------------|------------------|-------|-----------------------------------------|-----------------------------------------------------------------|-----------|----|-----------|----|-----------|----|-----------|----|------------|----|-------------|----|
| Parameter                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |  |                        |     |                  |     |                |     |                              |             |                  |       |                                         |                                                                 |           |    |           |    |           |    |           |    |            |    |             |    |
| Total suspended solids                                          | 45%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |  |                        |     |                  |     |                |     |                              |             |                  |       |                                         |                                                                 |           |    |           |    |           |    |           |    |            |    |             |    |
| Total phosphorus                                                | 47%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |  |                        |     |                  |     |                |     |                              |             |                  |       |                                         |                                                                 |           |    |           |    |           |    |           |    |            |    |             |    |
| Total nitrogen                                                  | 25%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |  |                        |     |                  |     |                |     |                              |             |                  |       |                                         |                                                                 |           |    |           |    |           |    |           |    |            |    |             |    |
| Total petroleum hydrocarbons                                    | Not claimed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |  |                        |     |                  |     |                |     |                              |             |                  |       |                                         |                                                                 |           |    |           |    |           |    |           |    |            |    |             |    |
| Gross pollutants                                                | 100 %                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |  |                        |     |                  |     |                |     |                              |             |                  |       |                                         |                                                                 |           |    |           |    |           |    |           |    |            |    |             |    |
| Size of Stormsack (Pit dimensions) (mm)                         | TFR for MUSIC modelling – high flow bypass in litres per second                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |  |                        |     |                  |     |                |     |                              |             |                  |       |                                         |                                                                 |           |    |           |    |           |    |           |    |            |    |             |    |
| 450 x 450                                                       | 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |  |                        |     |                  |     |                |     |                              |             |                  |       |                                         |                                                                 |           |    |           |    |           |    |           |    |            |    |             |    |
| 600 x 600                                                       | 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |  |                        |     |                  |     |                |     |                              |             |                  |       |                                         |                                                                 |           |    |           |    |           |    |           |    |            |    |             |    |
| 600 x 900                                                       | 32                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |  |                        |     |                  |     |                |     |                              |             |                  |       |                                         |                                                                 |           |    |           |    |           |    |           |    |            |    |             |    |
| 900 x 900                                                       | 39                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |  |                        |     |                  |     |                |     |                              |             |                  |       |                                         |                                                                 |           |    |           |    |           |    |           |    |            |    |             |    |
| 1200 x 900                                                      | 50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |  |                        |     |                  |     |                |     |                              |             |                  |       |                                         |                                                                 |           |    |           |    |           |    |           |    |            |    |             |    |
| 1200 x 1200                                                     | 65                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |  |                        |     |                  |     |                |     |                              |             |                  |       |                                         |                                                                 |           |    |           |    |           |    |           |    |            |    |             |    |
| <b>Test Stormwater<br/>Runoff</b>                               | <p>21 compliant stormwater events. Water chemistry was compliant with Table 1 in SQIDEP v1.3. Minimum number of aliquots collected, and samples were representative.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |  |                        |     |                  |     |                |     |                              |             |                  |       |                                         |                                                                 |           |    |           |    |           |    |           |    |            |    |             |    |
| <b>Test Catchment</b>                                           | <ul style="list-style-type: none"> <li>- The field testing for the ATLAN Stormsack (200) was carried out at Griffith University, Carpark H, Parkland Campus, Griffith Way, Southport, QLD, 4215.</li> <li>- The catchment area draining to the device was reported to be 1,181 m<sup>2</sup> directly connected to the Stormsack. The catchment was reported to be 66% impervious with the remainder including a eucalyptus forested area which drains to the Stormsack.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |  |                        |     |                  |     |                |     |                              |             |                  |       |                                         |                                                                 |           |    |           |    |           |    |           |    |            |    |             |    |
| <b>Maintenance<br/>Performed during<br/>monitoring</b>          | <p>The Stormsack should be cleaned/maintained when accumulated pollutants reach the trigger level of 150mm depth in the bag, or 50% capacity by volume.</p> <p>The monitored Stormsack was maintained twice during the SQIDEP monitoring program due to construction loads received from earthworks undertaken in the upstream catchment. Regular inspection of the Stormsack is recommended, as per the manufacturer's O&amp;M manual.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |  |                        |     |                  |     |                |     |                              |             |                  |       |                                         |                                                                 |           |    |           |    |           |    |           |    |            |    |             |    |

**STORMWATER**  
AUSTRALIA

**Verified method:**

The Reviewers have verified that the method undertaken complies with the intent and specifics of SQIDEP v1.3.

A more detailed Independent Evaluatores Report is available to get an understanding of what was checked and how the claim was verified.

|                  |                                                                                                                                                                                                             |                                                                 |                      |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|----------------------|
| Conditions/Notes | MUSIC modelling shall be carried out as follows:                                                                                                                                                            |                                                                 |                      |
|                  | A generic node is to be used in MUSIC with a high flow bypass set to the applicable TFR (see table below) for the size of the Atlan Stormsack proposed and with inlet and outlet concentrations as follows: |                                                                 |                      |
|                  | Pollutant                                                                                                                                                                                                   | Inlet concentration                                             | Outlet Concentration |
|                  | TSS                                                                                                                                                                                                         | 100                                                             | 55                   |
|                  | TP                                                                                                                                                                                                          | 100                                                             | 53                   |
|                  | TN                                                                                                                                                                                                          | 10                                                              | 7.5                  |
|                  | Size of Stormsack (Pit dimensions) (mm)                                                                                                                                                                     | TFR for MUSIC modelling – high flow bypass in litres per second |                      |
|                  | 450 x 450                                                                                                                                                                                                   | 10                                                              |                      |
|                  | 600 x 600                                                                                                                                                                                                   | 25                                                              |                      |
|                  | 600 x 900                                                                                                                                                                                                   | 32                                                              |                      |
|                  | 900 x 900                                                                                                                                                                                                   | 39                                                              |                      |
|                  | 1200 x 900                                                                                                                                                                                                  | 50                                                              |                      |
|                  | 1200 x 1200                                                                                                                                                                                                 | 65                                                              |                      |

**STORMWATER**  
AUSTRALIA

Independent Reviewers

| Evaluator Name | Evaluator Signature                                                                |
|----------------|------------------------------------------------------------------------------------|
| Mark Liebman   |  |
| Baden Myers    |  |

Issue of Verification Certificate

|                                                                |               |
|----------------------------------------------------------------|---------------|
| Acceptance by SQIDEP Governance Panel                          |               |
| Acceptance by Stormwater Australia Board of Directors          |               |
| Verification Issued                                            |               |
| Stormwater Australia Verification Certificate Number Reference | SA-2024/12-VC |

Verified under SQIDEP Version 1.3  
Body of Evidence Pathway

