Engineering Solutions Qld Pty Ltd

Consulting Engineers and Project Management

CONCEPTUAL STORMWATER MANAGEMENT PLAN (QUALITY)

WEINAM CREEK PRIORITY DEVELOPEMNT AREA

COAST GUARD DEVELOPMENT

FOR

REDLAND INVESTMENT CORPORATION

PROJECT NO: FC-22-014

DATE: 23 APRIL 2024

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2024/1543

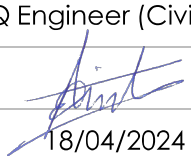
Date: 24 December 2025

Queensland Government

CLIENTS • SERVICE • SOLUTIONS

DOCUMENT CONTROL RECORD

Prepared By:	Pushkar Mevada
Position:	Civil Engineer
Signed:	
Date:	18/04/2024

Approved By:	Amith DeSilva
Position:	RPEQ Engineer (Civil) 21977
Signed:	
Date:	18/04/2024

REVISION STATUS

Revision No.	Revision Description	Date	Approval
0	ORIGINAL ISSUE	18/04/2024	NAIDS

Recipients are responsible for eliminating all superseded documents in their possession.

RELIANCE, USES and LIMITATIONS

This report is copyright and is to be used only for its intended purpose by the intended recipient and is not to be copied or used in any other way. The report may be relied upon for its intended purpose within the limits of the following disclaimer.

This study, report and analyses have been based on the information available to Engineering Solutions Qld Pty Ltd at the time of preparation. Engineering Solutions Qld Pty Ltd accepts responsibility for the report and its conclusions to the extent that the information was sufficient and accurate at the time of preparation. Engineering Solutions Qld Pty Ltd does not take responsibility for errors and omissions due to incorrect information or information not available to Engineering Solutions Qld Pty Ltd at the time of preparation of the study, report or analyses.

ENGINEERING SOLUTIONS QLD PTY LTD **ABN 38 163 915 160** **ACN 163 915 160**

FRASER COAST
Address: 4/31 Main Street, PIALBA
PO Box 1050, HERVEY BAY QLD 4655
Phone: (07) 4194 1550

Email: admin@esq.net.au

BRISBANE
Address: 12/1420A Logan Road, MOUNT GRAVATT
PO Box 1050, HERVEY BAY QLD 4655
Phone: (07) 3849 5951

Web: www.esq.net.au

CONTENTS

TABLE INDEX

FIGURE INDEX

APPENDICIES

1 INTRODUCTION

This Conceptual Stormwater Management Plan (Quality) has been prepared to provide recommendations to implement stormwater Quality improvement devices to meet the water quality objectives for the Weinam Creek Priority Development Area at Redland Bay Coast guard development site.

1.1 SCOPE OF WORKS

This report has been prepared on behalf of Redland Investment Corporation and presents a comprehensive review of available Stormwater Quality Improvement Devices (SQID) and stormwater Best Management Practices (BMP) to ensure that the proposed development adequately addresses the management of stormwater quality during both the construction and operational phases of the development. The subject site area for which the plan has been prepared is approximately 0.1351ha.

The objective of this report is to present practical stormwater designs which can be integrated into the development proposal, ensuring that the development minimises potential impacts on downstream receiving environments during both the construction phase of this development and while in operation.

The report has been prepared to meet the requirements of the State Planning Policy Code: Water Quality, in specific the requirements listed in Appendix 2 (July 2017). This is to ensure that the effect of development is managed and does not compromise the environmental values of the receiving environment.

1.2 CONSTRUCTION PHASE OBJECTIVES

To minimise the impact of construction phase activities, a set of site-specific best practice management measures are specified. These measures will be designed to control the severity and extent of soil erosion and pollutant transport from the development site. Table 1.1 outlines typical construction phase objectives.

TABLE 1.1 CONSTRUCTION PHASE OBJECTIVES

Construction Phase Objectives (Erosion and Sediment Control)	Minimise exposure of disturbed soils at any time during construction.
	Divert water run-off from undisturbed areas around disturbed areas.

	Collect and drain stormwater runoff through treatment devices (e.g. sediment bags, silt fences, etc.) from disturbed soils for targeted design storm events.
	Discharge of sediment laden stormwater is avoided for events up to and including the nominated design storm, where practicable, and minimised when the nominated design storm is exceeded.
	Site discharge to not exceed TSS – 50 mg/L.

1.3 OPERATIONAL PHASE OBJECTIVES

The overarching objective for stormwater management during the operational phase of the development is to ensure that the development does not cause an unacceptable impact to downstream properties and the receiving environments. Table 1.2 outlines the operational phase objectives.

TABLE 1.2 OPERATIONAL PHASE OBJECTIVES

Operational Phase Objectives (Quality)	Stormwater discharges from the site to achieve the specified load-based reduction targets in accordance with the State Planning Policy – Water Quality, Appendix 2, Table B. For the development site, relevant targets are as follows: TSS – 80% TP – 60% TN – 45% Gross Pollutants – 90%

1.4 SUBJECT SITE LOCATION

The subject site is located within the Redland City Council in Redland Bay, In between Marina Circuit and coast guard. The subject is bounded by Marina Circuit car park in the north, and by coast guard

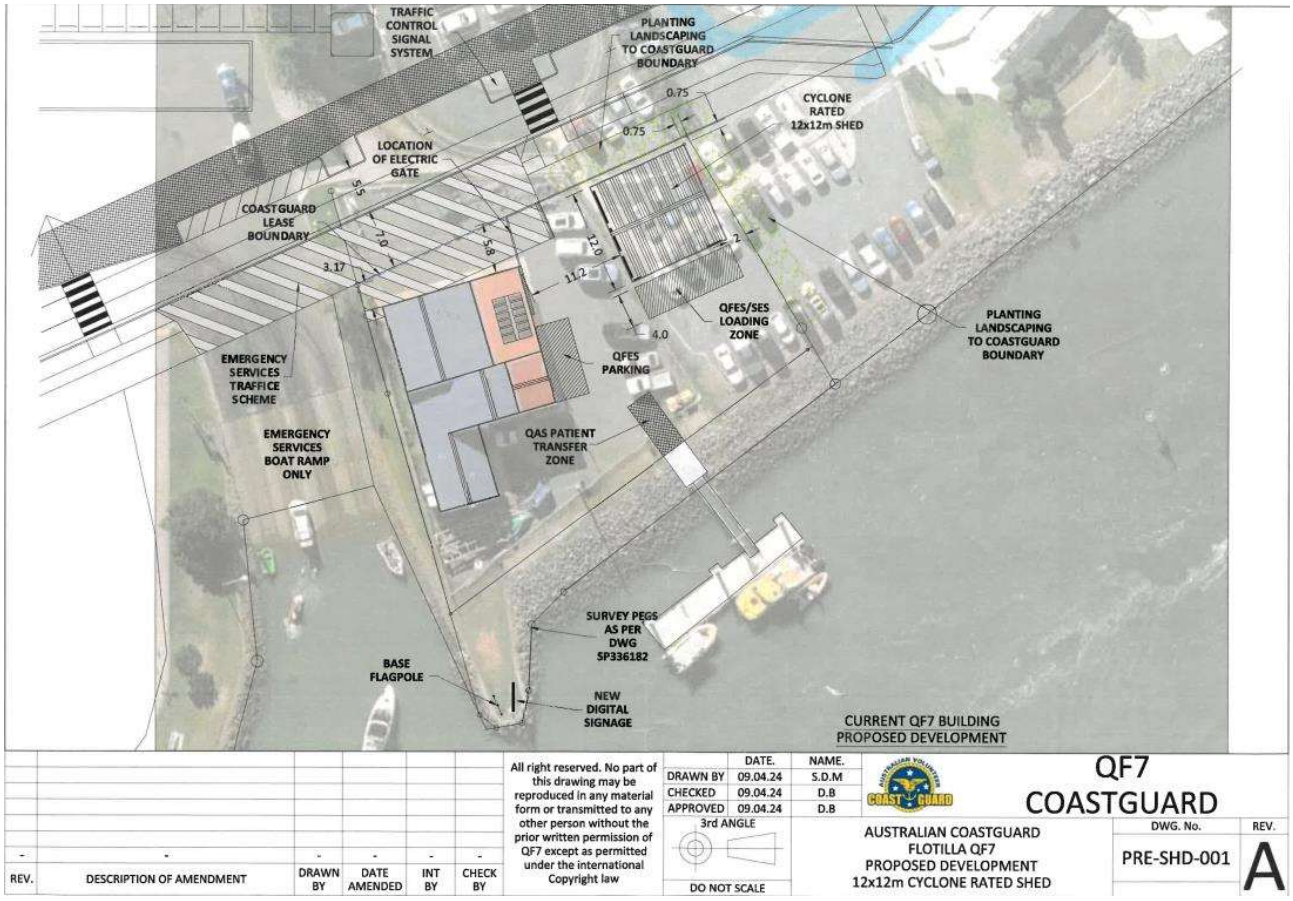
to the south. Figure 1 shows a locality map of the site and an aerial photo of the subject site (sourced from RCC E- Mapping).

FIGURE 1.1 SITE LOCALITY AND AREAL PLAN (RCC E- MAPPING).

2 PROPOSED DEVELOPMENT

The client is proposing to re-develop the site of coast guard for the range of commercial and community infrastructure purposes. The proposed development layout plan is shown in figure 2.1.

FIGURE 2.1 PROPOSED DEVELOPMENT LAYOUT



3 DEVELOPED CASE – WATER QUALITY

In order to determine the potential impact of the development on the water quality of downstream receiving environments, an assessment has been undertaken for both the construction phase and the operational stage of the development.

3.1 CONSTRUCTION PHASE

During the construction phase of the development, areas of the site will be cleared, any vegetation or turf areas removed, and soil surfaces will be exposed. During rainfall events, there will be therefore a risk that the eroded sediments are transported off site and into the downstream receiving environment.

An estimate of the potential volume of soil loss from the subject site has been calculated based on the Revised Universal Soil Loss Equation (RUSLE). It should be noted that the soil loss predicted via this methodology provides a best estimate and has been undertaken in an effort to identify the potential erosion risk associated with the construction phase of the project and to gain an indication of maintenance requirements.

RUSLE calculates annual erosion rates based on the following:

$$\mathbf{A = R \times K \times LS \times C \times P}$$

Where: A = annual soil loss due to erosion (t/ha/yr)

R = rainfall erosivity factor

K = soil erodibility factor

LS = topographic factor derived from slope length and slope gradient

C = cover and management factor

P = erosion control practice factor

As presented in Table 3.1 below, it is predicted that there is potential of up to 1.4 tonnes of sediment to be exported from each hectare of disturbed surface over a 12-month period. A bulk density of 1.3 tonnes per cubic metre has been relied upon for the calculation of sediment yield. The RUSLE calculation formula taken from the IECA Best Practices Erosion and sediment control manual also gives standard values for the C and P factors of 1.0 and 1.3 respectively for well controlled and compacted sites with no vegetation. The K value of 0.025 has been adopted assuming a sandy clay soil type.

TABLE 3.1 SEDIMENT VOLUME

Catch	Area (Ha.)	Slope Length (m)	Slope Grade (%)	Intensity $^{6}I_{2}$ (mm/hr)	R	K	LS	C	P	A (t/Ha/yr)	Yield (m^3/yr)
A	0.1351	60	0.33	13.7	4087	0.025	0.10	1	1.3	13.1	1.4

3.2 OPERATIONAL PHASE

The proposed development will result in an intensification of land use and will therefore result in higher pollutant loads being exported off site during the rain events.

The Model for Urban Stormwater Improvement Conceptualisation (MUSIC) has been used to estimate the potential pollutant loads generated by the development. The following sections outline the parameters relied upon within the MUSIC modelling.

3.2.1 RAINFALL AND EVAPOTRANSPIRATION DATA

Rainfall and evapotranspiration data has been obtained from the MUSIC software at Station 40913 Brisbane and is included within Table 3.2 below.

TABLE 3.2 METEOROLOGICAL AND RAINFALL RUNOFF DATA REPORTING

Parameter	
Time Step (minutes)	5
Mean Annual Rainfall (mm)	749
Evapotranspiration (mm)	1532

3.2.2 DEVELOPED CATCHMENT PARAMETERS

The developed site has been split into internal sub-catchments based on their site usage.

The pollutant export and runoff parameters for each sub catchment adopted have been based on the Table 3.6 values in Healthy Waterways Water by Design MUSIC Modelling Guidelines (HW, 2010). A summary of the source node parameters used for each catchment follows in Table 3.3. A summary of the pollutant export parameters and runoff parameters adopted is included in Tables 3.4 and 3.5.

TABLE 3.3 MUSIC NODE PARAMETERS

Catchment ID	Land Use	Area(ha)	Impervious %
Roof-1	Commercial	0.014	100
Road-1	Commercial	0.089	100
Roof-2	Commercial	0.032	100

TABLE 3.4 RAINFALL AND RUNOFF PARAMETERS

Parameter	All Nodes
Land Use	Commercial
Rainfall Threshold (mm)	1
Soil Storage Capacity (mm)	18
Initial Storage (% capacity)	10
Field Capacity (mm)	80
Infiltration Capacity Coefficient A	243
Infiltration Capacity Coefficient B	0.6
Initial Depth (mm)	50
Daily Recharge Rate (%)	0
Daily Baseflow Rate (%)	31
Daily Deep Seepage Rate (%)	0

TABLE 3.5 POLLUTANT EXPORT PARAMETERS

Flow Type	Surface Type	Total Suspended Solids (log mg/L)		Total Phosphorous (log mg/L)		Total Nitrogen (log mg/L)	
	Commercial	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Base Flow	Sealed road	0.78	0.39	-0.60	0.50	0.32	0.30
Storm Flow	Sealed road	2.43	0.38	-0.30	0.34	0.37	0.34
Base Flow	Roof	0	0	0	0	0	0
Storm Flow	Roof	1.3	0.38	-0.89	0.34	0.37	0.34

3.2.3 MUSIC RESULTS

Based on the parameters outlined above, the pollutant loads generated by the MUSIC have been summarised in Table 3.6 below.

TABLE 3.6 DEVELOPED INPUT POLLUTANT LOADS

Pollutant	Inflows (kg/yr)
TSS	248
TP	0.455
TN	2.86
GP	23.4

To ensure that pollutant loads are reduced from the stormwater that discharges from this site to levels suitable for the receiving environment and is in accordance with State and Local government guidelines, a treatment train of proposed stormwater measures has been adopted and detailed in Section 5 of this report.

4 STORMWATER MANAGEMENT – CONSTRUCTION PHASE

The construction phase water quality assessment estimated that development of the site has the potential to export approximately 1.4 tonnes of sediment from the site over a 12-month period.

In order to ensure that the discharge of sediment laden stormwater is avoided (for events up to and including the nominated design storm), where practicable, and minimised when the nominated design storm is exceeded, a set of best practice site management procedures has been developed for the subject site. These controls have been prepared with consideration to the following key principles:

- Integrate erosion and sediment control issues into site and construction planning.
- Develop effective and flexible erosion and sediment control measures (ESC) based on anticipated soil, weather and construction conditions.
- Minimise the extent and duration of soil disturbance.
- Control water movement through the site.
- Minimise soil erosion.
- Promptly stabilise disturbed areas.
- Maximise sediment retention on site.
- Maintain all ESC measures in proper working order at all times.
- Monitor the site and adjust ESC practices to maintain the required performance standard.

Due consideration will be given to any stripped topsoil being retained and reused in disturbed areas and rehabilitation of the site. The construction contractor is responsible for the implementation, inspection, repair and modification of all control measures.

4.1 SPECIFIC EROSION AND SEDIMENT CONTROL MEASURES

The following erosion and sediment controls have been developed in accordance with IECA Best Practice Erosion and Sediment Control guidelines. It should be noted that these designs are suitable for development assessment purposes only and should be refined in greater detail as part of a subsequent Operational Works design package.

4.1.1 SEDIMENT BASINS

The *IECA Best Practice Erosion and Sediment Control guidelines – Appendix B – Sediment Basin Design and Operation*, recommends the application of sediment basins within sub-catchments with a catchment area exceeding 2500 m^2.

In addition, the sediment loss predictions for this site are much lower than the trigger of 150 t/ha/year as specified by IECA Guidelines. Therefore, a temporary sediment basin is not considered necessary.

4.1.2 SEDIMENT FENCES

In order to minimise the loss of sediment from the disturbed area, sediment fences are to be installed along the downstream perimeter of the development site.

Sediment fences are to comprise of purpose-made woven or composite (non-woven with woven backing), geotextile fabric. Fences are to be erected vertically and supported by posts to create a fabric sediment trap. The bottom of the fence is to be buried to prevent water escaping under the fence.

4.1.3 ROCK PAD ENTRY AND EXIT

A well-defined rock-lined surface (pad) is to be placed immediately adjacent to the access roads. All vehicles are to enter the site during the construction phase via the designated rock pad entry. The pad is used to extract and retain sediment from the types of construction and site vehicles leaving the site.

4.2 WATER QUALITY MAINTENANCE

In order to ensure that the stormwater management measures detailed within this management plan are functioning correctly and to ensure that impacts to downstream receiving environments are mitigated, appropriate construction phase water quality maintenance is recommended below. All erosion and sediment control devices must be always maintained in proper working order. This includes ensuring that the hydraulic capacity of each device is not compromised at any time. Table 4.3 details the maintenance requirements for the specific erosion and sediment controls.

TABLE 4.1 EROSION AND SEDIMENT DEVICE MAINTENANCE REQUIREMENTS

Device/Control Measure	Maintenance Trigger	Action
Silt fences and rock pad entry/exit.	The capacity of the devices falls below 75% of its design capacity.	By the end of the day, during any stay in rainfall.

All material removed during maintenance, whether solid or liquid, is to be disposed of in a manner that does not cause ongoing soil erosion or environmental harm.

5 STORMWATER MANAGEMENT – OPERATIONAL PHASE

Previous sections of this report have demonstrated that development of the site has the potential to impact the quality of stormwater discharged from the subject site. In order to ensure that the operational phase objectives outlined within Section 1.3 of this report can be achieved, various stormwater management measures are proposed for inclusion within the development. To achieve these objectives, flows will need to be adequately managed prior to discharge.

5.1 SCHEMATIC DESIGN PLAN

With consideration given to the existing site characteristics, the proposed development configuration and the range of available stormwater management control measures, Appendix C presents a schematic design plan of the proposed drainage and treatment system proposed for incorporation within the development.

It is proposed that stormwater from the site be collected within an underground stormwater drainage network of pits and pipes before being routed to Stormwater Quality Improvement Device (SQID)

5.2 INTERNAL DRAINAGE

The proposed internal drainage will consist of road gully units situated within the roadways and field inlet pits located in the Carpark to capture Parking area runoff. All inlet pits will be fitted with Ecosol litter baskets and the end of line for each stage will be treated by a proprietary treatment device before reaching the overall discharge point.

5.3 QUALITY CONTROL – POLLUTANT REDUCTION

In accordance with the State Planning Policy – Water Quality, stormwater generated on the subject site is to be collected and treated prior to discharge. This will help to protect the environmental values of the downstream receiving waters.

The site is required to meet minimum mean annual load-based reductions of 80% for Suspended Sediment; 60% for Total Phosphorus; and 45 % Total Nitrogen; and 90% for Gross Pollutants.

5.3.1 MUSIC MODELLING

In order to determine the design requirements for the proposed stormwater treatment measures, key "Treatment Nodes" were added to the MUSIC model prepared for the developed case assessment

undertaken within Section 3 of this report. The following outlines the modelling parameters relied upon for each "Treatment Node".

ECOSOL LITTER BASKET

The Ecosol Litter Basket (at-source primary treatment solution) is an efficient pre-screening primary treatment system that captures and retains solid pollutants at drainage entry points.

The Ecosol Litter Basket captures and retains a range of pollutants at entry points to the drainage network. It retains more than 97% of pollutants greater than 2000 µm and in the field it has been found to collect much smaller particles, including fine sediments.

ECOSOL STORM PIT

A proprietary treatment device was included in the proposed stormwater treatment train to assist with removal of Gross Pollutant loads from the site. The Ecosol Storm Pit and the MUSIC treatment nodes were obtained from the manufacturer's website. Final treatment device sizing to be done by manufacturer to ensure treatment effectiveness at design flow.

5.3.2 MODELLING RESULTS

Results of the MUSIC modelling for the treatment train effectiveness are summarised in Table 5.1. The results indicate the 80%, 60% and 45% reduction targets for TSS, TP and TN respectively are achieved for the rainfall data set simulated. A screen capture of the MUSIC modelling results is included in Figure 5.1.

	Sources	Residual Load	% Reduction
Flow (ML/yr)	0.911	0.911	0
Total Suspended Solids (kg/yr)	248	48.3	80.5
Total Phosphorus (kg/yr)	0.455	0.157	65.4
Total Nitrogen (kg/yr)	2.86	1.57	45
Gross Pollutants (kg/yr)	23.4	0.248	98.9

FIGURE 5.1 SCREEN CAPTURE OF MUSIC MODELLING RESULTS.

TABLE 5.1 TREATMENT TRAIN EFFECTIVENESS

Catchment ID	Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction Achieved (%)	Water Quality Objective (%)
All Catchments	TSS	248	48.3	80.5	80
	TP	0.455	0.157	65.4	60
	TN	2.86	1.57	45	45
	GP	23.4	0.248	98.9	90

NOTE: All simulations have been run with pollutant export estimation set to "stochastic generation".

5.4 WATER QUALITY DEVICES MAINTENANCE

In order to ensure that the stormwater management measures detailed within this management plan function correctly in the long term, and to ensure that impacts to downstream receiving environments are mitigated, appropriate operational phase water quality device maintenance is to be undertaken. The following sections detail the minimum requirements for surface water monitoring and control device maintenance.

5.4.1 OPERATIONAL PHASE DEVICE MAINTENANCE

In order for each of the proposed stormwater treatment devices to achieve the necessary pollutant removal efficiencies, regular maintenance will be necessary. Poorly maintained devices will result in under performance and in some instances, may cause leaching of pollutants to downstream receiving environments. Based on the proposed treatment train, details appropriate maintenance regimes for each treatment device should be obtained directly from the manufacturer during the device installation.

All material removed during maintenance, whether solid or liquid, is to be disposed of in a manner that does not cause ongoing soil erosion or environmental harm and in accordance with Local Authority requirements.

6 CONCLUSIONS

This report presents a set of conceptual sediment and erosion controls which have been designed to minimise the discharge of sediment laden stormwater to downstream receiving environments. These measures include sediment fences to ensure sediment laden runoff is retained on-site. In addition, a rock entry/exit pad is to be located at all construction site entry points. These measures will need to be adequately maintained during the construction phase to ensure optimal performance.

In order to address stormwater quality during the operational phase, the overall catchment was split into 2 sub-catchments representative of the intention for site levels. The sub-catchment runoff will be conveyed through pipes after having passed through Ecosol Litter Baskets before arriving at the proposed end of line proprietary treatment device (SQID). The final number of Ecosol Litter Baskets will be based on the quantity analysis during the detailed design phase as the percentage capture through the litter baskets was assumed to be 100% of the internal site.

It has been demonstrated that by including these measures throughout the development to treat stormwater, pollutant removal efficiencies of 80%, 60% and 45% can be achieved for TSS, TP and TN respectively.

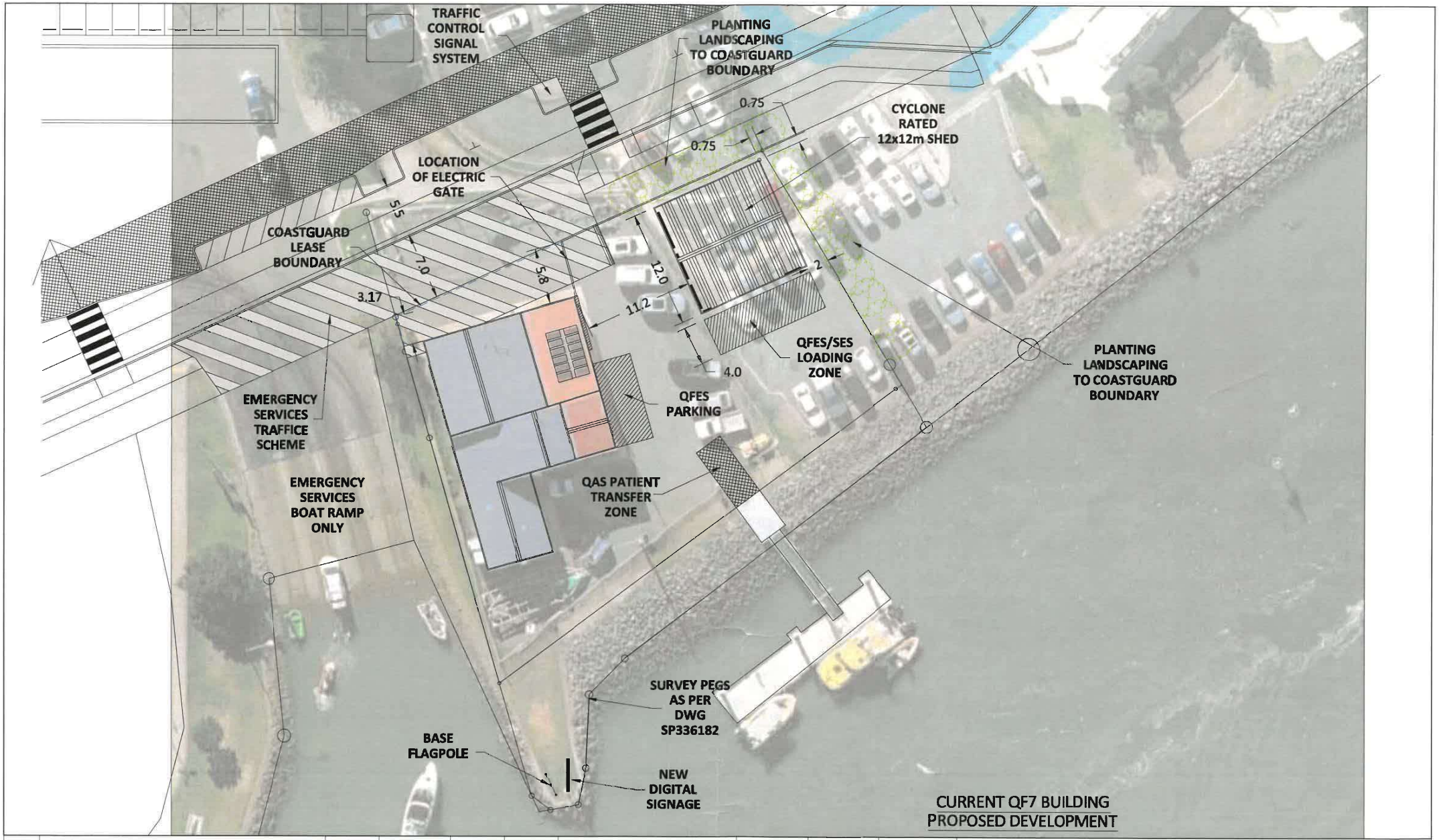
7 REFERENCES

The information presented herein has been prepared with reference to the following documents.

1. Department of Environment and Resource Management 2009, Monitoring and Sampling Manual, September 2009.
2. Department of Environment and Resource Management 2009, Queensland Water Quality Guidelines, September 2009.
3. Department of Natural Resources and Water, 2008, Queensland Urban Drainage Manual – Second Edition, Department of Natural Resources and Water, Brisbane.
4. Healthy Waterways 2006, WSUD Technical Guidelines for South East Queensland.
5. Water by Design, 2009. Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands, South East Queensland Healthy Waterways Partnership, Brisbane, Queensland.
6. Water by Design, 2010. MUSIC Modelling Guidelines. South East Queensland Healthy Waterways Partnership, Brisbane, Queensland
7. Fraser Coast Regional Council Planning Scheme.
8. Institute of Public Works Engineering Australia, 2013. *Queensland Urban Drainage Manual – Third Edition 2013 – p.*

APPENDIX A

PROPOSED DEVELOPMENT LAYOUT



REV.	DESCRIPTION OF AMENDMENT	DRAWN BY	DATE AMENDED	INT BY	CHECK BY
-	-	-	-	-	-

	DATE.	NAME.
DRAWN BY	09.04.24	S.D.M
CHECKED	09.04.24	D.B
APPROVED	09.04.24	D.B

3rd ANGLE

DO NOT SCALE

QF7 COASTGUARD

AUSTRALIAN COASTGUARD
FLOTILLA QF7
PROPOSED DEVELOPMENT
12x12m CYCLONE RATED SHED

DWG. No.	REV.
PRE-SHD-001	A

APPENDIX B
MUSIC CATCHMENT AREAS

REVISION: 1
19/04/2024

Job No.
FC-22-014

DWG No.
Z-066

CONCEPTUAL STORMWATER QUALITY CATCHMENT
WEINAM CREEK PRIORITY DEVELOPMENT AREA
WEINAM CREEK, REDLAND
FOR REDLAND INVESTMENT CORPORATION

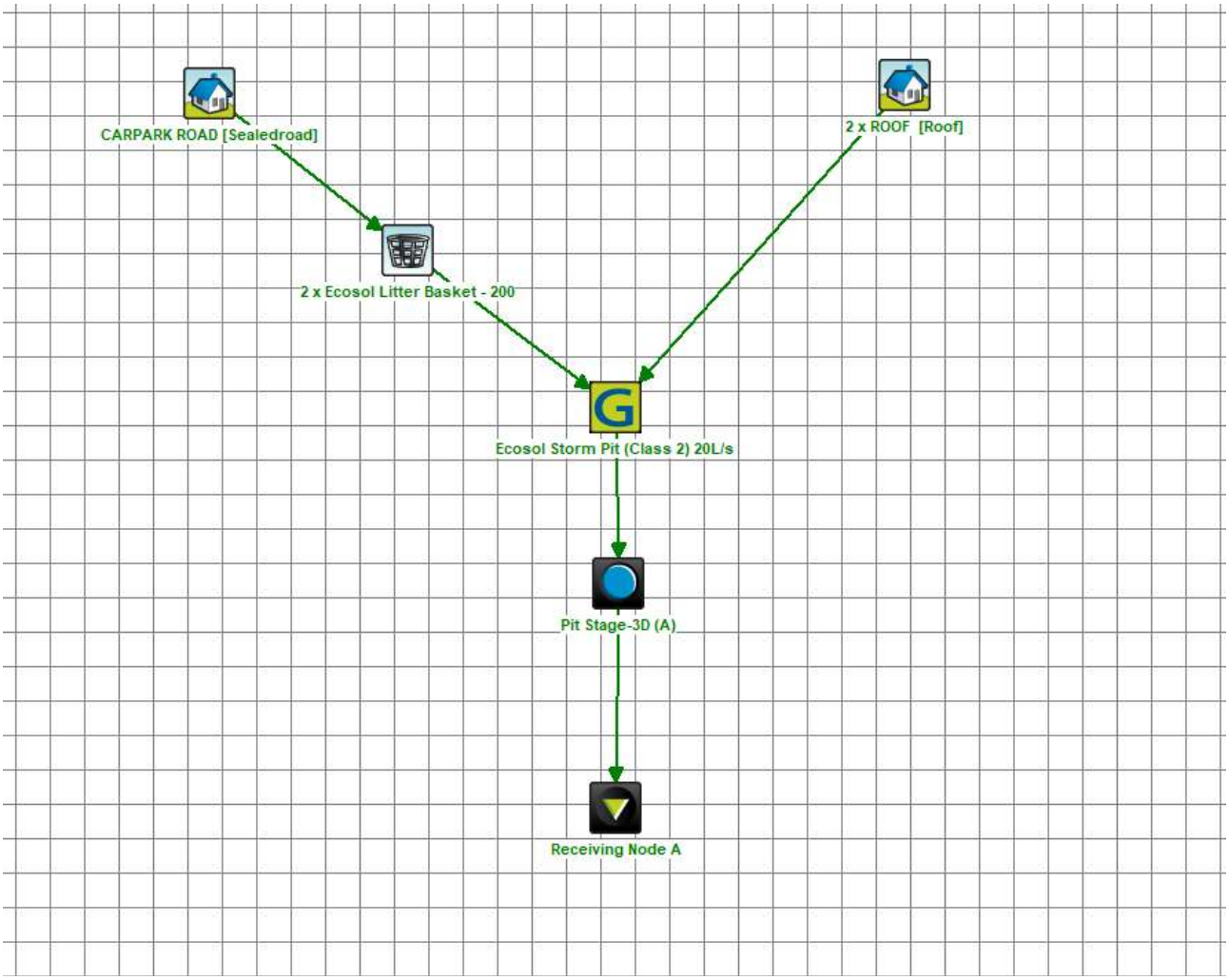
0 5 10 15
SCALE 1:500 (m)

DO NOT SCALE FROM PLAN

ENGINEERING SOLUTIONS QLD.
4/31 MAIN STREET, PIALBA
PO Box 1050, HERVEY BAY QLD 4655
T: (07) 4194 1550
E: admin@engineeringsolutionsqld.com.au
W: www.engineeringsolutionsqld.com.au
CLIENTS - SERVICE - SOLUTIONS

Engineering Solutions Qld

APPENDIX C
SCHEMATIC DRAINAGE TREATMENT TRAIN



www.esq.net.au