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WATER MANAGEMENT

Redland Investment Corporation

Weinam Creek PDA

Mixed Use Village Node Stormwater Management Plan & Flood Risk Assessment

July 2021

M1789_001-REP-002

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M7189_001 WEINAM CREEK PDA MASTERPLAN – MIXED USE NODE STORMWATER MANAGEMENT PLAN						
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Signatures						

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1. INTRODUCTION

Engeny Water Management (Engeny) has been engaged by Redland Investment Corporation (RIC) to produce a Stormwater Management Plan (SMP) for the Mixed Use Village Node of the Weinam Creek Masterplan.

The following is a summary of the scope of this SMP:

- Provide details of the stormwater quantity management strategy for the proposed development.
- Provide details of the stormwater quality management strategy for the proposed development.
- Provide a summary of the flood risks experienced by the development and consideration of that risk in the development design.

1.1 Existing Site Characteristics and Proposed Development

The existing characteristics of the Site comprise primarily of the Weinam Creek boat ramp, marina, ferry terminal and associated carparking. The proposed Mixed Use Village Node development involves the redevelopment of the carparking to the following components:

- Shopping Centre / Multi Deck Parking.
- Ground-level carparking and storage.
- Two apartment complexes.
- New loop road to provide access.

The development layout can be viewed in Appendix A.

1.2 Drainage

Site drainage will be managed by a combination of underground (pipe) and above-ground overland flow components. The site drainage design for the development has been undertaken by Calibre.

2. STORMWATER QUALITY MANAGEMENT

The proposed stormwater quality management strategy for the Mixed Use Village Node development has been approached in two separate components. These are:

- Component 1 – Loop Road (inclusive of road verge) and the ground level carparking.
- Component 2 – Shopping Centre / Multi-Deck Carpark and Apartments 1 and 2.

The stormwater quality catchment delineation for each of these components are shown in Figure 2.1.

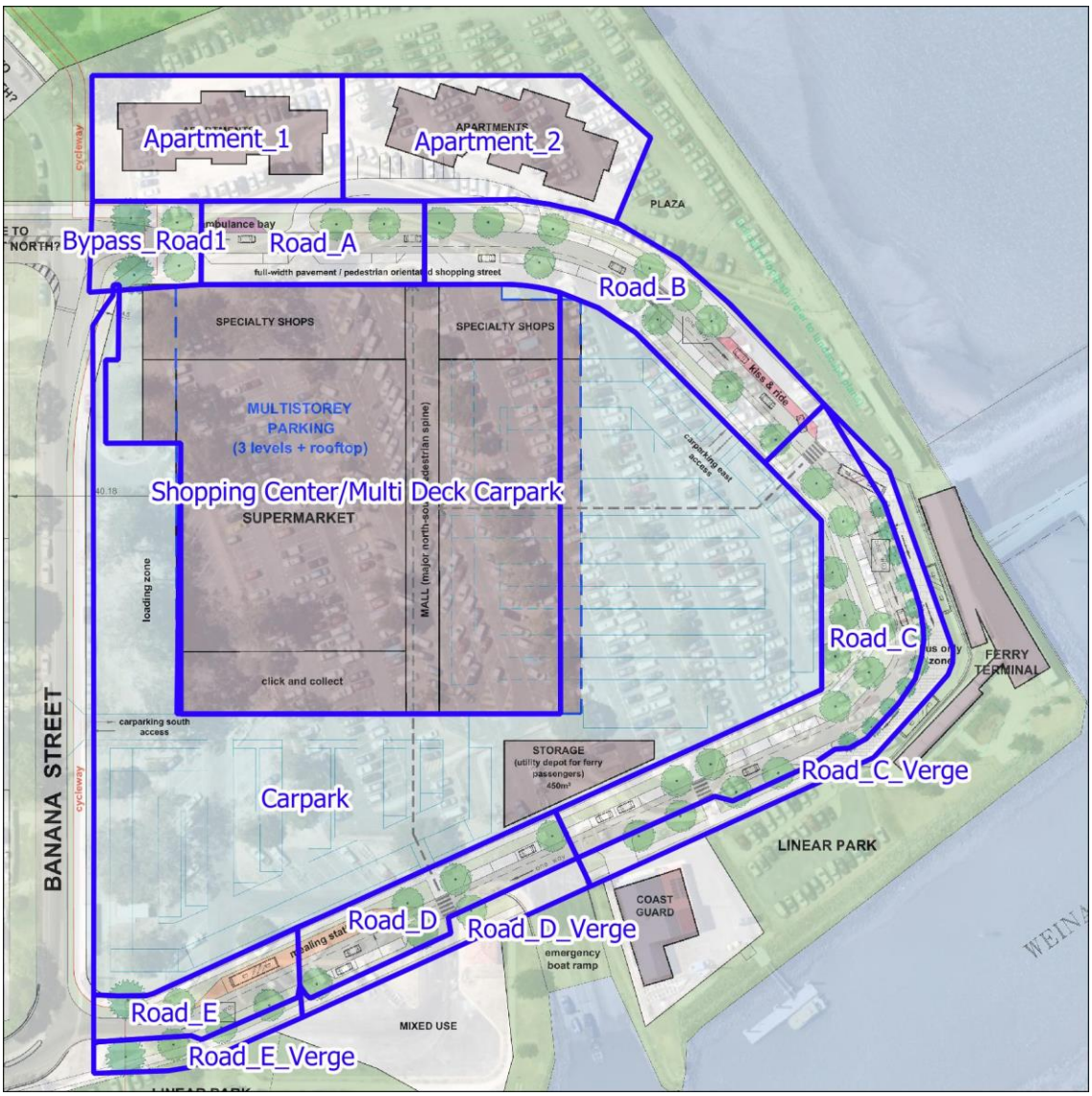


Figure 2.1 Stormwater Quality Catchments

The State Planning Policy (DGILP, 2017) provides the relevant water quality objectives (WQO) to achieve best practice water quality management for urban purposes in Queensland. The percentage removal efficiency targets as outlined in the SPP (DGILP, 2017) is summarised Table 2.1.

Table 2.1 Pollutant Removal Targets

Pollutant Type	Percentage Pollutant Removal Efficiency (as per SPP)
Total Suspended Solid (TSS)	80%
Total Phosphorous (TP)	60%
Total Nitrogen (TN)	45%
Gross Pollutant (GP)	90%

Through the stormwater quality management strategy outlined in the following sections, the WQOs have been met.

2.1 Component 1 - Loop Road and Ground Level Carparking

The loop road and the ground level carparking will be treated via proposed long bioretention pods and existing water treatment infrastructure in the form of a bioretention basin located at the Ferry Terminal and an existing gross pollutant trap (GPT) at the southern intersection of Banana Street south and the loop road. The following sections outline the modelling of these systems.

2.1.1 Water Quality Modelling

The pollutant export loads from the catchment and treatment train effectiveness were assessed using the Cooperative Research Centre for Catchment Hydrology's (CRCCH) Model for Urban Stormwater Improvement Conceptualisation (MUSIC). MUSIC is a decision support tool, used to plan and design appropriate urban stormwater management systems at the conceptual level. MUSIC Version 6.0 was used in this assessment. Model parameters including rainfall runoff and pollutant export parameters were adopted based on the recommendations from the *MUSIC Modelling Guidelines for Southeast Queensland* (Water By Design, 2010).

Climate Data

Climate data for the catchment was sourced from the Bureau of Meteorology (BOM). Rainfall, data was obtained from the Redlands HRS (40265) for the 10 years between 1997 and 2006 at six (6) minute intervals, resulting in a mean annual rainfall of 1088 mm.

Catchment Properties

The catchment areas were calculated from the proposed Mixed Use development layout as shown in Figure 2.1, and provided in Appendix A. Most of the loop road will be treated in either one of four proposed bioretention pods, the existing Ferry Terminal bioretention basin or the existing GPT. The loop road verge along the southern portion of the loop road (see Figure 2.1) will not be treated and thus has been modelled as bypassing formalised treatment, with some water quality treatment benefit provided by a buffer node to represent the green spaces proposed on the outer edge of the Mixed Use Village Node. Additionally, a small portion of road at the northern intersection of Banana

Street and the loop road will completely bypass all forms of treatment. The catchment areas and parameters are summarised in Table 2.2. A layout of the MUSIC nodal arrangement is provided in Figure 2.2.

Table 2.2 MUSIC Catchment Summary

Catchment ID	Area (ha)	Impervious Fraction (%)	MUSIC Node Type	Treatment Location
Carparking	1.219	90	Commercial	Bioretention Pod
Road_A	0.107	90	Commercial	Bioretention Pod A
Road_B	0.213	90	Commercial	Bioretention Pod B
Road_C	0.245	90	Commercial	Existing Bioretention Basin
Road_D	0.104	90	Commercial	Bioretention Pod D
Road_E	0.069	90	Commercial	GPT
Road_C_Verge	0.085	67	Commercial	Buffer
Road_D_Verge	0.04	67	Commercial	Buffer
Road_E_Verge	0.033	67	Commercial	Buffer
Bypass_Road1	0.053	90	Commercial	Untreated

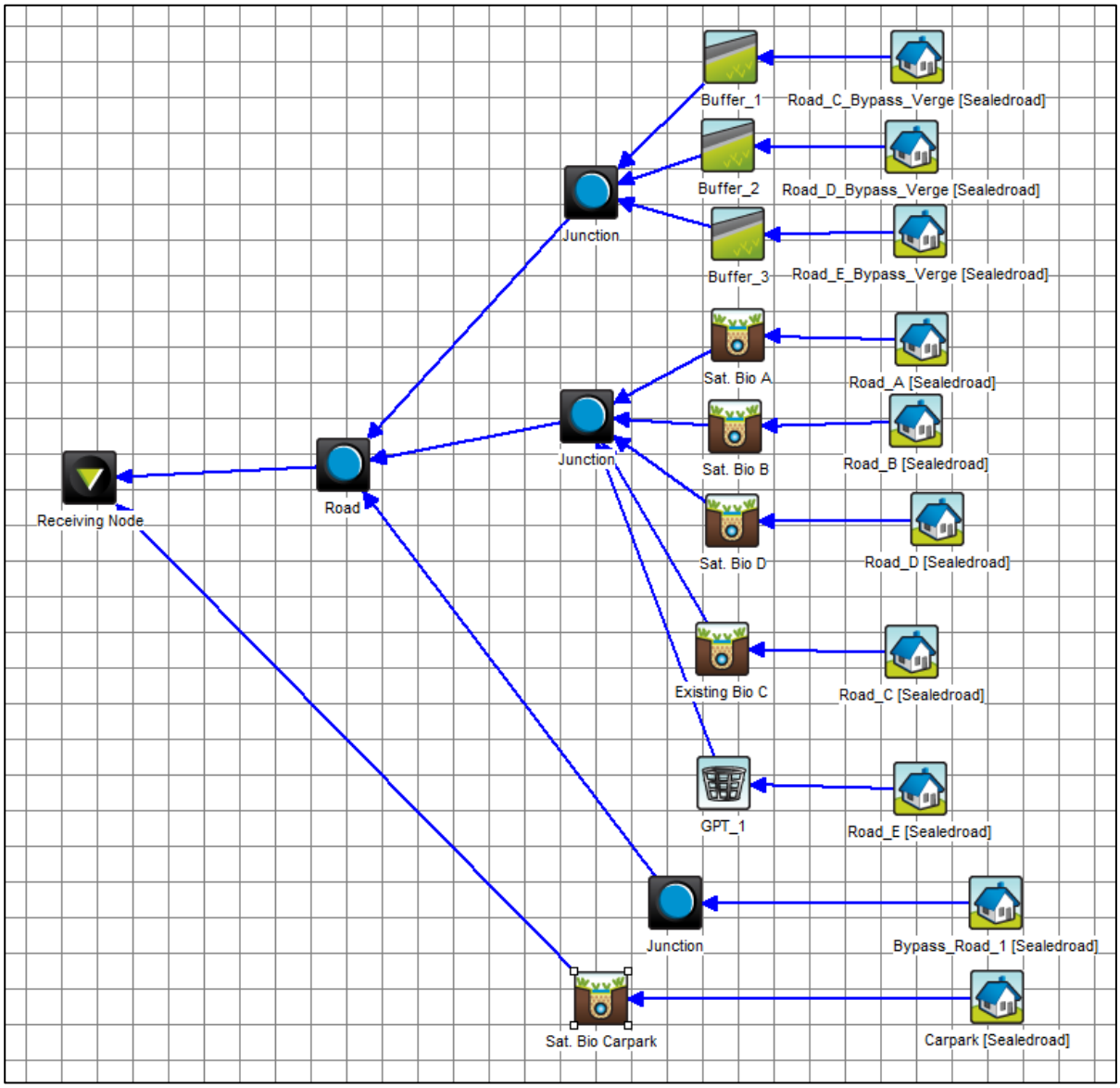


Figure 2.2 MUSIC Layout

Proposed Treatment – Bioretention Basin

The required additional bioretention filter media area has been sized to meet the WQOs for the entirety of the Mixed Us Village Node. The bioretention parameters for each basin is summarised in Table 2.3, and the approximate location of each of the proposed and existing basins is shown in Figure 2.3. The exact location of the proposed basins and configuration will be finalised at detailed design. Preliminary modelling has been utilised to inform constraints relating to filter media depth, with a depth of 500 mm being preferable for the proposed bioretention pods, with a depth of 400 mm required to be adopted for Bioretenton Pod B in order for the system outlet to remain above HAT.

Table 2.3 Bioretention Parameters

Parameter	Sat. Bio A	Sat. Bio B	Sat. Bio D	Sat. Bio Carpark	Existing Bio C
Filter Area (m^2)	15	30	15	200	140
Extended Detention Depth (mm)	200	200	200	200	300
Filter Depth (m)	500	400	500	500	400
Transition Layer Depth (m)	100	100	100	100	100
Drainage Layer Depth (m)	400	400	400	400	200

Existing Treatment – Bioretention Basin

Situated behind the Ferry Terminal is an existing bioretention basin that is being used to treat the existing hardstand areas surrounding the terminal. Following the construction of the loop road, this basin will receive flow from the catchment indicated on Figure 2.1. The basin parameters and location are provided in Table 2.3 and Figure 2.3 respectively.

Existing Treatment – GPTs

Currently in the marina area there are two existing operational GPTs, with the location of these provided in Figure 2.3. These GPTs are known to treat a portion of the carpark and some of the existing road. It is proposed that the northern-most GPT is to be decommissioned as part of the development and replaced with a bioretention pod. The southern GPT however, is going to be repurposed to treat a small portion of the southern loop road that is currently not being treated by any system. The GPT system size (Ecosol Gross Pollutant Trap 4300) was provided by Redlands City Council and the treatment efficiencies provided by the system supplier in order for the GPT to be represented in the MUSIC model. The GPT technical specification is provided in Appendix C.

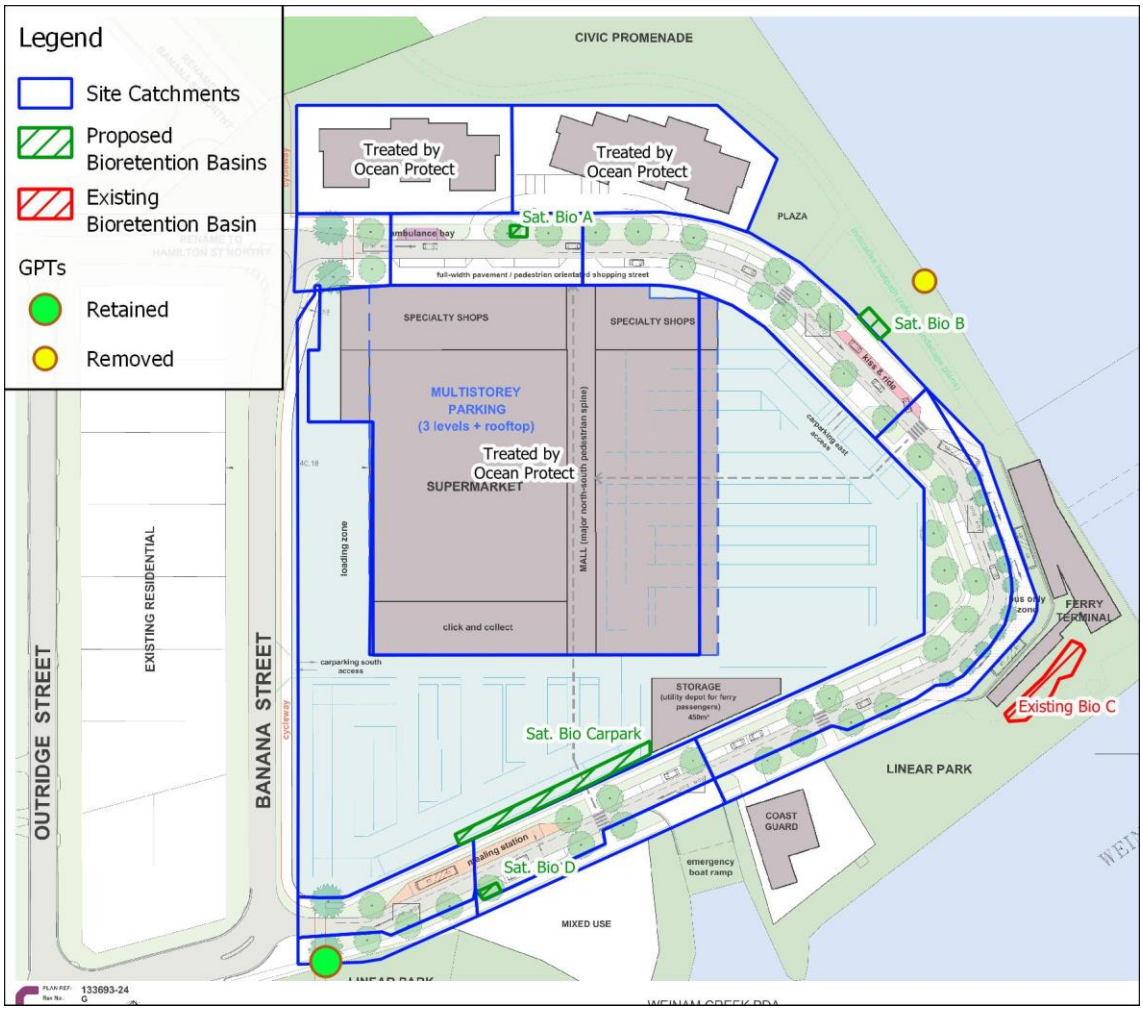


Figure 2.3 Stormwater Treatment System Layout

Water Quality Results

The proposed treatment devices outlined above are suitable to meet the WQOs for the proposed loop road and ground level carparking components of the Mixed Use Village node of the Masterplan. A summary of the treatment efficiency is provided in Table 2.4

Table 2.4 MUSIC Model Results

Parameter	Target Removal Efficiency (%)	MUSIC Removal Efficiency (%)
TSS	80	80.1
TP	60	64.6
TN	45	51.2
GP	90	91

2.1.2 Bioretention Design

The proposed bioretention systems to treat the carpark and loop road will comprise of the following:

- 1.5 m wide bioretention pods on the interior edge of the loop road, sized to the catchment reporting to each pod.
- One singular bioretention system located in the south-west corner of the carpark.

The proposed systems will be a Type 1 Saturated basins to encourage drought-resistance and to prevent against salinity ingress. The parameter for each proposed basin is included in Table 2.3. The outlets from the system will discharge directly to Redland Bay / Weinam Creek mouth, with the outlet pipe for the bioretention systems to be placed at, or above, the current Highest Astronomical Tide (HAT) level of 1.57 m AHD. The indicative location of the systems can be viewed in the civil engineering plans developed by Calibre, with further refinement to be undertaken at Operational Works.

The bioretention pods will be planted with native groundcovers. Safety considerations, such as interfaces with kerb and pedestrian paths will be considered at detailed design. The species to be considered for planting in the bioretention pods are summarised in Table 2.5.

Table 2.5 Planting Schedule

Plant Name	Density (Plant/sqm)
CAREX appressa	2
CARPOBROTUS glaucescens	2
FICINIA nodose	6
GAHNIA aspera	4
JUNCUS usitatus	6

Plant Name	Density (Plant/sqm)
LOMANDRA hystrix	1
THEMEDA australis	6

Shade trees will be provided adjacent to the systems. Examples of previously constructed bioretention pods that are intended to be similar to the proposed bioretention pods in the loop road are shown in Figure 2.4.

Figure 2.4 Indicative Bioretention Pod Design

2.2 Component 2 – Apartments and Shopping Centre

For the apartment and shopping centre components of the Mixed Used Node of the Weinam Creek Masterplan, proprietary device systems developed and sized by Ocean Protect are proposed as these components will be managed under a body corporation arrangement or similar.

The treatment system for these components will comprise:

- OceanGuard gross pollutant traps installed on inlet pits.
- 690 mm tall PSorb cartridge StormFilter system within precast manholes.

These treatment systems will receive roof water and surface water flows from the minor storm events through pipe systems and discharge directly to Redland Bay, and will not interact with the bioretention systems proposed to treat the carpark and loop road.

Initial sizing has been undertaken for the sizing requirements for these OceanProtect systems and have been provided in Appendix B, with further design to be undertaken at Operational Works.

3. STORMWATER QUANTITY MANAGEMENT

Due to the placement of the development as discharging directly to Redland Bay, with no discharge proposed onto adjoining private property, no detention or mitigation of stormwater runoff is proposed.

3.1 Lawful Point of Discharge

The Lawful Point of Discharge for the Mixed Use Village Node component of the Masterplan is Redland Bay, located directly adjacent to the development.

4. FLOOD RISK ASSESSMENT

4.1 Sources of Flooding

The proposed Mixed Use Village Node of the Weinam Creek Masterplan is located beyond the influence of Weinam Creek flooding. The flood risk to the development is from Redland Bay tidal conditions. The tidal conditions, which have been used to inform the design levels of the various components of the Mixed Use Village Node are as below:

- Highest Astronomical Tide (Current Conditions) = 1.57 m AHD.
- Highest Astronomical Tide (2070 Conditions) = 1.98 m AHD.
- Highest Astronomical Tide (2100 Conditions) = 2.37 m AHD.
- Storm Tide (2100 Conditions) = 3.22 m AHD.

4.2 Consideration of Flood Risk

As it is not feasible from a construction perspective to adopt Storm Tide 2100 conditions for all components of the Mixed Use Village Node development, due to tie ins with existing development in the surrounding area, specific tidal conditions have informed design levels in relation to the expected magnitude of flood impact on the proposed components. The adopted tidal condition to inform the design level for each Mixed Use Village Node component is summarised in Table 4.1. The adoption of these levels has been discussed previously with relative representatives from RCC and EDQ for in-principle support.

Table 4.1 Adopted Design Levels

Mixed Use Village Node Component	Tidal Condition	Minimum Design Level
Loop Road	Highest Astronomical Tide - 2070	1.98 m AHD
Carparking	Highest Astronomical Tide - 2100	2.37 m AHD
Shopping Centre / Multi-Deck Carpark	Storm Tide – 2100	3.22 m AHD
Apartments	Storm Tide – 2100 for Non-Habitable Floor + 300 mm Freeboard to Habitable Floor	3.22 m AHD for Non-Habitable Floor 3.52 m AHD for Habitable Floor

Tidal inundation mapping for the existing (current) and proposed context for HAT 2070 (1.98 m AHD), HAT 2100 (2.37 m AHD) and Storm Tide 2100 (3.22 m AHD) is presented in Figure 4.1 and Figure 4.2 for the current and proposed context, respectively. The design floor levels are also shown on

Figure 4.2 and the flood risks and management measures are outlined in the following sections.

Figure 4.1 Current Tidal Inundation Mapping

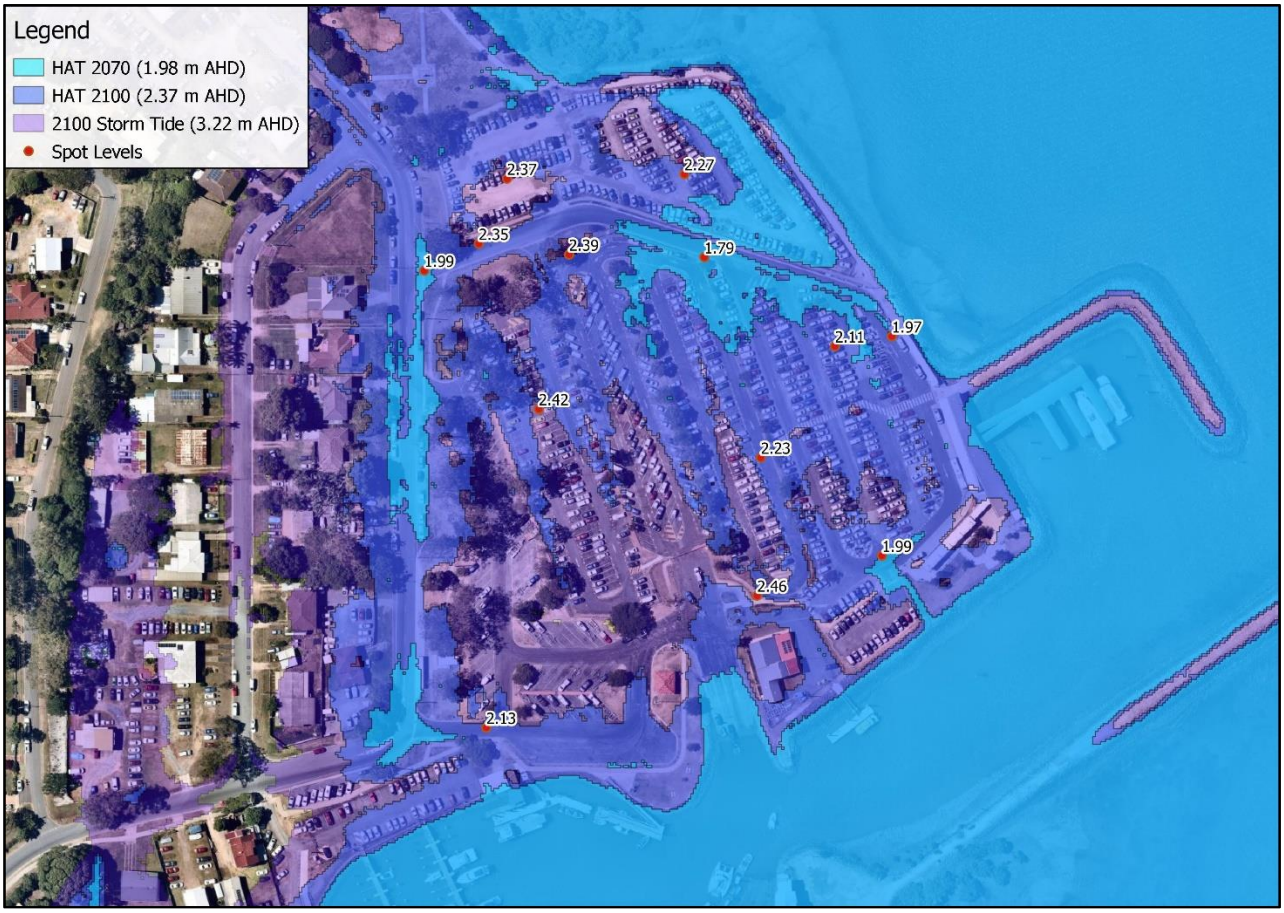
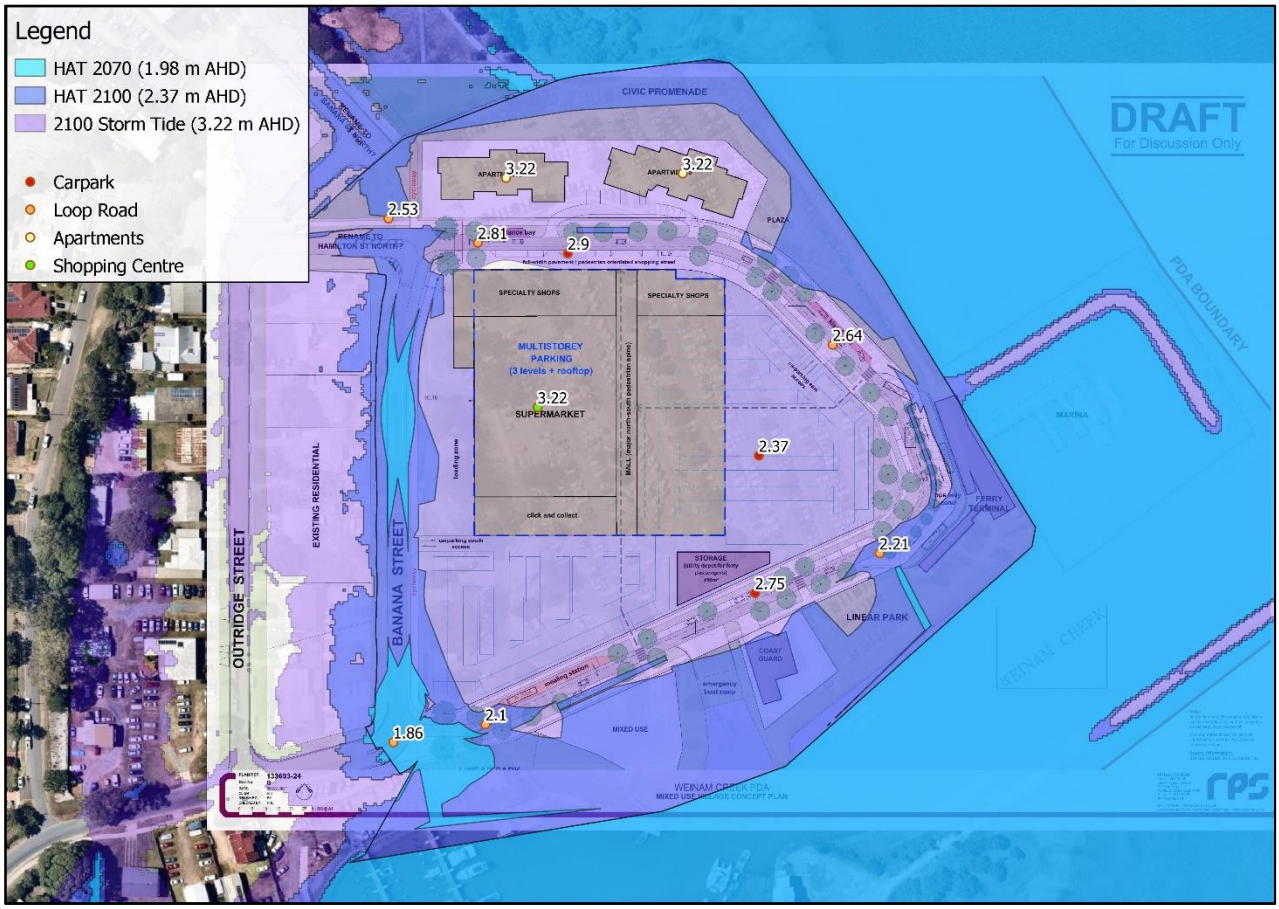


Figure 4.2 Proposed Tidal Inundation Mapping



4.2.1 Flood Risk Analysis

The flood risk to the development is from Redland Bay tidal conditions and the depth of tidal inundation at key locations is provided below:

Table 4.2 Flood Depth – Tidal Inundation

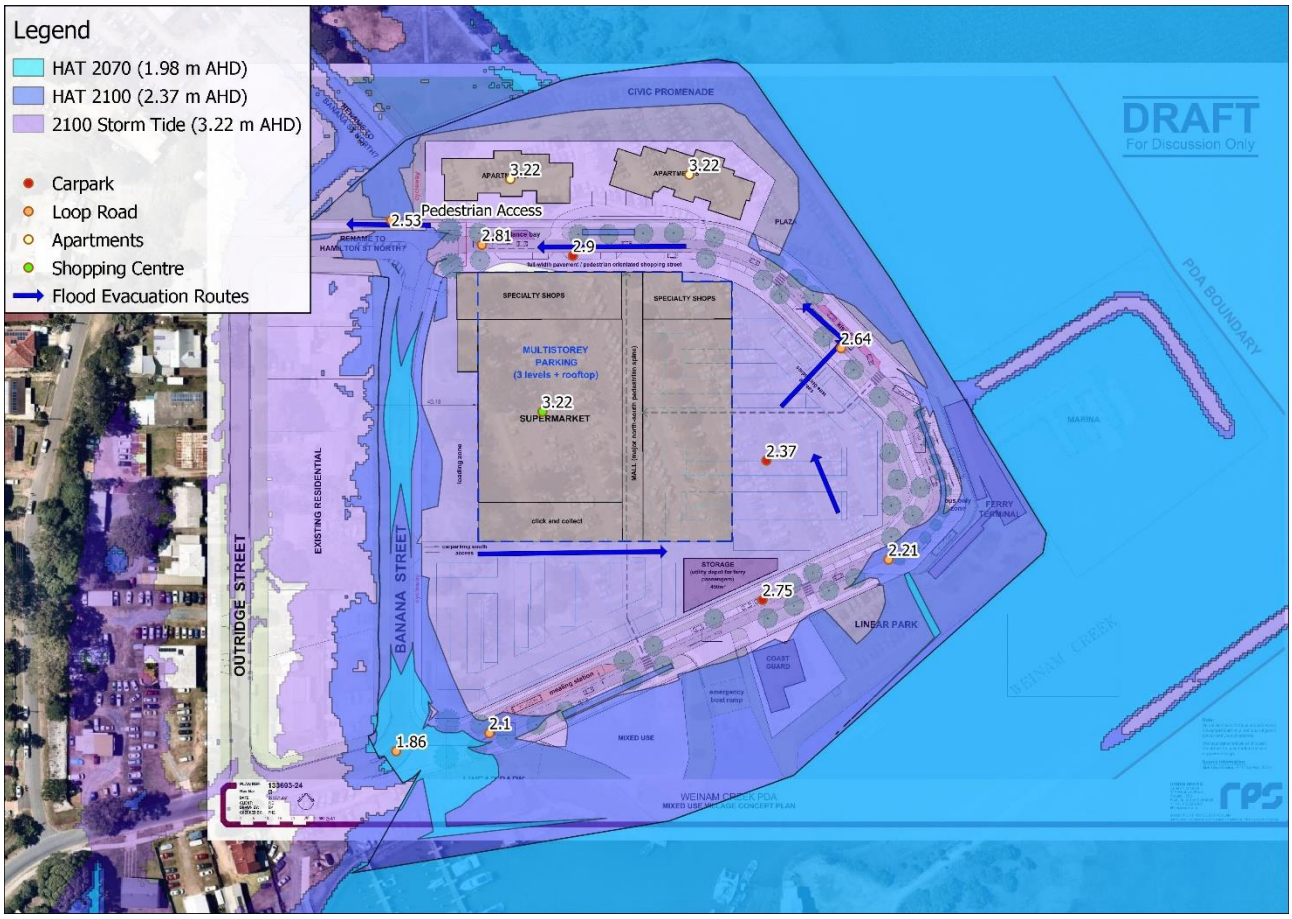
Location	Maximum Flood Depth for Storm Tide 2100
Loop Road	Up to 1240 mm
Carparking	Up to 850 mm
Shopping Centre / Multi-Deck Carpark	Flood Free
Apartments	Flood Free

Due to the nature of tidal inundation, the flood risk relates to the depth of inundation and flow velocities are expected to be relatively slow. The duration of inundation will vary depending on

specific conditions of the tide event and the warning time should be adequate to allow for appropriate flood emergency response. Flood forecasting and warning for coastal inundation is generally more reliable than riverine or fluvial flooding and the warning time generally tends to be much longer.

Ingress and egress for the Mixed Use Village Node development (including apartments) will be possible via the carpark's east access to the new loop road and north to Hamilton Street for Weinam Creek flood events up to and including the 1% AEP as well as the HAT 2070 tidal conditions, however the intersection of Banana Street and Hamilton Street North is shown to be inundated in the HAT 2100 and 2100 Storm Tide events. However, flood free pedestrian access is possible to Hamilton Street North in all tidal events considered, except the 2100 Storm Tide event. The maximum flood depth in within the northern section of the new ring road and Hamilton St North is 410 mm in the 2100 Storm Tide event. The flood evacuation routes are shown on Figure 4.3.

Figure 4.3 Flood Evacuation Routes



Flood risk management measures for the Mixed Use Village Node will be defined at a later stage as part of the Masterplan FEMP. The flood emergency management procedures will be specified for the development in accordance with Redland City Council's flood emergency management procedures for coastal inundation.

5. SUMMARY

A summary of the proposed Stormwater Management Plan and flood risk management for the Mixed Use Village Node of the Weinam Creek Masterplan is provided below:

Stormwater Quality

The state Planning Policy Water Quality Objectives will be met for the proposed development through incorporation of the following:

- Saturated bioretention pods located adjacent to the loop road, proportionally split dependent on treatment catchment, to treat the loop road. Utilisation of the existing GPT at the southern Banana Street and loop road intersection and the existing bioretention basin to further treat remaining catchment areas.
- Singular saturated bioretention system located along the southern edge of the carpark to treat the ground level carparking.
- OceanProtect Ocean Guards and 690 mm tall PSorb StormFilter cartridges within pre-cast manhole systems to treat the apartment and Shopping Centre / Multi Deck components of the development.

Stormwater Quantity

Due to the location of the proposed Mixed Use Village Node of the Weinam Creek Masterplan, direct discharge to Redland Bay is able to be achieved without interaction with private property. Therefore, no stormwater detention is proposed as part of the SMP.

Flood Risk

The proposed Mixed Use Village Node development experiences flood risk from tidal conditions. A risk-based and constructability approach has been taken to setting of design levels in respect to the various tidal conditions. The following is a summary of the minimum adopted levels:

- Loop Road - Highest Astronomical Tide (2070 Conditions) = 1.98 m AHD
- Ground Level Carparking - Highest Astronomical Tide (2100 Conditions) = 2.37 m AHD
- Shopping Centre and Multi Deck Carparking – Storm Tide (2100 Conditions) = 3.22 m AHD
- Apartments - Storm Tide (2100 Conditions) = 3.22 m AHD to Non- Habitable Floor Level plus 300 mm freeboard to Habitable Floor Level.

Detailed Flood Emergency Management Plans will be developed for each component as the design progresses.

6. QUALIFICATIONS

a. In preparing this document, including all relevant calculation and modelling, Engeny Water Management (Engeny) has exercised the degree of skill, care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering principles.

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   (ii) Engeny considers it prudent to revise any aspect of the works in light of any information which becomes known to it after the date of submission.

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g. This report does not provide legal advice.

7. REFERENCES

DILGP (2017), *State Planning Policy.*

IPWEAQ (2017), *Queensland Urban Drainage Manual.* Institute of Public Works Engineering Australasia, Queensland: 4th Edition.

Redlands City Council (2018), *Redlands Planning Scheme 7.2.*

Water By Design (2010) *Music Modelling Guidelines.* Version 1.0 – 2010.

APPENDIX A

Development Layout

DRAFT
For Discussion Only

CIVIC PROMENADE

RENAME TO BANANA ST NORTH?

cycleway

APARTMENTS

APARTMENTS

PLAZA

RENAME TO HAMILTON ST NORTH?

ambulance bay

one way

full-width pavement / pedestrian orientated shopping street

indicative footpath (refer to landscape plans)

4.5

SPECIALTY SHOPS

SPECIALTY SHOPS

one way

kiss & ride

MULTISTOREY PARKING (3 levels + rooftop)

carparking east access

40.18

SUPERMARKET

loading zone

MALL (major north-south pedestrian spine)

one way

MARINA

PDA BOUNDARY

bus only zone

FERRY TERMINAL

click and collect

EXISTING RESIDENTIAL

OUTRIDGE STREET

BANANA STREET

carparking south access

cycleway

STORAGE (utility depot for ferry passengers) 450m²

LINEAR PARK

one way

mealing station

COAST GUARD

emergency boat ramp

WEINAM CREEK

MIXED USE

LINEAR PARK

Note:
All Lot Numbers, Dimensions and Areas are approximate only, and are subject to survey and Council approval.

The boundaries shown on this plan should not be used for final detailed engineers design.

Source Information:
Site boundaries: RPS Survey/DCDB

PLAN REF: 133693-24
Rev No: G
DATE: 25 MAY 2021
CLIENT: RIC
DRAWN BY: BM
CHECKED BY: PHE

0 5 10 15 20 25 1 : 500 @ A1

WEINAM CREEK PDA
MIXED USE VILLAGE CONCEPT PLAN

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APPENDIX B

Proprietary Device Information

OceanProtect Proprietary Device Sizing

Sizing of the required OceanProect OceanGuard and PSorb StormFilter cartridge system has been undertaken in accordance with the following guidelines:

- MUSIC Version 6.3.0.
- Rainfall Station 40265 Redland, 6 Minute Time Step From 1997 To 2006.
- Water by Design's MUSIC Modelling Guidelines Version 1.0 - 2010 utilizing modified % impervious area, rainfall threshold, soil properties & pollutant concentration.

They have been modelled to meet the QLD State Planning Policy (July 2017) targets. These are;

- 80% Total Suspended Solids Reduction.
- 60% Total Phosphorus Reduction.
- 45% Total Nitrogen Reduction.
- 90% Gross Pollutant Reduction.

The MUSIC model layout is provided in Figure B1.

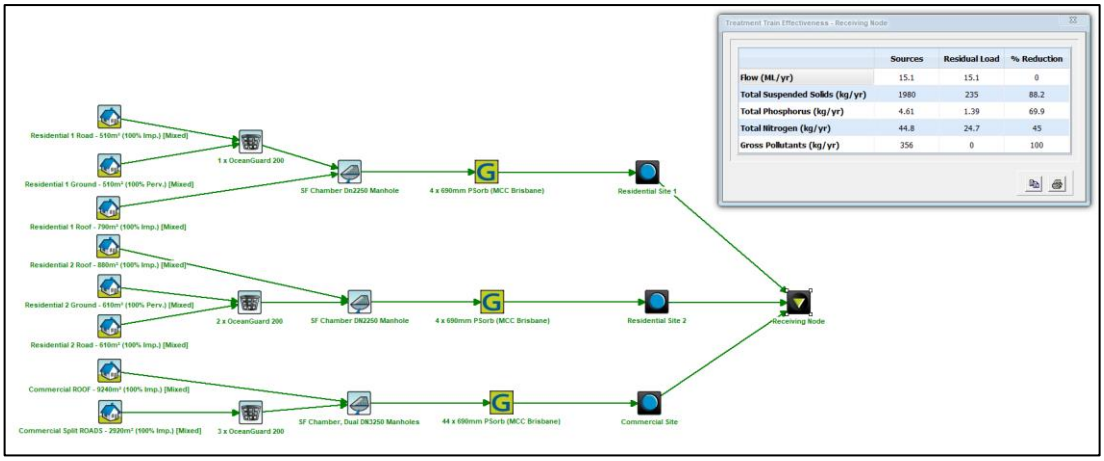


Figure B1 MUSIC Model Layout

The proposed stormwater quality treatment solution is:

- Apartments Site 1:
  - 1 OceanGuard with 200micron mesh bags (OG-200) for Residence Site 1.
  - A 4xTall(690) PSorb cartridge StormFilter system within a precast manhole. DN2250 for Residence 1.
- Apartments Site 2:

- 2 OceanGuards with 200micron mesh bags (OG-200) for residence Site 2.
- A 4xTall(690) PSorb cartridge StormFilter system within a precast manhole, DN 2250 for Residence 2.

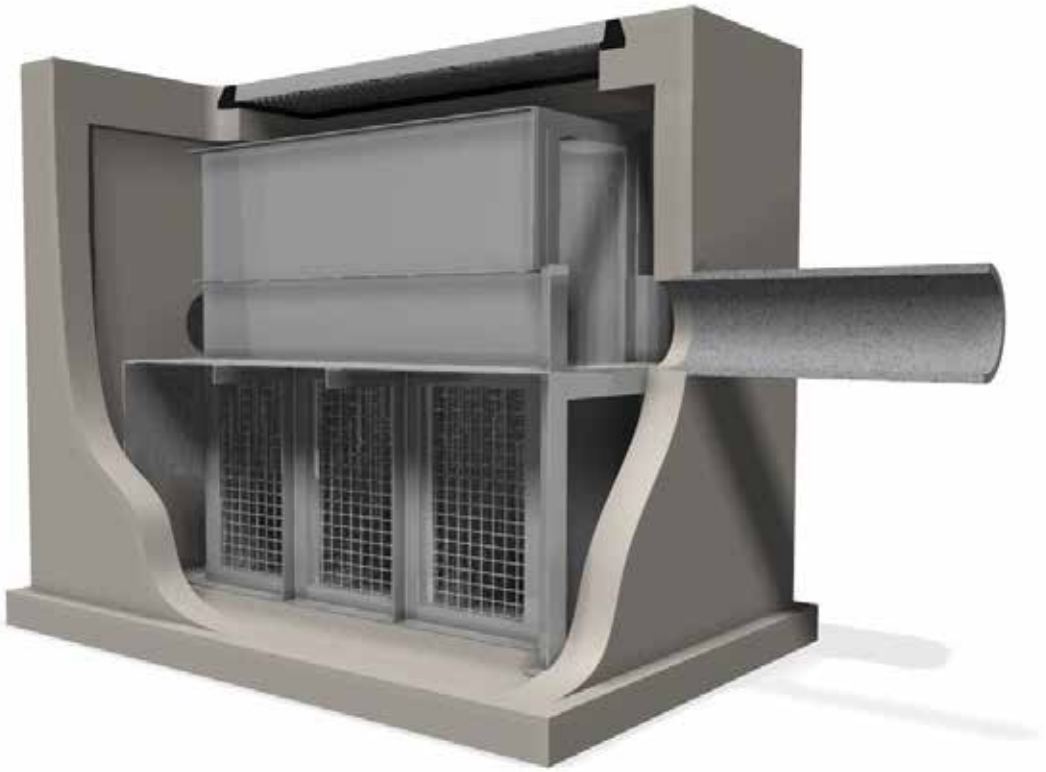
- Shopping Centre / Multi Deck Parking Site:

  - A 44xTall(690) PSorb cartridge StormFilter system within a precast Double Manhole, Dual DN3250.
  - 3 OceanGuards with 200micron mesh bags (OG-200) for commercial site.

APPENDIX C

Existing GPT Specification

Ecosol™ Gross PollutantTrap Technical Specification



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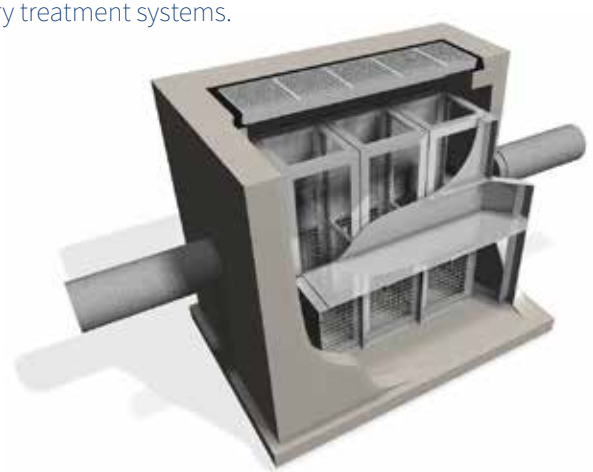
ASSET SOLUTIONS™

Contents

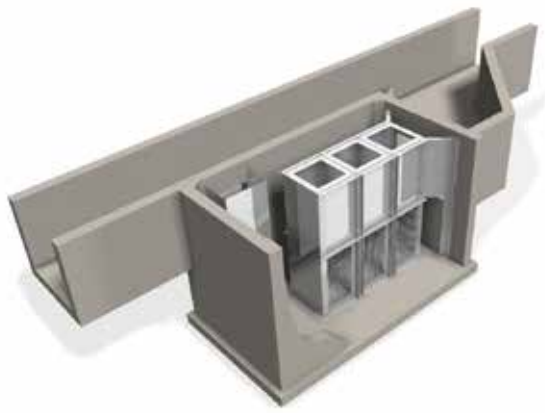
1.0 Introduction

Increasingly stringent environmental best management practice requires planners and developers to apply a fit-for-purpose treatment train approach to stormwater treatment to achieve today's water quality objectives (WQOs). An integral element to any good WSUD is primary treatment or pre-screening of stormwater flows to remove coarse sediment and gross pollutants prior to downstream secondary or tertiary treatment systems such as wetlands.

The Ecosol™ Gross Pollutant Trap provides effective primary treatment of stormwater flows thereby significantly enhancing the operational life of downstream secondary and tertiary treatment systems.



Typical In-Line Ecosol™ GPT configuration



Typical Off-Line Ecosol™ GPT configuration

The system has been designed to provide a robust and durable cost effective primary treatment system that captures and retains solid pollutants conveyed in stormwater conduits.

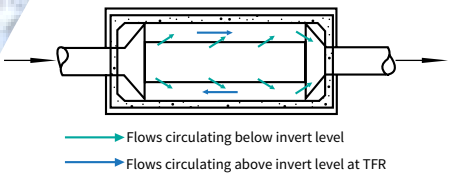
In developing this innovative stormwater treatment system careful consideration has been given to durability, longevity, cost and maintainability. Key commercial technical features include:

- low visual impact and energy footprint;
- designed hydraulics with proven performance and longevity;
- scalable design; and
- cost effective maintenance regime.

This technical manual describes the operation and performance characteristics of the system.

URBAN ASSET SOLUTIONS™

1.1 How and Why the Ecosol™ GPT Works



The objective of stormwater treatment is to achieve a real, visible, and sustainable improvement in water quality. Pollution control measures, including Gross Pollutant Traps (GPT's), such as the Ecosol™ GPT, litter baskets, sediment basins, grass swales, infiltration systems and sand filters all reduce the level and concentration of a variety of pollutants, thereby enhancing water quality.

The Ecosol™ GPT is a non-blocking, wet sump, tangential filtration system that has been specifically designed to filter stormwater pollutants conveyed in stormwater conduits by capturing and retaining all contaminants larger than 2mm up to a designed treatable flow rate (TFR). It can play and integral role in reducing pollution in urbanised catchments and help reduce the footprint of a total stormwater treatment train by providing essential prescreening.

Developed in 1996 and tested by the University of South Australia and also EngTest the commercial consulting division of the Adelaide University it remains today one of the most widely recognised and used stormwater primary treatment systems. Today as part of our continual product improvement program the modern Ecosol™ GPT is designed to provide high pollutant retention rates with little hydraulic impact on the drainage infrastructure.

2.0 Ecosol™ GPT Credentials and Case Studies

The Ecosol™ GPT is designed specifically to provide essential primary treatment of stormwater runoff. It is a compact, efficient and cost-effective solution to the ever-increasing problem of gross pollutants present in stormwater flows. Key to its success is the robust, engineered design and tangential screens housed in a pre-cast concrete pit that provides a significantly greater screening area than that of traditional direct screening trash rack designs. Further its large detention chamber enables gravitational separation to occur retaining fine particulate matter conveyed in stormwater.

Urban Water Resources Centre – University of South Australia
Product Performance Testing.

In 1997 and 1998 the University of South Australia (UniSA), was commissioned to undertake a series of tests on the widely-used Ecosol™ GPT (formerly known as the RSF 4000) to confirm the product's performance. The tests measured the capture efficiency of the system under varying flow conditions and gradients and also the hydraulic headloss of the system under varying flows and gradients.

EngTest Department of Civil and Environmental Engineering –
University of Adelaide – Product Performance Testing

In October 1998 after further product development Ecosol commissioned Engtest the Department of Civil and Environmental Engineering at the University of Adelaide to undertake further testing on the system to confirm hydraulic head loss and capture efficiencies.

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2.0 Ecosol™ GPT Credentials and Case Studies Continued

Avocet Consulting - CFD modelling to determine pollutant trapping performance and fluid hydraulic characteristics under varying flow conditions.

In early 2000 to mid-2001 as part of the companys continuous product improvement program Ecosol engaged the services of Avocet Consulting to assess the Ecosol™ GPTs hydraulic performance, structural integrity, capture efficiency, treatable flow rates relevant to product sizing and scaling. Additional laboratory testing was also completed to monitor its performance as it filled and also to review the non-blocking, tangential filtration longevity of the system under varying flow conditions and percentage of fill.

EngTest Department of Civil and Environmental Engineering – University of Adelaide – Performance Review

In June 2013 the University of Adelaide (EngTest) completed a series of additional product tests to further verify product performance and concurrently reviewed all past laboratory and field testing on the performance of the product to comprehensively determine its performance for current industry applications.

3.0 Warranty and Life Expectancy

The Ecosol™ GPT has a one-year warranty covering all components and workmanship. Urban Asset Solutions Pty Ltd will rectify any defects that fall within the warranty period. The warranty does not cover damage caused by vandalism and may be invalidated by inappropriate cleaning procedures or where the unit is not cleaned within the recommended frequency. The Ecosol™ GPT is designed to meet strict engineering guidelines and manufacturers guarantees and is one of the most durable stormwater treatment systems available. The stainless steel components have a life expectancy of 15 years while the pre-cast concrete pit has a life expectancy of 50 years providing appropriate maintenance practices are employed.

4.0 Safety Considerations

The simple, yet effective design of the Ecosol™ GPT reduces OH&S risks as most of the work is undertaken in a controlled factory environment. The unit arrives to site complete and ready for installation reducing significantly on-site time, an important factor given the costs associated with delays that can be caused by inclement weather.

5.0 Key Features and Benefits

The Ecosol™ GPT captures and retains more than 98% of pollutants larger than 2000µm and whilst designed as a primary treatment solution, can capture and retain attached particulate Suspended Solids, Phosphorous and Nitrogen at its design Treatable Flow Rate (TFR).

Its efficiency is largely dependant on the chemical composition of the particles and the bonding of these chemical constituents to the surface of particles and the body of pollutants forming a media within the device.

Easily installed, the pre-cast modular Ecosol™ GPT can be fitted to conduits of almost any size and shape, either within the drainage network or off-line adjacent to creeks or open channels. Its range of applications include industrial and commercial sites, such as car parks, shopping centres and wash-bays, residential developments, airports, freeways, civil construction projects and wetlands.

Key Features	Benefits
Hydraulics	• Low headloss (k) factor • Designed and managed hydraulics eliminates blockage risk • Patented hydraulically-driven barrier reduces premature by-pass • Non-blocking tangential filtration screening
Pollutant Capture and Retention	• Captures and retains more than 98% of solid pollutants > 2000µm • Captures and retains up to 99% free oils and grease in spill situations • No remobilisation of captured settled Gross Pollutants
Design and Construction	• Can be sized to suit a wide range of flows, gradients and pipe sizes • Up to a GPT 4900 unit comes complete to site making installation easy and safe • Shallow depth below invert reduces water table problems • Product is made in-house thereby reducing lead times significantly
Cleaning and Maintenance	• Cost-effective vacuum cleaning so no need for the pollutants to be handled • Large pollutant storage capacity • Baffle design for emergency spill storage
Environmental Impact	• Effective pre-screening as part of a treatment train to achieve water quality objectives • Positive effect on natural ecosystem by improving water quality • Unit is housed in its own pit with little effect on the site aesthetics
Tried and Tested	• Independently laboratory field tested • Meets industry standards and guidelines

Table 1 - Ecosol™ GPT key features and benefits.

6.0 Key Dimensions

The table below shows the approximate dimensions and holding capacities for, the Ecosol™ GPT. Their capacity to retain large quantities of captured pollutants ensures that its specified capture efficiency is maintained between scheduled cleaning events.

Ecosol GPT Product Code	Maximum Inlet/Outlet Pipe Diameter	Treatable Flow Rate (L/s)	Approximate External Dimensions (L x W x D from inlet invert level) (mm)	Pollution Holding Capacities		
				Solid Pollutants >2mm	Free Oils and Grease	Water
				m^3	Litres	Litres
GPT 4200	Up to 300mm	Up to 51	2200 x 900 x 750	0.23	268	667
GPT 4300	Up to 525mm	Up to 120	2700 x 1350 x 750	0.32	469	1,181
GPT 4450	Up to 600mm	Up to 260	3600 x 1650 x 1050	1.03	1,347	3,348
GPT 4600	Up to 900mm	Up to 470	4500 x 1950 x 1350	2.43	2,994	7,211
GPT 4750	Up to 1050mm	Up to 730	5600 x 2300 x 1650	4.83	5,711	13,608
GPT 4900	Up to 1350mm	Up to 1,050	6500 x 2600 x 1975	8.30	9,576	22,768
GPT 41050	Up to 1500mm	Up to 1,430	7450 x 2950 x 2300	13.11	14,850	35,262
GPT 41200	Up to 1800mm	Up to 1,870	8630 x 3300 x 2625	19.52	22,793	51,698
GPT 41350	Up to 1950mm	Up to 2,370	9700 x 3700 x 2950	**27.70**	**30,578**	72,495
GPT 41500	Up to 2100mm	Up to 2,930	10680 x 4000 x 3250	37.94	41,491	98,317
GPT 41800	Up to 2400mm	Up to 4,210	12730 x 4700 x 3900	65.33	70,452	166,836

Table 2 - Key product dimensions

Notes:

1. The unit can be sized to suit almost any type of pipe or box culvert.
2. Unit dimensions can vary depending on the vehicle load requirements and the wall thickness.

The Ecosol™ GPT is available in four configurations:

- In-line/End of Line;
- Off-Line;
- Fixed tangential screens for vacuum truck cleaning;
- Removable basket configuration for cleaning by crane truck.

Unit Design Loading

The range of Ecosol™ GPT's are designed for Class B, D and up to Class G loadings suitable for underground installations in highways, airport and wharf applications.

7.0 Capture Efficiencies

In order to determine a meaningful characterisation of the products collection efficiency, an extensive verification phase was undertaken by Avocet Consulting Pty Ltd, Ecosol and EngTest (The University of Adelaide). Tables 3 and 4 summarise these results.

Particulate Size (Micron)	Capture Efficiency
20 - 60	23%
60 - 200	67%
200 - 600	94%
600 - 2000	98%

Table 3 – Typical PSD results

ECOSOL GPT CAPTURE EFFICIENCY PERFORMANCE SUMMARY		
Pollutants	**Capture Efficiency**	**Details**
Gross Pollutants (GP)	98%	Particulate >2000 micron
Total Suspended Solids (TSS)	61%	Particulate 20-2000 micron (mean averages)
Total Phosphorous (TP)	29%	Particulate and dissolved mean average efficiency less standard deviation
Total Nitrogen (TN)	1%	Particulate and dissolved mean average efficiency less standard deviation
Total Petroleum/Hydrocarbon (TPH)	99%	In dry weather emergency oil spill solutions
	23%	In a high flow event

Table 4 – Mean average pollutant percentage reductions

Figures quoted are mean collection efficiency statistics based on available product testing data. It is important to note that the water quality CE values are indicative of potential field CEs given that the product is designed as a primary treatment solution providing physical screening and the removal of chemical constituents is largely dependent on the chemical composition of the particles and the bonding of these chemical constituents to the surface of particles. Further, finer and attached particle filtration performance of the product is also dependent on the body of pollutants forming a media already captured by the filter. Quoted CE values are intended as a general guide, please consult with your Urban Asset Solutions Pty Ltd representative for site specific product sizing and modelling.

8.0 MUSIC Modelling Guidelines

These guidelines provide instruction to the creation and application of a treatment node for the Ecosol™ GPT for the Model for Urban Stormwater Improvement Conceptualisation (MUSIC). The Ecosol™ GPT can be modelled in MUSIC using the Gross Pollutant Trap Treatment node to represent the results derived from independent laboratory testing and field testing by the University of South Australia and the University of Adelaide (Engtest The school of Civil, Environmental and Mining Engineering). The guidelines apply to the creation of the treatment node within MUSIC V6.1.0.

8.1 Creating the Node

Insert a GPT treatment node into your model by selecting "GPT" under the treatment nodes menu. When the node is created the node properties dialog is displayed. There are several changes that need to be made in this dialog.

- Adjust the text in the location box to read "Ecosol GPT" plus any other relevant information (4200, 4300 etc.).
- Adjust the low flow bypass to reflect any flow (m^3/ sec) diverted away from the unit before treatment (usually zero)
- Adjust the high flow bypass to reflect the treatable flow rate (TFR values are detailed in table 2) (m^3/sec) any higher flows will bypass treatment.

NOTES: Can be used to describe assumptions or location of reduction values for authority approvals.

Adjust the transfer function for each pollutant selecting the pollutant and editing (right click on the function point) the input and output values on the graph below to reflect capture efficiencies (CE) of the treatment device. Table 5 provides the input and output values for the Ecosol™ GPT based on High Flows. Table 5 provides input and output nodes for the Ecosol™ based on Low Flows.

Pollutant	Removal Rate (%)	Entered Input Value	Entered Output Value
Total Suspended Solids (20 - 2000µm)	61	1000	390
Total Phosphorus	29	1000	710
Total Nitrogen	1	1000	990
Gross Pollutants (>2000µm)	98	1000	20

Table 5 - Ecosol™ Gross Pollutant Trap – input and output values

9.0 Design Guidelines

To ensure your system is appropriately designed for its intended application and meets local water quality objectives it is essential that the following minimum information is provided.

- Confirm the required treatable flow rate – this is the minimum stormwater run-off volume that must be treated. Typically this is the 1 in 3 month to 1 in 1 year ARI.
- Confirm the maximum design flow capacity of the drainage line. This is important as it allows us to appropriately design and model the system to cater for these peak flows at minimal head-loss.
- Confirm the proposed number and locations of Ecosol™ GPT's to be installed. Where possible please provide clearly marked drainage plans indicating the proposed locations.
- Confirm local water quality objectives - Recent state governmental planning policies have established clear stormwater quality bench mark objectives for local and regional councils. Accordingly local and regional council water sensitive urban design objectives have been amended to meet these stormwater pollution reduction targets. It is important we are provided this information specific to your site and local council regulations so that we can clearly advise you of the products removal efficiency relevant to these WQO's.

For further assistance in sizing or specifying a system for your next project please complete the form in Appendix 1 and forward to your local Urban Asset Solutions Pty Ltd representative.

Urban Asset Solutions Pty Ltd engineering team is able to provide a comprehensive design proposal for almost any project where the Ecosol™ GPT is proposed either individually or in conjunction with any other filtration systems working together in a treatment-train approach. Services offered include preliminary hydraulic, structural, and total concept designs, as well as consideration to access and hardstand designs for cleaning and maintenance. This includes MUSIC (Model for Urban Stormwater Improvement Conceptualisation) modelling, CAD drawings and product specifications together with maintenance schedules and associated costs.

Further, Urban Asset Solutions Pty Ltd can also undertake all civil and structural installation works, and our complete turnkey service also includes full maintenance of the proposed stormwater treatment systems and reporting.

10.0 Hydraulic Specification

Gross Pollutant Traps (GPT's), such as the Ecosol™ GPT, are primarily designed to remove gross pollutants (>2mm) from stormwater at high treatable flow rates (TFR) and can play an integral role in reducing pollution in heavily-urbanised catchments that discharge into our waterways.

The Treatable Flow Rate (TFR) is the minimum flow that a GPT must treat, without by-pass, to achieve the desired pollutant capture criteria for a particular development. It varies dependent on that catchment size and percentage of impervious area thereby determining the pipe size and gradient. Typically, the Ecosol™ GPT is designed to treat the 1-in-3 month Annual Rainfall Intensity (ARI) discharges, with greater flows by-passing the unit.

Ecosol GPT Product Code	maximum Inlet/Outlet Pipe Diameter	Treatable Flow Rate (L/s)	Approximate External Dimensions (L x W x D from inlet invert level) (mm)
GPT 4200	Up to 300mm	Up to 51	2200 x 900 x 750
GPT 4300	Up to 525mm	Up to 120	2700 x 1350 x 750
GPT 4450	Up to 600mm	Up to 260	3600 x 1650 x 1050
GPT 4600	Up to 900mm	Up to 470	4500 x 1950 x 1350
GPT 4750	Up to 1050mm	Up to 730	5600 x 2300 x 1650
GPT 4900	Up to 1350mm	Up to 1,050	6500 x 2600 x 1975
GPT 41050	Up to 1500mm	Up to 1,430	7450 x 2950 x 2300
GPT 41200	Up to 1800mm	Up to 1,870	8630 x 3300 x 2625
GPT 41350	Up to 1950mm	Up to 2,370	9700 x 3700 x 2950
GPT 41500	Up to 2100mm	Up to 2,930	10680 x 4000 x 3250
GPT 41800	Up to 2400mm	Up to 4,210	12730 x 4700 x 3900

Table 6 - Ecosol GPT indicative product Treatable Flow Rates

10.1 By-Pass Capacity and Head-Loss

The range of Ecosol™ GPT's has been designed to cater for maximum flow by-pass at minimal head-loss. The placement of any structure into a stormwater line will induce headloss. The extent of this head-loss is a function of the velocity in the outlet pipe and the k factor adopted. The k factor must be representative of the type of structure and its operation during full-flow conditions as distinct from the TFR.

The Ecosol™ GPT has one of the lowest k factors of any GPT currently available. Extensive independent testing has been carried out to confirm the unit's k factor for a range of pipe and unit sizes based on full flow, worst case scenarios. These tests show that the k factor can vary between 0.6 and 1.5 depending on the pipe configuration and the relative unit size, as shown below.

Gradient	*k* Factor
1%	0.6
2%	1.0
3%	1.5

Table 7 – Measured maximum k factor for the Ecosol™ GPT at the suggested treatable flow rate for non surcharged flows.

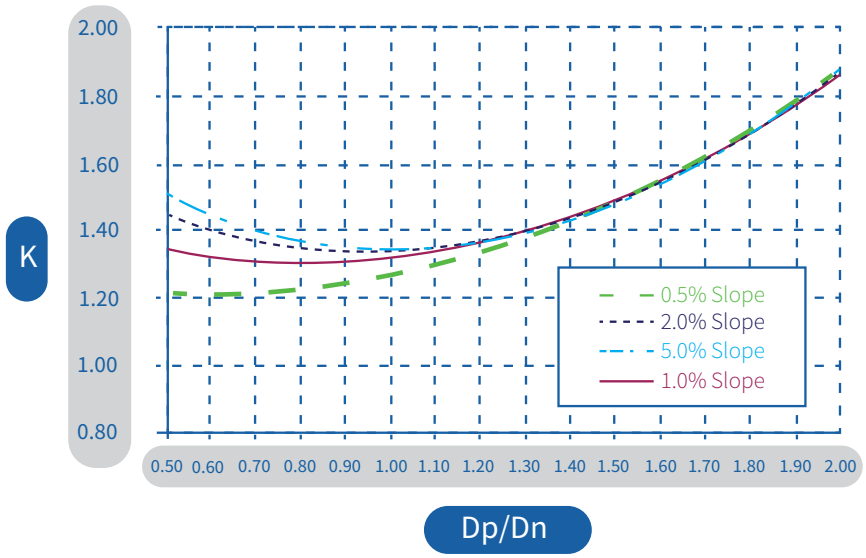

Figure 1 Measured maximum k factors for the Ecosol™ GPT at its designed maximum by-pass flow rate (designed discharge rates) in a surcharged environment.

11.0 Cleaning and Maintenance

The cleaning frequency and the cost, depends heavily on the catchment size and type, the unit's proximity to a waste facility and the quality and quantity of stormwater runoff

Cleaning frequencies are based on typical pollution loads of 0.280m³ /ha/year for gross pollutants and 0.380m³ /ha/year for sediment generated on typical fully developed fully developed urban catchment. For larger catchments or during extended dry weather periods additional system cleaning may be required.

Urban Asset Solutions Pty Ltd specialises in the cleaning and maintenance of all Stormwater Treatment Devices including vegetated solutions and would be pleased to assist you with your ongoing asset maintenance.

Ecosol GPT Product Code	Pollution Holding Capacities			Optimal Catchment Area (Ha)	Recommended Cleaning Frequency
	Solid Pollutants >2mm	Free Oils and Grease	Water		
	m³	Litres	Litres	Ha	Per Annum
GPT 4200	0.23	268	667	0.35	1
GPT 4300	0.32	469	1,181	0.50	1
GPT 4450	1.03	1,347	3,348	1.50	1
GPT 4600	2.43	2,994	7,211	3.60	1
GPT 4750	4.83	5,711	13,608	7.30	1
GPT 4900	8.30	9,567	22,768	12.50	1
GPT 41050	13.11	14,850	35,262	19.80	1
GPT 41200	19.52	22,793	51,698	29.50	1
GPT 41350	27.70	30,578	72,495	41.90	1
GPT 41500	37.94	41,491	98,317	57.40	1
GPT 41800	65.33	70,452	166,836	98.90	1

Table 8 - Ecosol™ GPT Recommended Cleaning Frequencies

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12.0 Monitoring

Under normal weather and operating conditions, your Ecosol™ GPT should be checked, minimum every 3 months depending on quality and quantity of the inflow to the unit. Initially, Urban Asset Solutions Pty Ltd recommends that monitoring is undertaken monthly or immediately after a major rain event. Once the unit has been in operation for an extended period of time (say, 12 months) then the monitoring schedule can be adjusted to reflect the actual operating conditions specific to the catchment.

Under normal operating conditions the unit would normally require cleaning approximately every 12 months.

13.0 Monitoring, Cleaning and Maintenance Service

An essential element of any good stormwater management program includes regular inspections, cleaning, and maintenance of installed Stormwater Quality Improvement Devices (SQIDS) to ensure that they continue to capture and retain pollutants to their designed specifications without premature by-pass and without any adverse impact on the drainage capacity of the stormwater conduit that it is installed on.

Cleaning frequencies, methodologies and even they equipment used to maintain these systems will vary depending on the type of device installed the catchment type, size and rainfall patterns.

At Urban Asset Solutions Pty Ltd we offer:

- a competitive cleaning and maintenance service;
- a long-standing record in safe work practices, supported by Quality Assured processes;
- in-depth knowledge and experience with all popular types and brands of GPTs;
- a complete understanding of pollution removal and disposal regulations and processes that ensures your unit is cleaned effectively and efficiently without risk of damage and;
- useful, easy-to-read reports, allowing you to track performance and pollution loading.

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14.0 Applications and Configurations Continued

The Ecosol™ GPT is usually installed In-Line/end-of-line on stormwater pipes or box culverts ranging in size from 200mm to 1800mm, although is suitable for larger pipes and box culverts. The product can be easily integrated into most drainage designs for residential, commercial or industrial applications .

Commercial Precincts

Car Parks

Residential Developments

The unit is also suitable for installation off-line adjacent to large open channels or drains.

The Ecoso™ GPT is able to be custom designed specific to you application. We can vary the loading class, pit depth and accommodate varying pipe types and sizes.

15.0 Turnkey Services

Urban Asset Solutions Pty Ltd design and estimating staff provide a dedicated management approach towards your project. In addition all staff are capable of liaising with the client, the consulting engineer, the contractor, and all other interested third parties to achieve a successful outcome.

16.0 Accreditation

Urban Asset Solutions Pty Ltd is accredited to ISO 14001 (Environment) and AS/NZS 9001 (Quality). Our commitment to continuously improving our products and services is demonstrated by our ongoing accreditation for Quality and Environmental Management. Urban Asset Solutions Pty Ltd is also committed to a safe environment for its employees. We are fully third-party accredited to AS/NZS 4801and OHSAS 18001.

17.0 Suppiler and Technical Product Contact Details

For any maintenance or technical product enquiries please contact:
Urban Asset Solutions Pty Ltd
Tel: 1300 706 624
Fax: 1300 706 634
Email: info@urbanassetsolutions.com.au

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Appendix 1

Ecosol™ GPT Essential Information Form

To ensure your system is appropriately designed for its intended application and meets local water quality objectives it is essential that the following minimum information is provided:

Customer Details

Contact Person:

Company Name:

Phone:

Fax:

Email:

Project and Site Information

Project Name:

Project Address:

Type of Development/Catchment Type:

Pollutant Removal Targets (%):
Site Water Quality Objectives (WQO's)

- Gross Pollutants (>2000µm)
- Total Suspended Solids (20 – 2000µm)
- Total Phosphorus
- Total Nitrogen
- Heavy Metals
- Total Petroleum/ Hydrocarbon
- Other

Local Authority:

Device Location:

Designed Discharge (Peak ARI Flow Rate) L/s:

Treatable Flow Rate (L/s):

Tidal or submerged (inundated) system:

Inlet Pipe Diameter/Size

Depth to Inlet pipe invert level

Preferred access cover type and loading
(Grated or solid top) (Class A, B or D)

Other essential design or site relevant information:

Please forward the above information for your next project to your local Urban Asset Solutions Pty Ltd representative. On receipt Urban Asset Solutions Pty Ltd will model and design the most appropriately sized system to suit your application to assist you achieve the project Water Sensitive Urban design objectives.
Email: info@urbanassetsolutions.com.au - Fax: 1300 706 634.

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Appendix 2

References

Please note that the Ecosol™ GPT was originally known as the Ecosol RSF 4000.

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Appendix 2 Continued

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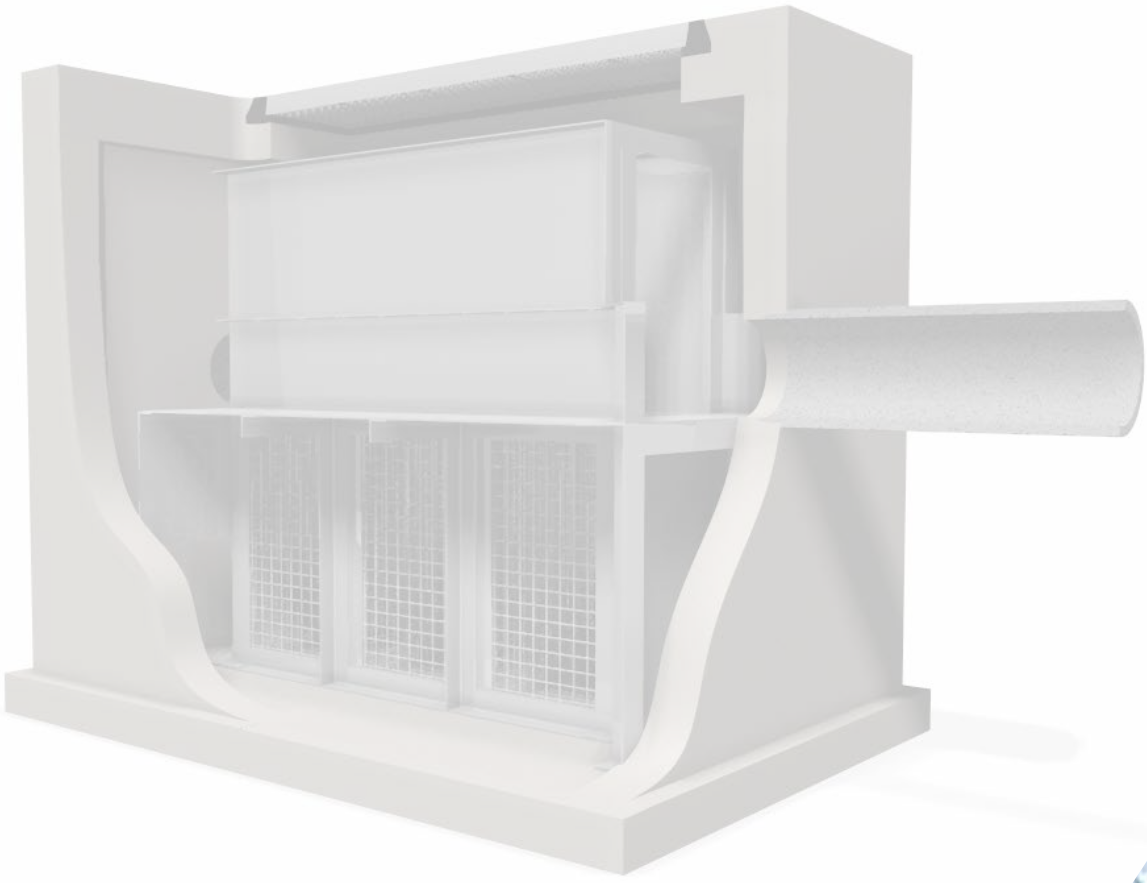

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