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AURA PRECINCT 18

STORMWATER MANAGEMENT PLAN V3

Company. Stockland
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DOCUMENT CONTROL SHEET

DOCUMENT

Aura Precinct 18

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EXECUTIVE SUMMARY

This report addresses stormwater quality management for the first phase of development within Precinct 18 at Aura.

The stormwater management plan adopts the same approach to MUSIC modelling and stormwater treatment train as previous stages at Aura.

The stormwater quality targets have been derived from the Caloundra South Water Quality Management Plan to achieve a no-worsening of water quality in Bells Creek.

The performance results are summarised in the table below.

Parameter	Source load	Residual load	Load reduction	Target	Complies
Total Suspended Solids (kg/yr)	5820	194	96.7%	95%	Yes
Total Phosphorus (kg/yr)	11	0.994	90.9%	89%	Yes
Total Nitrogen (kg/yr)	53.8	17.2	68%	68%	Yes
Gross Pollutants (kg/yr)	507	0	100%	100%	Yes

Modelling results show that the treatment area required is three times larger than the minimum size specified (1.5% of contributing catchment area) in the State Planning Policy, reflecting the significance of receiving waters.

The ultimate stormwater strategy for Precincts 17 - 19 involves the creation of a series of lakes with associated wetlands. These are to be located downslope of the development works covered by this plan. The stormwater strategy described in this report is therefore conservative in nature because supplementary treatment will be provided through the wetlands that will be built as part of the lake management strategy.

The stormwater management plan for the first phase of development in Precinct 18 is a standalone plan. Nothing in this stormwater management plan is contingent on any future works elsewhere in Precincts 17 - 19, and can therefore be approved prior to the preparation of plans for those future works.

INFORMATION REQUEST ITEMS

	INFORMATION REQUEST / FURTHER ISSUES ITEM	RESPONSE
a	Include the model parameters for the treatment nodes; rainwater tanks, wetland, bio-retention basins and swales.	A copy of the MUSIC model was provided with the submission which includes all model parameters. Additional screenshots of treatment node parameters are included.
b	Table 2 shows that the school and sports field has been excluded from the MUSIC model. This is not acceptable and is required to be included as part of the contributing catchment.	The reason there are no school and sportsfield areas included in Catchment A in the MUSIC model is that there are no school and sportsfield areas in Catchment A.
c	Table 2 and 3 show medium density sites are assumed as Urban Residential node. This is not appropriate as it is anticipated that these sites may have large proportion of open-air car parking area as a contributing catchment. Specify more appropriate assumption for medium density sites.	The relevant guidelines for MUSIC modelling under the IA are the Water by Design 2010 MUSIC Modelling Guidelines. This provides for the use of Residential nodes for residential land use up to 80 dwellings/ha. Refer also Drapper D, Olive K, McAlister T, Coleman R and Lampard J-L (2022) A Review of Pollutant Concentrations in Urban Stormwater Across Eastern Australia, After 20 Years. Front. Environ. Chem. 3:853764. doi: 10.3389/fenvc.2022.853764. This paper provides relevant and recent data on stormwater quality in SEQ which affirms that the adopted parameters are conservative. If higher pollutant loads were assumed from the noted land uses, the overall treatment performance—expressed as percentage load reduction—would improve. This principle is explained in Healthy Land & Water (2022), *Total annual loads: an alternative methodology for complying with Queensland's post-construction phase stormwater management design objectives that incentivises low impact design,* Brisbane, Queensland, Healthy Land & Water).
d	Provide concept drawings for the WSUD treatment devices (Stages 23 and 25, Lots 9004 and 9005; and Stage 45 Lot 9018) to demonstrate the basin footprint can be located within the drainage reserve boundaries.	Refer civil engineering drawings
e	In the MUSIC model, include by-pass (secondary drainage link) for the sediment basin by-passing the wetland and bio-basin, based on maximum treatable flow rate.	MUSIC models are rarely sensitive to high flow bypass parameters in the model, because once the capacity of a treatment measure is exceeded negligible treatment occurs. A high flow bypass is set at 0.25 $m^3/s/ha$. and the results are insensitive to this change.
f	Include high flow by-pass for the wetland in the MUSIC model, to represent by-passing the wetland.	High flow bypass is configured at the sediment basin and no further downstream bypass is necessary in the model.

	INFORMATION REQUEST / FURTHER ISSUES ITEM	RESPONSE
g	Similar with previous precinct Stormwater Management Plan, individual rainwater tanks for standard residential lots must incorporate a conservative factor to ensure the MUSIC model is modelled conservatively. 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. Amend the MUSIC model to assume only 80% of standard residential lots have functioning rainwater tanks and reuse (assuming 20% of the property owners do not maintain their rainwater tank and pump).	The stormwater management plan is based on the assumption that all specified stormwater assets are maintained. There is no relevant guideline referenced under the IA that requires treatment assumptions to be arbitrarily discounted. Nonetheless, all rainwater tank demands have been reduced by 20% and the results are insensitive to this change.
h	Section 1.5, para 4 states "The stormwater treatment provided by this plan is at least to the standards required for discharge into Bells Creek, and exceeds the standard required for discharge into the lakes, which is assumed to be the standard stormwater quality targets described in the Queensland State Planning Policy". The report states that the stormwater management strategy does not rely on treatment by the proposed lakes. The water quality objectives for discharge to Bells Creek South is considerably higher than the SPP objectives. If the discharge quality to the lake is the SPP target, then it is not clear how the required additional treatment would be undertaken prior to discharge to Bells Creek South. Provide clarification for the proposed treatment train between the lakes and prior to discharge to Bells Creek South. Alternatively, remove the reference to the SPP.	Reference to SPP is removed.
i	In Section 1.6 of the Stormwater Management Plan, include possible use of rainwater for irrigation in the sports park north of P18.1. Investigate stormwater reuse for this sports park and amend the SMP accordingly.	The stormwater strategy demonstrates compliance with the required objectives, and provides for significant reuse of water through the use of rainwater tanks. Further reuse risks adversely affecting the water balance of the future proposed lakes. Where any opportunities for additional water reuse are identified they may be pursued at Stockland's choice are not an essential aspect of this stormwater management plan for compliance with the IA.
j	Section 2, para 1 mentions about the target pollutant loads '194 kg/year for total suspended solids (TSS), 1.2 kg/year for total phosphorus (TP) and 17.2 kg/year for total nitrogen (TN)'. These references should be removed from the Stormwater Management Plan. Alternatively, provide commentary on how these annual pollutant loads are extracted from the Design Flow BMT Stormwater Quality Management Plan (2019).	Reference removed

GLOSSARY

Term	Definition
AEP	Annual Exceedance Probability
ARI	Average Recurrence Interval
AVRC	Annual Volumetric Runoff Coefficient (mean annual runoff as a proportion of mean annual rainfall)
Catchment	Area of land that collects rainfall and contributes to surface water (streams, rivers, wetlands) or to groundwater
Groundwater	Sub-surface water in the soil or rock structure
Ha	Hectares
Impervious	An impermeable surface where the majority of rainfall becomes runoff by limiting the infiltration of water into the underlying soils
Infiltration	The movement of water from the ground surface into the underlying soil profile
QUDM	Queensland Urban Drainage Manual
Receiving water	A water body that may receive runoff from the catchment under consideration and has some environmental value or beneficial use.
Runoff	Surface overland flow of water resulting from rainfall or irrigation exceeding the infiltration capacity of the soil
SBSMP	Site Based Stormwater Management Plan. A SBSMP shall identify potential on and off-site impacts associated with stormwater for a proposed development. The SBSMP shall also identify a range of stormwater management strategies and actions for water quality, water quantity, and environmental issues.
Stormwater runoff	All surface water runoff from rainfall, predominantly in urban catchments.

1 INTRODUCTION

1.1 Background

The urban design vision for Aura Lakes is to create a vibrant place to live, work and play, with a focus on high amenity which leverages the natural assets of the site.

Aura is located in the catchment of Bells Creek which drains into the environmentally sensitive Pumicestone Passage, which has a High Ecological Value (HEV) classification. As such, stormwater needs to be managed in a way that ensures protection of the receiving waterways.

The Aura Lakes precinct presents additional stormwater management considerations, given the need to sustain water levels, and ensure adequate water quality within the proposed lakes.

The approved Water Quality Objective (WQO) is to achieve ‘no change’ and specifically maintain existing water quality (20th, 50th and 80th percentiles).

1.2 Project Scope

Aura Lakes will require careful planning and incorporation of the latest science in stormwater quality and quantity to identify a viable strategy that:

- Integrates with, and enhances, the overall character, amenity, and sense of place of the precinct in terms of urban greening and cooling.
- Provides the necessary level of waterway protection.
- Supports high amenity feature lakes.
- Is efficient in terms of infrastructure costs and land area allocated for stormwater management.
- Interfaces with any relevant local and regional stormwater harvesting schemes.
- Minimises costs associated with ongoing asset management.

1.3 Locality

The Aura Lakes precinct is located within the Caloundra South Priority Development Area (PDA), and is bordered by Bells Creek to the north and west, and the (under construction) Bells Creek Arterial to the south and east (refer Figure 1).

Figure 1 Locality Plan

1.4 Site characteristics

The site drains in a north easterly direction to Bells Creek South. The highest elevations along the southern boundary are at approx. 21 m AHD, falling to 1 m AHD in the northeastern corner. The site has gently rolling hills with slopes typically in the order of 2 – 4% (see Figure 2).

This stormwater management plan addresses the first phase of development within Precincts 18, which is an area of approximately 1000 lots as shown in Figure 3.

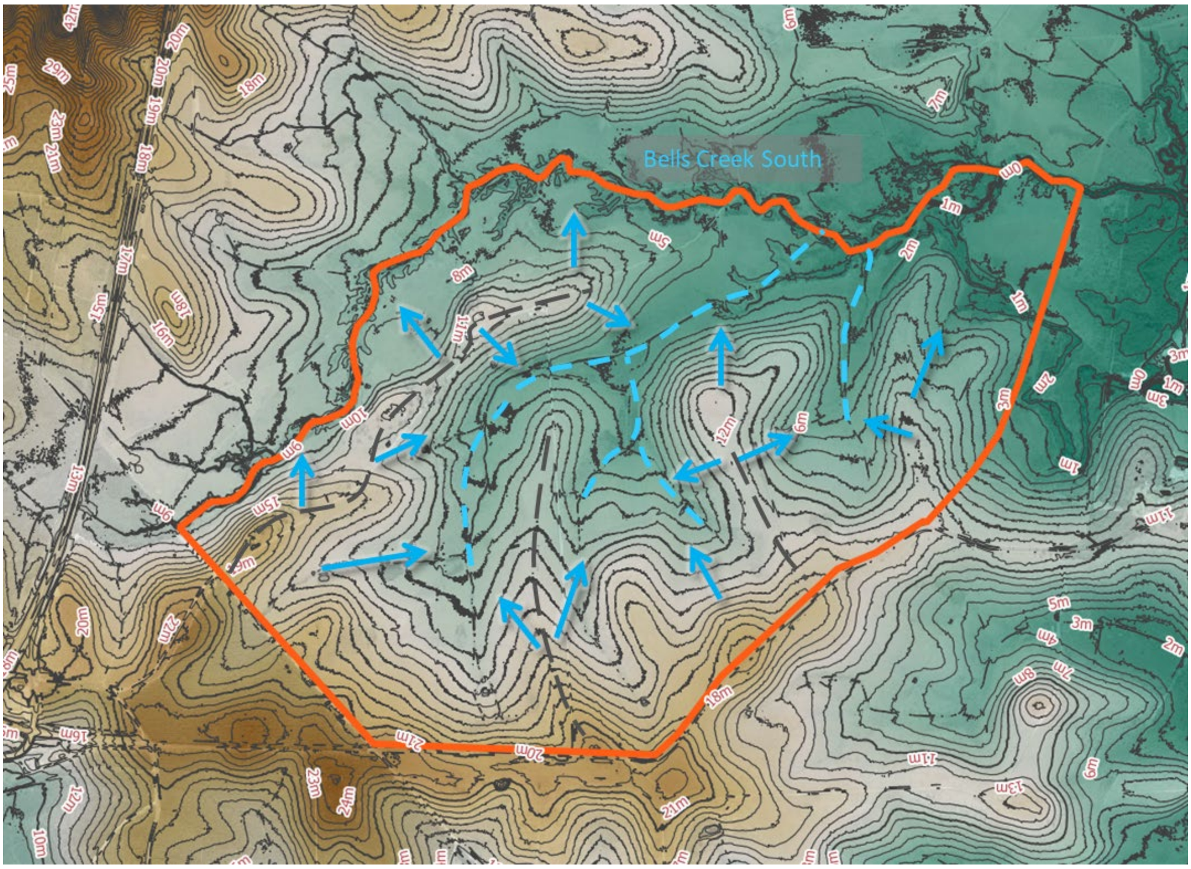

Figure 2 Site Topography (1 m contour lines shown)

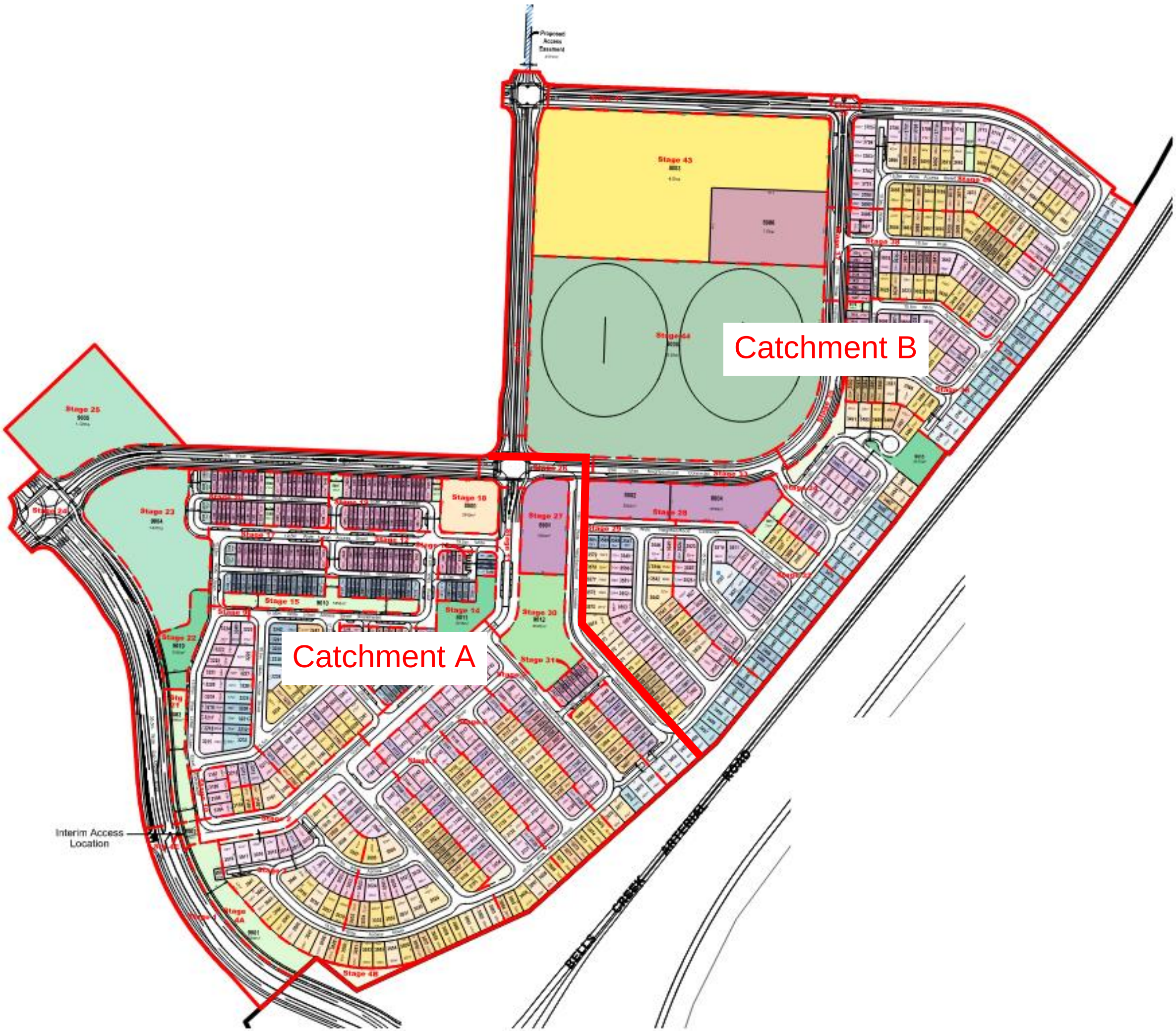

Figure 3 Site Plan – Precinct 18 First Development Phase

With the exception of the Bells Creek corridor which has a largely intact riparian canopy (Figure 4), the site is mostly cleared grazing land with only minor stands of mature trees (see Figure 5).

Internal drainage lines have been subject to direct grazing and have limited ecological values (see Figure 6). The drainage lines are very flat with grades of about 0.5%.

Figure 4 Bells Creek South

Figure 5 Typical site terrain and condition

Figure 6 Existing drainage line

This stormwater management plan relates to the first portion of development within Precinct 18 for an area indicated in Figure 3.

1.5 Lakes

The ultimate stormwater strategy for Precincts 17 - 19 involves the creation of a series of lakes with associated wetlands, as described in the Infrastructure Agreement.

The lakes are to be located downslope of the development works covered by this plan.

This stormwater management plan is cognisant of the lakes, but not dependent on them as the water quality objectives have been met without the need to consider any benefit resulting from lake treatment, and can therefore be approved as a standalone plan prior to the full design and documentation of the lakes.

The key linkage between this plan and the ultimate lakes strategy is that the proposed wetlands will deliver additional water quality benefits to those documented in this report.

Nothing in this stormwater management plan is contingent on any future works elsewhere in Precincts 17 - 19, and can therefore be approved without regard to any design or reporting on those future works.

A separate lakes management plan will be provided relevant to the future corresponding development application.

1.6 Regional Stormwater Harvesting

A regional stormwater harvesting scheme has been proposed for Aura, which would transfer runoff from Aura to Ewen Maddock Dam to supplement regional water supplies and minimise stormwater runoff.

The relevance of that scheme to stormwater management in Precinct 17-19 is that harvesting infrastructure (capture, storage and pumping systems) would need to be created, and significant volumes of runoff would be diverted away from Bells Creek and Pumicestone Passage, potentially helping reduce stormwater pollution loads and possibly leading to smaller stormwater treatment systems.

At the time of preparing this report, that scheme was at concept stage only, and timeframes for design, approvals and construction are uncertain. Conservatively, the stormwater treatment systems described in this report are designed as if no harvesting is occurring. If harvesting were to be implemented, there may be grounds to review and update this report and potentially reduce the size of treatment systems.

1.7 Frog buffers

Frog habitat is identified across Aura for the following frogs which are of National and State significance (MSES and MNES):

- Wallum Sedge Frog: Management is to occur in accordance with the approved *Caloundra South Wallum Sedge Frog Management Plan*. Some frog habitat areas within the development footprint will be removed and compensatory habitat areas created.
- Wallum Froglet: to be managed in accordance with the approved *Caloundra South Acid Frog Management Plan*
- Wallum Rocket Frog: to be managed in accordance with the approved *Caloundra South Acid Frog Management Plan*

Note that there are no frog habitat areas within the area subject to this stormwater management plan (as shown in Figure 3).

2 PERFORMANCE TARGETS

The treatment strategy for Precincts 17-19 meets the stormwater objectives established for the Aura development to ensure no adverse impacts to Bells Creek and Pumicestone Passage.

The target annual pollutant load reductions (from unmitigated urban pollutant loads) are as follows:

- Total suspended solids (TSS): 95%
- Total phosphorus (TP): 89%
- Total nitrogen (TN): 68%.

These stormwater objectives were established as part of the stormwater planning and waterway modelling for the whole Aura development as documented in Aura Development Stormwater Quality Management Plan (DesignFlow and BMT, 2019).

3 STORMWATER QUALITY MANAGEMENT

3.1 Strategy Overview

The stormwater quality strategy is as follows:

- Rainwater tanks: Rainwater tanks are to be used in residential lots consistent with previous stages of Aura. Rainwater captured in tanks is to be used in toilets and outdoor demands. Tanks are not intended to be used in multi-unit developments and small lot residential sites (<250 m²) due to a combination of reduced space and limited irrigation demands.
- Gross pollutant traps on lots for landuses that generate high volumes of litter (i.e. commercial, industrial, school, community facilities, Child car and sporting ovals)
- Treat the balance of runoff with end-of-line treatment systems integrated into open space areas. These are combined sediment basins, wetlands and bioretention systems) have been sized to achieve the stormwater quality objectives in combination with upstream treatments.
- Be cognisant of—and be able to integrate with—the potential future lakes and regional stormwater harvesting scheme, while being able to be approved as a standalone stage of development.

3.2 MUSIC Modelling

The stormwater treatment train has been modelling using Music v6.3 and the parameters have been established in accordance with the MUSIC Modelling Guidelines (Water by Design, 2010).

A copy of the MUSIC model is available with this report.

Key model parameters are described below:

- Rainfall is based on Caloundra WWTP 6-minute pluviograph data for the period 1997-2009, with a mean annual rainfall of 1570 mm and ET of 1618 mm (as per MUSIC modelling for previous stages of Aura). Refer Table 1 for further details.
- Rainfall runoff parameters as per Water by Design (2010).
- Pollutant concentrations as per Water by Design (2010).

Table 1 Meteorological and Rainfall-Runoff Data Reporting Table

INPUT	DATA USED IN MODELLING
Rainfall station name and number	Caloundra WWTP 1997-2009 6min Updated V2
Time step	6-minute time
Modelling period	1997-2009
Mean annual rainfall (mm)	1570
Evapotranspiration (mm)	1618
Rainfall runoff parameters	Per Water by Design (2010)
Pollutant export parameters	Per Water by Design (2010)

The proposed development is bisected by a central north-south ridge and comprised of two key catchments: Catchment A drains to the north west and towards potential future lakes, while catchment B drains to the north east. Both catchments ultimately drain into Bells Creek. A land use breakdown for each catchment is presented in Table 2 and Table 3 respectively. All areas have been directly measured from AutoCAD drawings of the site layout shown in Figure 3.

Lumped land use nodes have been used for all subcatchments, with the exception of Road Reserves and Residential areas, where split catchment approach has been used (per Water by Design 2010) to enable rainwater tanks to be modelled.

The MUSIC modelling is based on a one-hectare unit model that reflects the land use proportions detailed in Table 2 and Table 3. This allows results to be scaled based on catchment area.

Table 2 Catchment A Details

Land use	Area (m^2)	% of catchment	Adopted node per Water by Design (2010)	Adopted impervious %
Open Space	43,134	15.2%	Urban Residential	10%
MD Sites	5,000	1.8%	Urban Residential	80%
Childcare	3,580	1.3%	Commercial	80%
Small Lot	34,506	12.1%	Urban Residential	80%
Road Reserves	116,203	40.8%	Urban Res Road Split	65%
School	Nil in this catchment	0.0%	N/A	N/A
Sports Fields	Nil in this catchment	0.0%	N/A	N/A
Residential (>250 m^2)	82,102	7.3%	Urban Res Roof Split	100%
		7.3%	Urban Res Roof Split	100%
		14.5%	Urban Ground Split	20%
Total	**284,525**	**m^2**		

Table 3 Catchment B Details

Land use	Area (m^2)	% of catchment	Adopted node per Water by Design (2010)	Adopted impervious %
Open Space	71,926	19.6%	Urban Residential	10%
MD Sites	8,510	2.3%	Urban Residential	80%
Commercial	750	0.2%	Commercial	80%
Small Lot	21,611	5.8%	Urban Residential	80%
Road Reserves	75,977	20.5%	Urban Res Road Split	80%
School	40,010	10.8%	Commercial	60%
Sports Fields	65,000	10.8%	Urban Residential	0%
Residential (>250 m^2)	86,701	5.9%	Urban Res Roof Split	100%
		5.9%	Urban Res Roof Split	100%
		11.7%	Urban Ground Split	20%
Total	**370,485**	**m^2**		

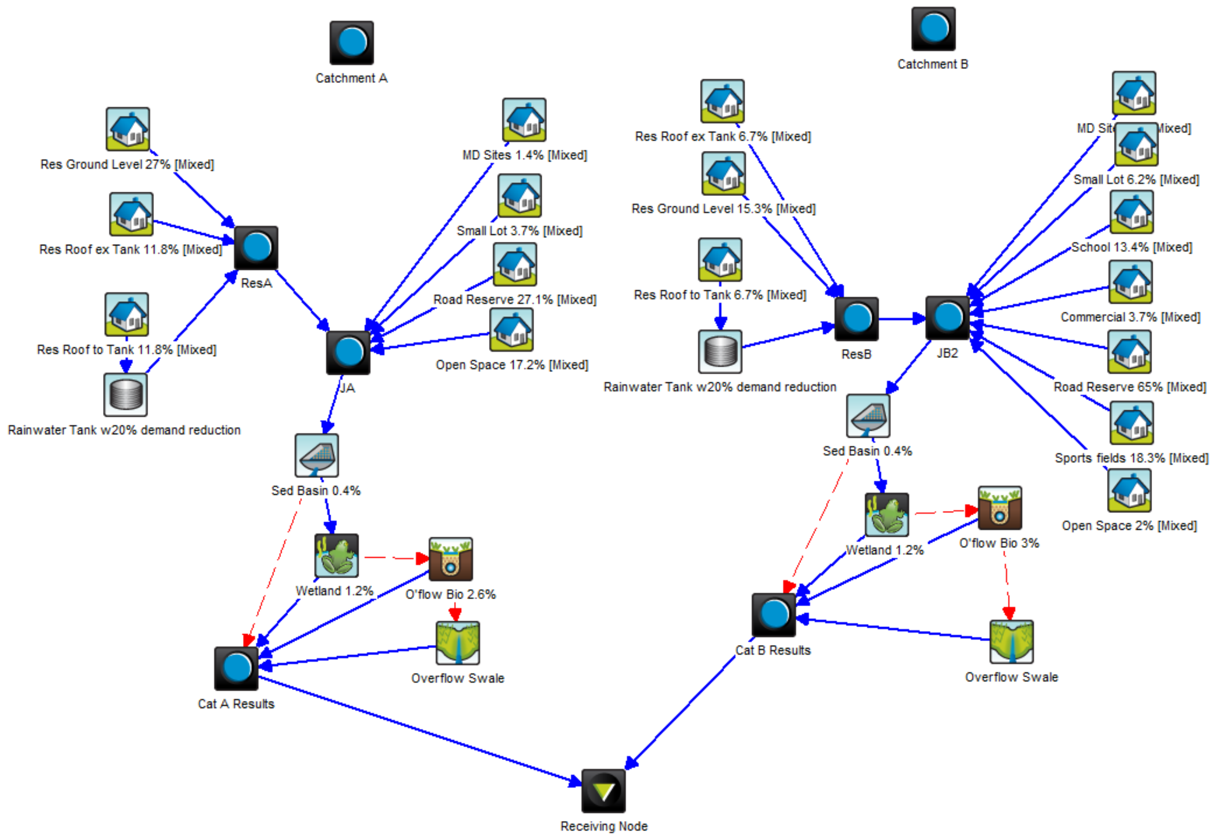

Figure 7 MUSIC model schematic

3.3 Treatment trains

Key details on the sizing of the treatment trains is summarised below in Table 4.

The appended MSUIC model provides full details on the treatment trains and model configuration.

Table 4 Treatment Train Details

	Notes	Catchment A	Catchment B
Rainwater tanks	Res lots >250 m². Tank demands as per previous stages of Aura, pro-rated based on reduced number of lots with tanks. Conservatively, the demands on rainwater tanks have been reduced by 20% to account for possible non-conformances and low maintenance (the results are insensitive to this assumption).	Y	Y

Sediment Pond	Provides pretreatment of coarse sediment. Configuration is the same as previous stages at Aura with slight increase in size to compensate for reduced rainwater tanks. A high flow bypass of 0.5 $m^3/s/ha$ is adopted with flows above this assumed to bypass all subsequent treatment measures.	0.4% of catchment	0.4% of catchment
Wetland	Low (treated) flows drain to catchment outlet, overflows to bioretention. Configuration is the same as previous stages at Aura.	1.2% of catchment	1.2% of catchment
Bioretention	Extended detention of bio extends over wetland footprint. Underdrainage flows to catchment outlet, overflows via swale. Configuration is the same as previous stages at Aura with slight increase in size to compensate for reduced rainwater tanks.	2.6% of catchment	3.0% of catchment
Overflow swale	Configuration is the same as previous stages at Aura.	Nominally 20m	Nominally 20m

MUSIC model parameters for all the treatment nodes are provided on the following pages in Figure 8 to Figure 12.

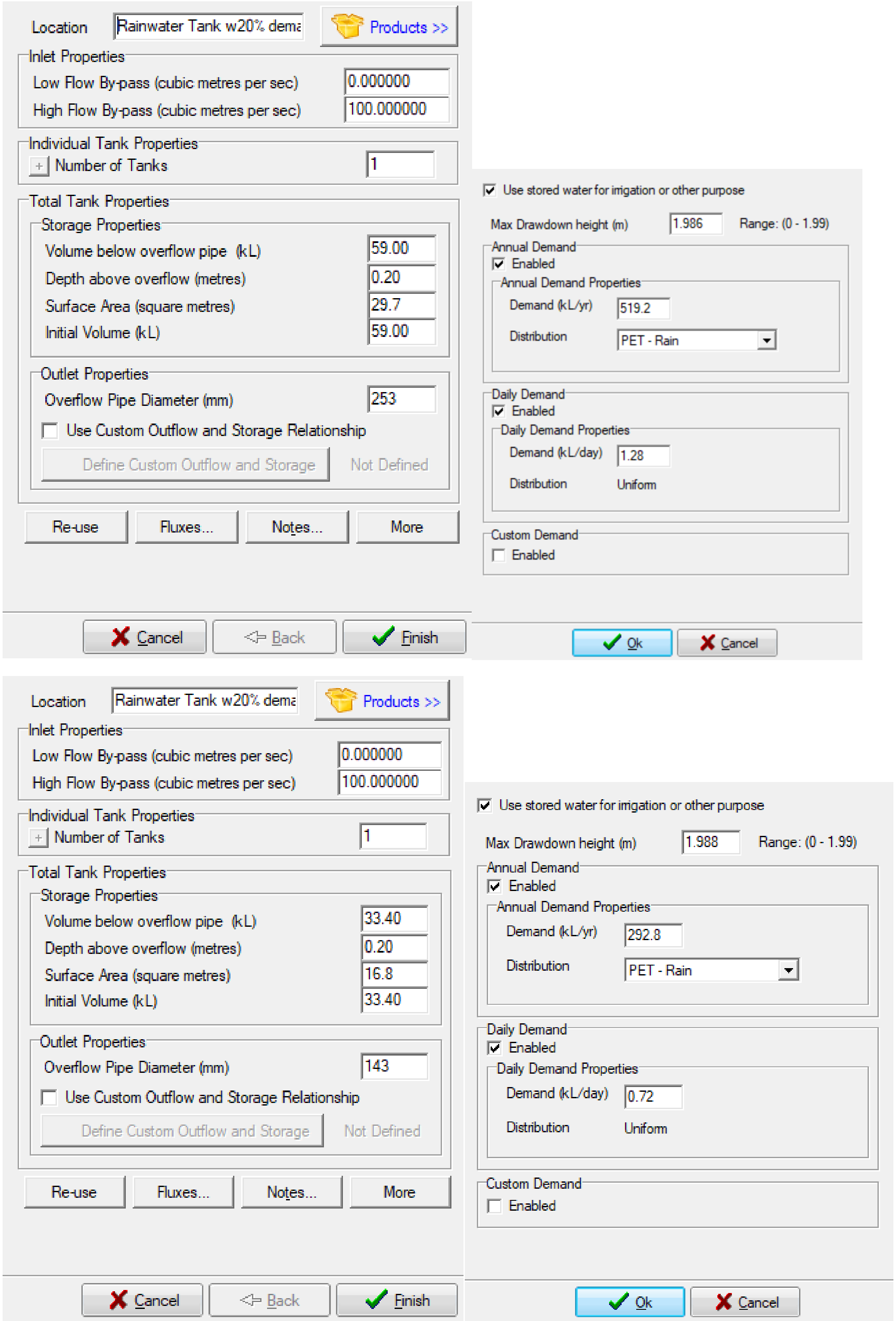

Figure 8 Rainwater Tank Node Parameters (Catchment A top, Catchment B above)

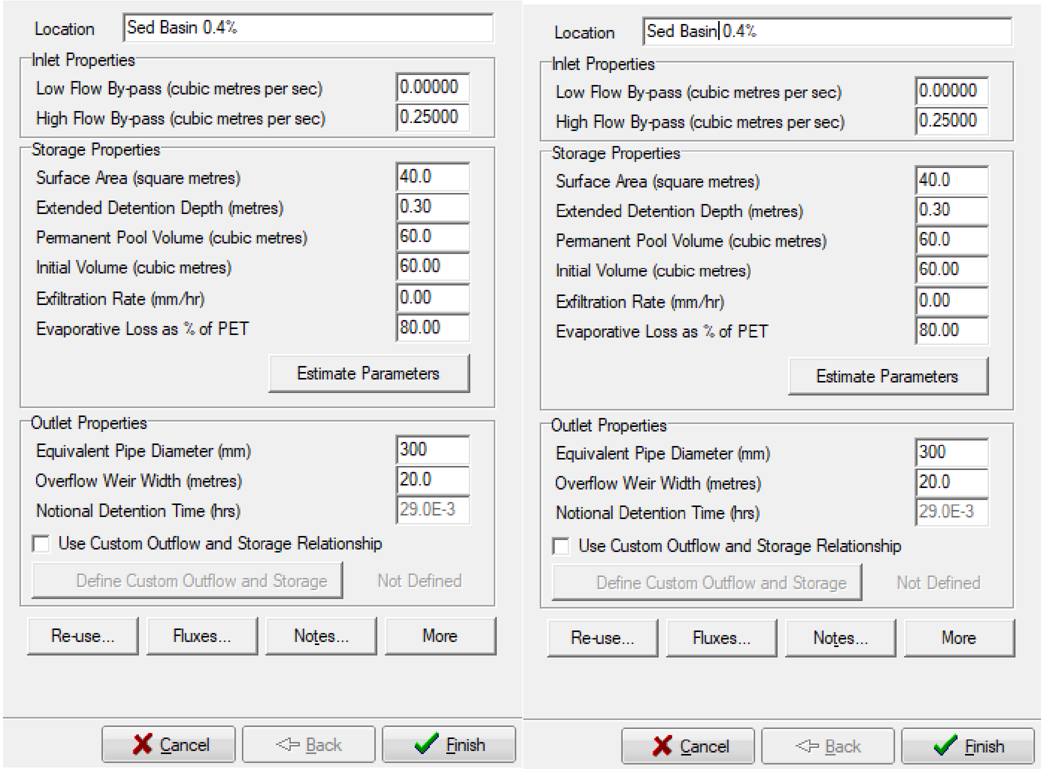

Figure 9 Sediment Basin Node Parameters (Catchment A left, Catchment B right)

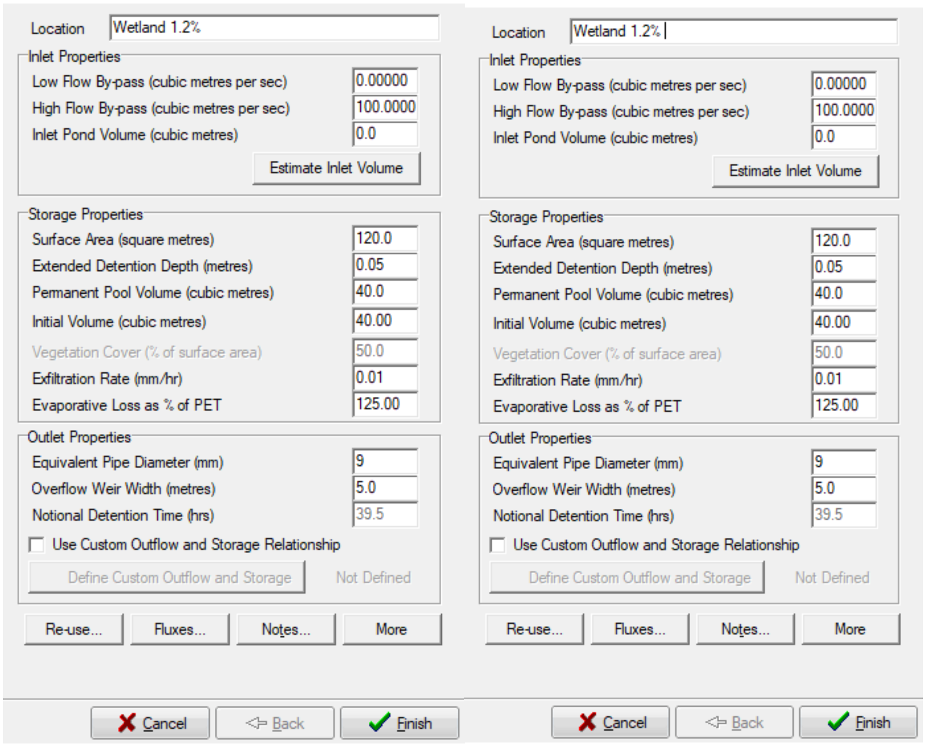

Figure 10 Wetland Node Parameters (Catchment A left, Catchment B right)

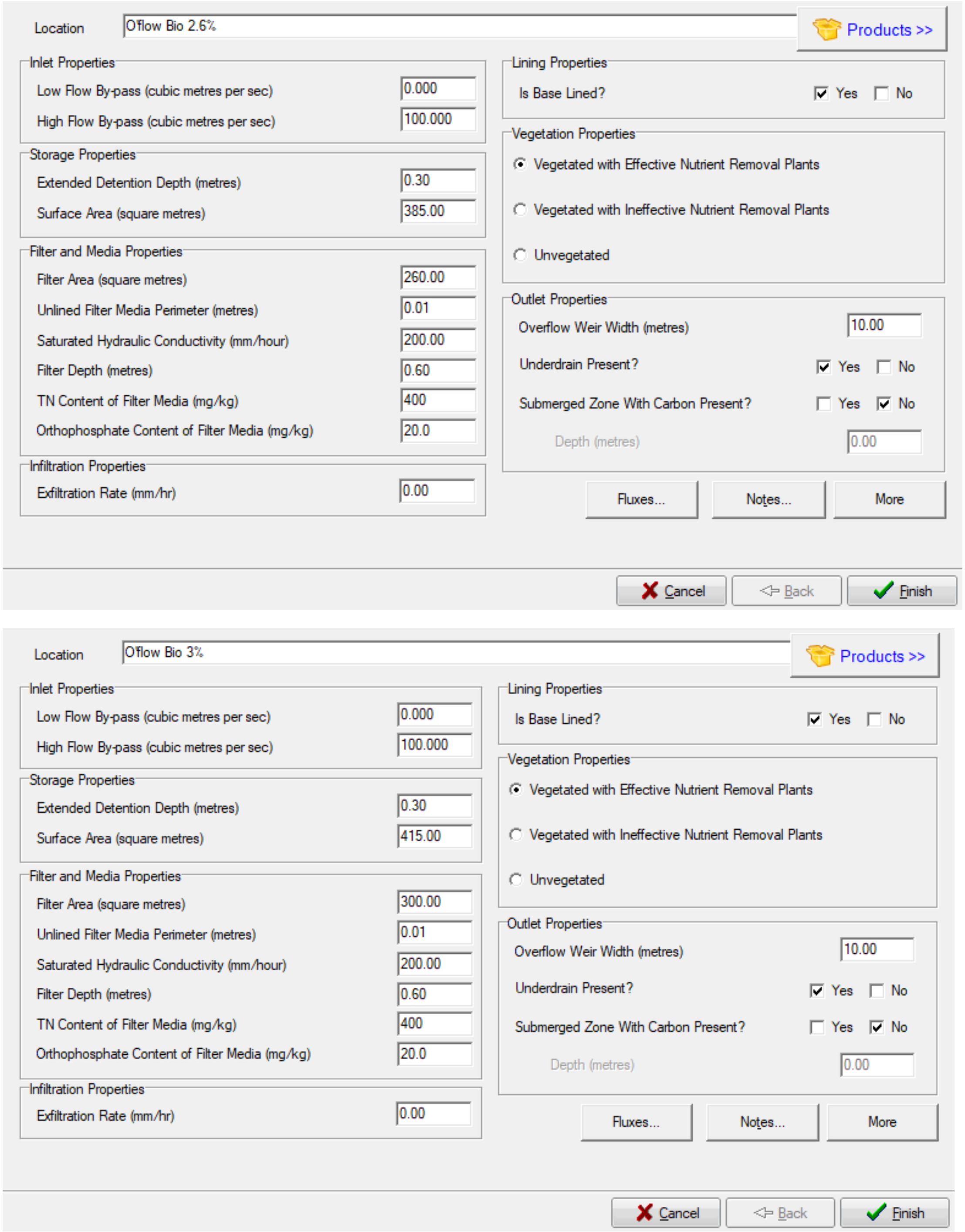

Figure 11 Bioretention Node Parameters (Catchment A top, Catchment B above)

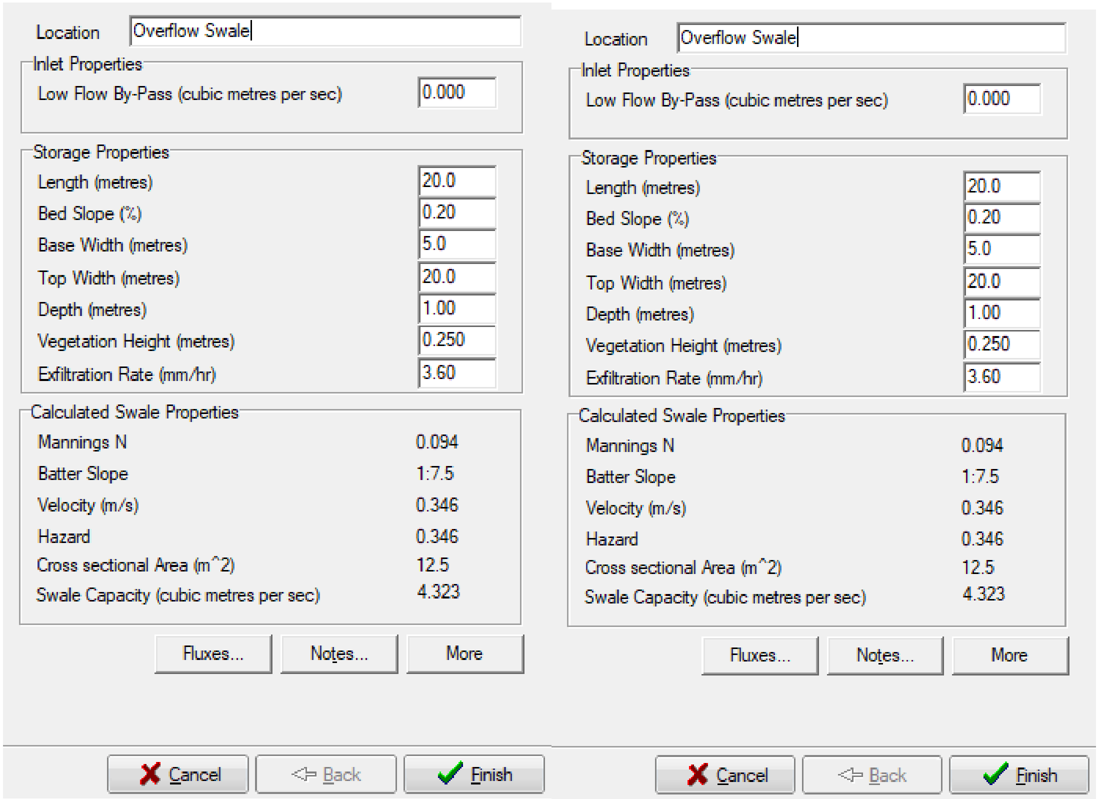

Figure 12 Swale Node Parameters (Catchment A left, Catchment B right)

3.4 Model Results

The MUSIC model results are presented in Table 5 below, and demonstrate that compliance with the Aura stormwater quality targets.

The results are conservative for the following reasons:

- There are numerous studies showing TSS, TP and TN at lower concentrations to those adopted in this assessment.
- Bioretention systems are assumed to have zero exfiltration, even though some groundwater recharge through the base of the bioretention systems would occur.
- MUSIC has been shown to significantly overestimate the amount of water discharged by performance of bioretention systems (see Hoban and Gambirazio 2021).
- The model does not account for routing effects of the drainage network.
- The modelling does not incorporate the recommendations of ARR2019 Book 5 on urban losses and discounting total impervious area to effective impervious areas.
- The modelling assumes perfect stormwater drainage and any pervious area infiltration in re-expressed in the stormwater network in accordance with Water by Design (2010).
- Catchment A will drain to a future wetland and lake system with a recirculation system that sends water back through the wetland-lake loop. The benefits of that system have not been accounted for.

Table 5 MUSIC Model Results[1]

Parameter	Source load	Residual load	Load reduction	Target	Complies
Total Suspended Solids (kg/yr)	5,820	194	97%	95%	Yes
Total Phosphorus (kg/yr)	11	0.994	91%	89%	Yes
Total Nitrogen (kg/yr)	53.8	17.2	68%	68%	Yes
Gross Pollutants (kg/yr)	507	0	100	100%	Yes

3.5 Staging of Works

The proposed stormwater treatment measures are designed to manage pollutant loads from established urban catchments.

During the construction phase of development, High Efficiency Sediment (HES) basins should be implemented to deal with sediment-laden construction runoff.

HES basins should remain in place until about 80% of the catchment has been developed, and then stormwater quality measures described in this report should be established.

Construction of stormwater measures should be generally in accordance with the Water by Design Construction and Establishment Guidelines.

3.6 Asset Management

The proposed bioretention systems are to be constructed and established in accordance with *Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands (Water by Design 2010).*

The performance standards for off maintenance, and transfer of the assets to Council, are to be in accordance with: *Transferring Ownership of Vegetated Stormwater Assets* (Water by Design 2012).

Maintenance of the assets is to be in accordance with *Maintaining Vegetated Stormwater Assets* (Water by Design 2012).

3.7 Gully Baskets

Gully baskets with 200-micron mesh inserts, are a highly effective means of improving urban stormwater quality, and are particularly beneficial in catchments with high anthropogenic litter loads (such as near schools and shopping centres), and as a means to reduce organic litter load into lakes. While not essential for compliance with the water quality objectives, during detailed design, consideration should be given to installing gully baskets in strategic locations.

[1] MUSIC uses a stochastic random number generator that picks a stormwater pollutant concentration at each timestep from a preset probability distribution based on a mean and standard deviation of pollutant concentrations. Therefore, successive runs of the same MUSIC model produce differing results.

4 COMPLIANCE WITH THE INFRASTRUCTURE AGREEMENT

The Caloundra South Priority Development Area Infrastructure Agreement (2015) at Part C describes Infrastructure Standards for Stormwater Infrastructure, as summarised in the table below.

Design Standards

		Compliance Notes
General	(a) A Works Contribution	
	i. must be designed using IFD (intensity-frequency duration) information that is current at the time of design, or draft at the time of design where the draft information is considered conservative and appropriate for the catchment. The design rainfall and boundary conditions used for setting developed Lot levels must also represent future conditions expected at the end of the development life, nominated as year 2100;	Complies - Refer civil drawings
	ii. must be located so as to provide for safe and unobstructed access for maintenance;	Complies - Refer civil drawings
	iii. may be located:	
	A. in the Environment Protection Zone;	Complies
	B. on Public Land; or	Complies
	C. for a Works Contribution for the Piped Drainage System, on Private Land, other than a residential allotment;	Complies
	iv. may not be located in the Frog Zone within 30 m of a frog breeding pond; and	Complies
	v. that is a Wetland, Bioretention System or Lake, may not be located:	
	A. in the Riparian Corridor; and	Complies
	B. in the Frog Zone	Complies
	(b) Stormwater Harvesting Infrastructure may be constructed within any other Works Contribution for Stormwater Infrastructure identified in the Infrastructure Contribution Schedule.	N/A – No stormwater harvesting infrastructure proposed within the scope of this plan
Stormwater Quality Management Assets	A Works Contribution that is a Stormwater Quality Management Asset must:	
	(a) have regard to the recommendations of:	
	i. PDA Guideline No. 13 – Engineering Standards – Stormwater Quality, noting the design rainfall standards outlined in General (a)(i) of this table take precedence;	Complies
	ii. Water By Design's Water Sensitive Urban Design Technical Design Guidelines for South East Queensland (2006);	Complies
	iii. Water By Design's Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands (2010);	Complies
	iv. Water by Design's Framework for the Integration of Flooding and Stormwater Management into Open Space (2011);	Complies
	v. DEHP Urban Stormwater Quality Planning Guidelines (2013);	Document no longer available

		Compliance Notes
	vi. Water By Design's Bioretention Technical Design Guidelines (2012);	Complies, noting updated filter media specifications are proposed.
	vii. the Planning Scheme Policy for Development Works in Sunshine Coast Planning Scheme (2014), to the extent that provisions of that document are relevant and appropriate in the circumstances; and	Complies
	(b) be designed so that flow velocities through the Stormwater Quality Management Asset for any flood event up to the 1 in 100-year Average Recurrence Interval do not exceed 2.0m/s (exclusive of energy dissipators or other hydraulic structures meeting the standards of the QUDM).	Complies
Lakes	A Works Contribution that is a Lake must have regard to the recommendations of (unless replaced by an industry accepted guideline relevant to South East Queensland prior to the time of design):	N/A – No lakes are proposed within the scope of this plan
	(a) PDA Guideline No. 13- Constructed Lakes;	
	(b) Townsville Constructed Lakes Design Guideline: Prepared for Townsville City Council (DesignFlow and RPS, 2010);	
	(c) Mackay City Council Engineering Design Guidelines: Constructed Lakes (2008); and	
	(d) the Planning Scheme Policy for Development Works in Sunshine Coast Planning Scheme (2014), to the extent that provisions of that document are relevant and appropriate in the circumstances.	
Wetlands and Bioretention Systems	A Works Contribution for an 'End-of-line' Wetland and 'End-of-line' Bioretention System must be designed to have flood immunity during any flood event with a 1-year average recurrence interval.	Complies
Stormwater Conveyance Infrastructure	A Works Contribution for Stormwater Conveyance Infrastructure must be designed in accordance with:	Refer civil drawings
	(a) PDA Guideline No. 13 – Stormwater Quality;	
	(b) the QUDM;	
	(c) the Planning Scheme Policy for Development Works in Sunshine Coast Planning Scheme (2014), to the extent that provisions of that document are relevant and appropriate in the circumstances; and	
	(d) the design standards of Table 3.	

The IA specifies that the above standards may change during the life of this Agreement, to reflect the current standards of the day, by agreement of the parties.

5 REFERENCES

Caloundra South Priority Development Area Infrastructure Agreement (2015)

DesignFlow & BMT (2OJ9) Aura Development Stormwater Quality Management Plan

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