SHORELINE REDLANDS
WATER QUALITY MANAGEMENT PLAN
VERSION 06

DesignFlow
Prepared for Lendlease Communities (Shoreline) Pty Ltd
January 2023

Document Control Sheet

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Client:	Lendlease Communities (Shoreline) Pty Ltd
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Circulation:	Lendlease Communities (Shoreline) Pty Ltd

Disclaimer

DECLARATION OF ACCURACY

I declare that:

1. To the best of my knowledge, all the information contained in, or accompanying this Management Plan *Shoreline Redlands - Water Quality Management Plan V05* is complete, current and correct.

2. I am duly authorised to sign this declaration on behalf of the approval holder.

3. I am aware that:

a. Section 490 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where the person is reckless as to whether the information is false or misleading.

b. Section 491 of the EPBC Act makes it an offence for a person to provide information or documents to specified persons who are known by the person to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth) where the person knows the information or document is false or misleading.

c. The above offences are punishable on conviction by imprisonment, a fine or both.

Signed 

Full name (please print)

Philip Mann

Organisation (please print)

Lendlease

Date 5/9/23

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Figures

Tables

1 INTRODUCTION

Lendlease Communities (Shoreline) Pty Ltd has commenced planning the development of the Shoreline development (the site), which is proposed to include over 4,000 homes, shops, restaurants, 2.2km of foreshore parkland and wildlife corridors along major drainage pathways. The project site is ~303 hectares and is currently used for both grazing and cropping activities.

The Shoreline development was determined a controlled action under Environmental Protection and Biodiversity Conservation (EBPC) Act 1999, as part of the Shoreline development site drains directly to the Moreton Bay Ramsar wetland and because of potential impacts to listed threatened and migratory species, and communtiies.

The EPBC Act Approval (EPBC 2016/7776, April 2018) requires that the approval holder, now Lendlease Communities (Shoreline) Pty Ltd, submit a Water Quality Management Plan (WQMP) to the Minister, and gain written approval to the WQMP, before commencement of development works. The requirements of the WQMP are specified in Condition 7 of the EPBC Act approval, including that the plan must accord with the National Water Quality Guidelines (2018) and include:

a) a monitoring program sufficient to determine pre-commencement water quality within all catchments within the site and at a reference/control monitoring site;
b) a rationale for the sampling effort undertaken to determine pre-commencement water quality and justify the selection of the reference/control monitoring site with respect to the potential impacts of the action and the objectives of the WQMP;
c) details of the ongoing monitoring locations and the parameters to be monitored;
d) proposed early warning indicators, trigger thresholds and limits for detecting impacts on surface water quality;
e) contingency measures to be implemented in the event that trigger thresholds are breached; and
f) provisions to make monitoring results publicly available on the approval holder's website for the life of the project.

This document fulfils the requirements of the EPBC Act Approval as outlined above.

2 SITE DESCRIPTION

2.1 LOCATION

The proposed Shoreline development site (the site) is located at the southern end of Redland Bay (Figure 1). The application extent and proposed development land use are presented in Figure 2.

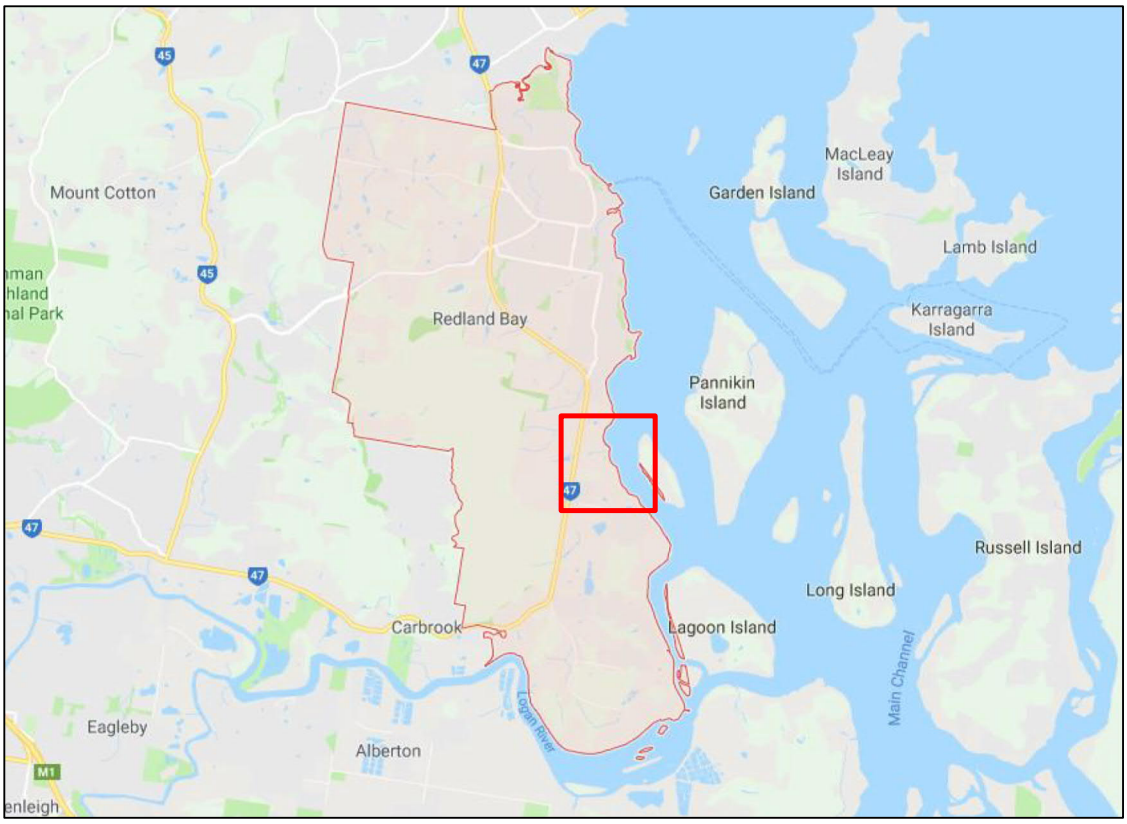


Figure 1. Location of the Shoreline development.

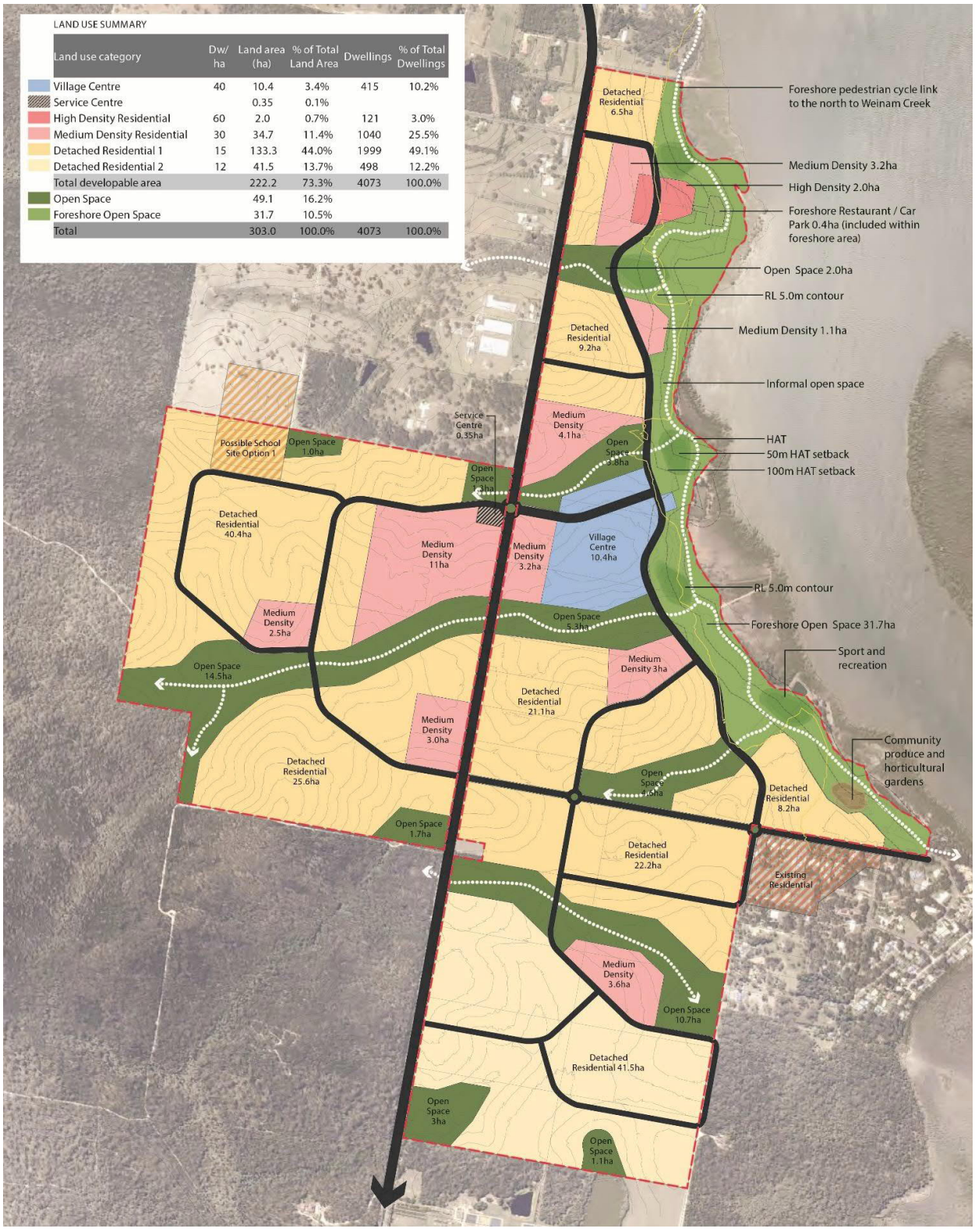


Figure 2. Application extent and proposed development land use (Source: LAT27).

2.2 EXISTING LAND USE

Existing land uses across the proposed development site comprise grazing and agricultural activities (Figure 3). The development site has been mostly cleared of native vegetation, with areas of remnant vegetation present along the foreshore zones and areas within Catchment 3 (see Figure 3). Areas of remnant vegetation are mostly located outside of proposed urban development zones, and have been retained within the drainage lines and other open spaces (Figure 2).

2.3 SOILS

Soil types across the development site primarily comprise Redland basalt ("red" volcanic soils) which are well structured soils of medium permeability. The basalt soils are highly fertile and have supported agriculture within the region for a century. Elevated areas of the site may also comprise lower permeability fractured metamorphic rocks.

2.4 TOPOGRAPHY, DRAINAGE AND HYDROLOGY

The site is split into sub-catchments which flow in either an easterly direction into Moreton Bay or in a south-westerly direction towards Serpentine Creek. The primary consideration of this report are the five sub-catchments draining directly to Moreton Bay which are presented in Figure 3. These five sub-catchments are relatively small (<100ha) and dominated by low to moderate, undulating, topography with slopes varying between 4-12%. The drainage lines are characterised by broad, low gradient ephemeral flow paths generally without a defined channel.

A brief description of existing drainage pathways for each sub-catchment is provided below:

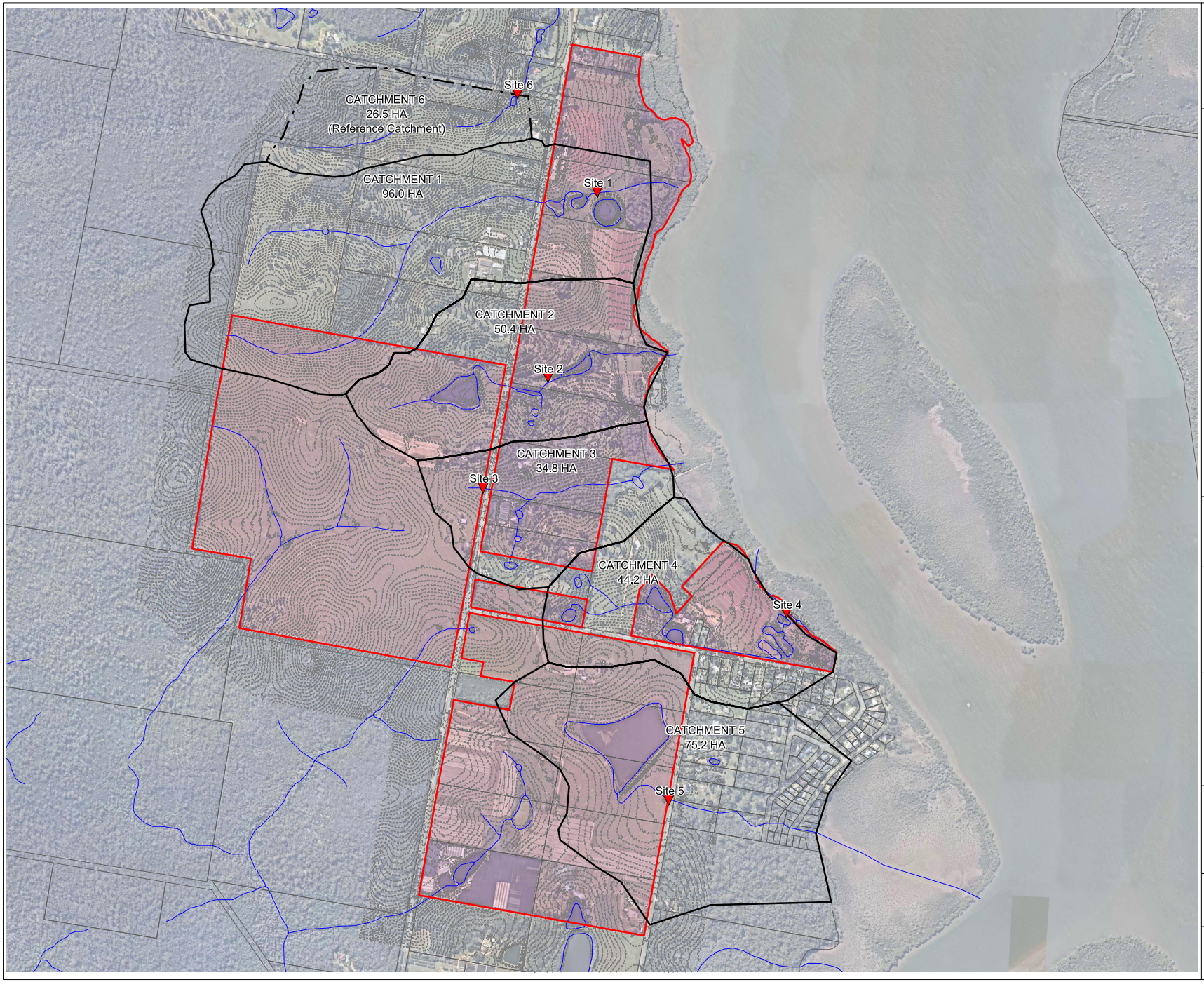
- **Catchment 1 (96ha)** – The majority of Catchment 1 is located within private property to the north and west of the site. Surface runoff flows in an easterly direction across private property and enters the development site via a drainage line under Serpentine Creek Road. The runoff enters a series of farm dams located within the drainage line. The drainage line downstream of the dams has been infilled and flow appears to discharge from this catchment only following large rainfall events. The tidal reach downstream of the farm dams is mangrove dominated.
- **Catchment 2 (50.4ha)** – The majority of Catchment 2 is located within the site, with the north-west zone of the catchment being in private property outside the development. Surface runoff from the upper catchment (grazing areas to the south-west) flows into a large dam, and then via a grassed depression under Serpentine Creek Road and into a series of online dams which provide water to a local plant nursery. Much of the vegetation along this reach of the drainage line has been modified by the nursery land use. Downstream of the dams, overland flows pass through remnant vegetation for approximately 400m, another farm dam, and discharge to a mangrove lined drain into Moreton Bay.
- **Catchment 3 (34.8ha)** – The majority of the catchment is located within the site, with areas to the south and south-east of the catchment located within private property. Land use within this catchment also includes aquaculture. Surface runoff flows in an easterly direction through a series of online dams and discharges to Moreton Bay.

- **Catchment 4 (44.2ha)** – Approximately half of the catchment is located within the site. The catchment has numerous large farm dams which are used for irrigation and stock watering. There is a small urban sub-catchment in the south east portion of the catchment. Runoff from the catchment enters Moreton Bay only when farm dams are full or directly via sheet flow from the cane farm. The drainage outfall is via mangrove lined drain.
- **Catchment 5 (75.2ha)** – The western half of Catchment 5 will be developed as part of Shoreline, with the remaining catchment comprised of urban development and native vegetation to the east. Runoff from the upper catchment drains to a large dam located within the development site. Overflows from the dam discharge under Orchard Road to a poorly defined drainage line that flows through an area of remnant vegetation and discharges to Moreton Bay.
- **Catchment 6 (26.5ha)** – Catchment 6 forms the reference catchment for the Shoreline development. It is located outside of the development footprint and no urban development is proposed in this catchment. The upper third of the catchment is predominantly remnant forest and the lower two-thirds have been cleared for rural land use. Runoff flows via a broad depression towards a small farm dam located upstream of Kidd St. Flows from the farm dam discharging via culverts under Kidd St, which form the downstream extent of Catchment 6.

2.5 EXISTING DAMS

Numerous online farm dams exist within the site drainage lines to provide irrigation and/or cattle water sources for the current land uses (Figure 4). Generally these dams are large compared to the contributing catchments, which has altered the natural flow characteristics of the downstream waterways by reducing the runoff volume.

The dams are also typically located downstream of agriculture and grazing areas. Sediment and nutrient laden run-off from these land uses is captured and stored within the dams during rainfall events. When the stagnant stored water is flushed downstream during flow periods, it is adversely impacting on the health of the downstream waterways. This finding is supported by the site water quality monitoring completed to date, which has found poor water quality within the sites' tributaries (as discussed in Section 3 below).



DesignFlow

LEGEND

- Shoreline Application Boundary
- RP Boundary
- 1m contours
- Drainage
- Moreton Bay draining catchment
- Water quality sample site

N W E S

Scale:
1 : 12,500 (A3)

FIGURE 3
CATCHMENTS, DRAINAGE AND EXISTING LAND USE

Project: 4235
Shoreline Redlands

Date:
21 June 2018

Client:
Lend Lease Pty Ltd

Figure 4. Examples of farm dams located within the development site.

3 BASELINE WATER QUALITY MONITORING

3.1 APPROACH

3.1.1 Parameter selection

The water quality parameters adopted for the baseline water quality modelling were selected from the range of physico-chemical indicators adopted for the water quality objectives (WQOs) for 'lowland freshwater streams' provided in The *Environmental Protection (Water) Policy 2009 Redland Creeks environmental values and water quality objectives. Basin No. 145 (part), including Coolnwynpin, Eprapah, Hilliards, Lota, Moogurrapum, Tarradarrapin, Tingalpa and Wynnum creeks. July 2010* (DEHP) (Table 1).

Table 1. Water quality objectives for Lowland freshwater (comprising lowland streams, wallum/tannin stained streams and coastal streams).

Parameter	Lowland Freshwater
Management level (level of protection)	Aquatic ecosystem – moderately disturbed
Turbidity:	<50 NTU
Suspended solids:	<6 mg/L
Chlorophyll a[1]:	<5 µg/L
Total nitrogen:	<0.50 mg/L
Oxidised N:	<0.06 mg/L
Ammonia N:	<0.02 mg/L
Organic N:	<0.42 mg/L
Total phosphorus:	<0.05 mg/L
Filterable reactive phosphorus (FRP):	<0.02 mg/L
Dissolved oxygen:	85% – 110% saturation
pH:	6.5 – 8.0

[1]*Chlorophyll a (reflective of phytoplankton biomass) was excluded from the base line sampling due to the ephemeral flow regime (i.e. results would provide no meaningful information).*

3.1.2 Sampling frequency

Figure 5 presents a summary of daily rainfall from the nearest Bureau of Meteorology weather station 'Rocky Point Sugar Mill' (Station ID 40319). Water quality sampling has been completed at 6 sites on 24 occasions between March 2017 and February 2021 (not all sites were sampled all rounds).Sampling of Site 6 commenced in September 2018. No sampling was undertaken between April 2017 to February 2018 and between November 2018 and December 2019.

The sampling sites comprise of a site within each of the sites' five sub-catchments (Sites 1-5) plus a reference site (Site 6) in an external catchment (Catchment 6) located to the north of Catchment 1 (Figure 3).

Water quality samples were collected following rainfall events to ensure that flow was present within the drainage lines (waterways) during sampling. Typically, no flow was observed in the periods between rain events due to the ephemeral flow regimes of these drainage lines. Samples were collected directly from the waterways (not the farm dams). Sampling was not undertaken during periods of no flow.

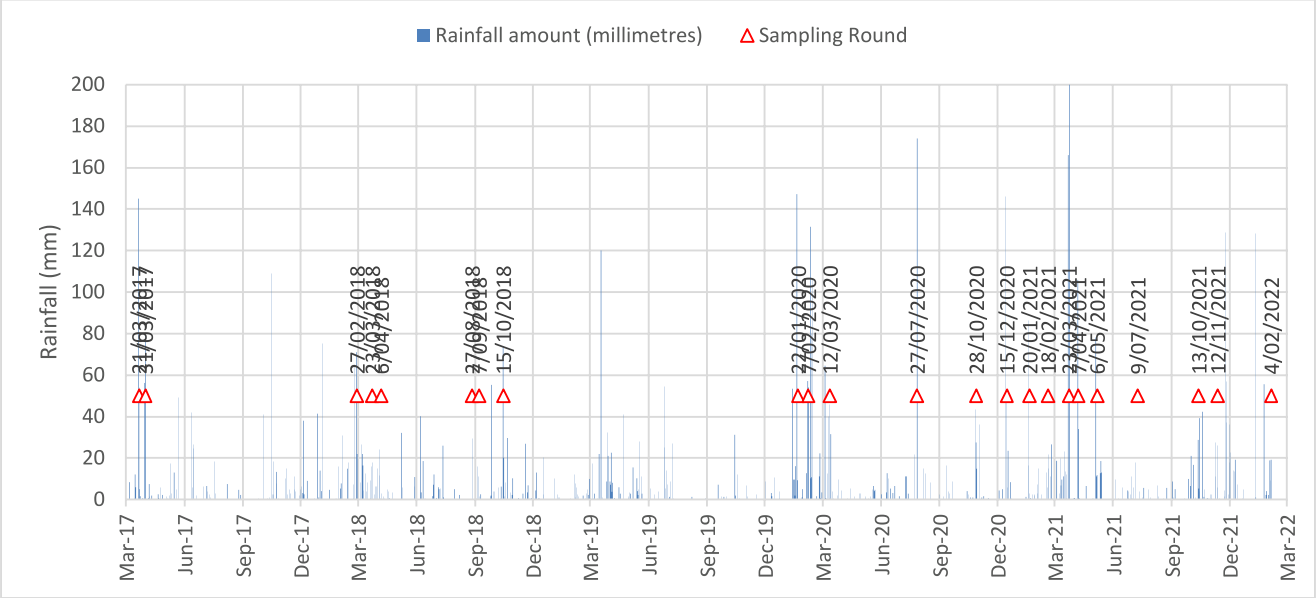


Figure 5. Daily rainfall and timing of sampling events.

3.2 RESULTS

The data collected from these sampling events have been used to develop a baseline of discharge water quality across the site as a benchmark for comparison during development phases. The physico-chemical parameters measured and mean water quality values and standard error of the sample mean values for each site are presented in Table 2.

The water quality results have been compared to the Water Quality Objectives (WQO) applicable to 'slightly to moderately disturbed' lowland freshwater streams for the Southern Redland Bay catchments outlined in *Environmental Protection (Water) Policy 2009 Redland Creeks environmental values and water quality objectives* (Department of Environment and Resource Management (2010)).

Table 2. Mean values (± standard deviation of the sample median) of baseline water quality parameters for waterways within Shoreline.

Water Quality Parameter	Site 1 (± SD)	Site 2 (± SD)	Site 3 (± SD)	Site 4 (± SD)	Site 5 (± SD)	Site 6 (± SD)	All Sites (± SD)	WQO	LOR
Number of samples	26	25	25	25	24	18	143	-	-
*Turbidity (NTU)	28.5 (± 53.3)	23.2 (± 27.4)	97.8 (± 277.7)	91.5 (± 168)	61.8 (± 128.3)	12.1 (± 10.5)	16.6 (± 149.1)	*<50*	*0.1*
*Suspended Solids (SS) (mg/L)	16 (± 13)	13 (± 18)	61 (± 119)	37 (± 46)	49 (± 96)	10 (± 12)	12 (± 68.7)	*<6*	*5*
Total Dissolved Solids @180°C (mg/L)	288 (± 117)	216 (± 66)	189 (± 70)	389 (± 121)	285 (± 175)	188 (± 77)	230 (± 131)	*no WQO*	*50*
*Total Nitrogen as N (mg/L)	2.8 (± 3.3)	1.4 (± 0.7)	2.2 (± 4.1)	4.7 (± 3.7)	3.7 (± 2.2)	1 (± 0.6)	1.4 (± 3.07)	*<0.5*	*0.1*
Ammonia (mg/L)	0 (± 0.09)	0 (± 0.01)	0 (± 0.01)	0 (± 0.32)	0 (± 0.15)	0 (± 0.03)	0.02 (± 0.18)	*<0.2*	*0.01*
Nitrite as N (mg/L)	0.01 (± 0.01)	0.01 (± 0)	0.01 (± 0.01)	0.07 (± 0.09)	0.02 (± 0.02)	0.01 (± 0)	0.01 (± 0.04)	*no WQO*	*0.01*
Nitrate as N (mg/L)	1.26 (± 2.83)	0.01 (± 0)	0.07 (± 0.28)	2.23 (± 3.4)	0.52 (± 1.43)	0.04 (± 0.04)	0.01 (± 2.07)	*no WQO*	*0.01*
Oxidised N (Nitrite + Nitrate) (mg/L)	1.26 (± 2.84)	0.01 (± 0)	0.07 (± 0.28)	2.2 (± 3.42)	0.53 (± 1.45)	0.04 (± 0.04)	0.01 (± 2.1)	*<0.06*	*0.01*
Total Kjeldahl Nitrogen as N (mg/L)	1.5 (± 0.8)	1.4 (± 0.7)	2.2 (± 4)	2.5 (± 0.8)	3.1 (± 1.3)	1 (± 0.6)	1.4 (± 2)	*no WQO*	*0.1*
Organic N (mg/L)	1.5 (± 0.7)	1.3 (± 0.7)	2.1 (± 4.1)	2.2 (± 0.8)	3.1 (± 1.3)	1 (± 0.5)	1.4 (± 2)	*<0.2*	*0.1*
*Total Phosphorus (mg/L)	0.26 (± 0.19)	0.31 (± 0.34)	0.68 (± 1.81)	0.84 (± 0.62)	3.31 (± 2.01)	0.1 (± 0.07)	0.32 (± 1.58)	*<0.05*	*0.01*
Filterable Reactive Phosphorus (mg/L)	0.11 (± 0.11)	0.15 (± 0.3)	0.15 (± 0.19)	0.38 (± 0.44)	2.78 (± 1.77)	0.03 (± 0.03)	0.11 (± 1.24)	*<0.02*	*0.01*
Dissolved Oxygen (% saturation)	63.8 (± 33.4)	44.5 (± 27.3)	42.5 (± 24.1)	67.1 (± 37.9)	53.4 (± 19.9)	73.8 (± 12.9)	57.6 (± 29.6)	*85% to 110%*	*0.01*
pH	6.39 (± 0.57)	5.94 (± 0.51)	5.8 (± 0.57)	7.06 (± 0.6)	6.6 (± 0.34)	5.41 (± 0.36)	6.21 (± 0.73)	*6.5 - 8.0*	*0.01*
Electrical Conductivity (µS/cm)	405 (± 196)	297 (± 151)	235 (± 117)	622 (± 241)	359 (± 273)	235 (± 138)	289 (± 234)	*no WQO*	*0.1*
Temperature (°C)	24.5 (± 3.4)	23.2 (± 4.3)	23.2 (± 4)	24.7 (± 3.8)	25.2 (± 4.1)	24.4 (± 4)	25 (± 4)	*no WQO*	*0.1*
Redox Potential (mV)	156 (± 70)	156 (± 61)	170 (± 81)	114 (± 60)	146 (± 61)	207 (± 53)	159 (± 69.9)	*100-600*	*0.1*

Notes: ** denotes an adopted threshold parameter for trigger values (refer Section 6). Shaded cells represent non-conformance with EPP (Water) 2009 QWQG water quality objectives. WQO = Water Quality Objective, LOR = Limit of Reporting.*

The following sub-sections compares each water quality parameter against these WQO.

3.2.1 Turbidity

Mean turbidity values for Sites 1, Site 2 and Site 6 (reference site) were below the WQO for turbidity. Site 3 and Site 4 exceeded the WQOs, with Site 5 with only a marginal exceedance.

3.2.2 Suspended Solids (SS) (mg/L)

Mean suspended solids concentrations exceeded the WQO at all sites. The agricultural and grazing land uses, and associated bare soils, are the likely sources of elevated suspended solids. Site 2 and Site 6 (reference site) only marginally exceed the WQOs.

3.2.3 Nitrogen

Mean total nitrogen and organic nitrogen concentrations exceeded the respective WQO's at all sites. Mean oxidised nitrogen concentrations conformed to the WQO at two sites, Sites 2 and 6. The agricultural and grazing land uses are the likely sources of elevated nitrogen levels, in the form of fertiliser and cow manure.

3.2.4 Phosphorus

Mean phosphorus concentrations (Total Phosphorus and Filterable Reactive Phosphorus) exceeded the WQOs at all sites (except Site 6 for FRP). Of note, mean phosphorus concentrations were the lowest at Site 6 (reference site). The agricultural and grazing land uses are the likely sources of elevated phosphorous levels, in the form of fertilisers and cow manure.

3.2.5 Dissolved Oxygen

Mean dissolved oxygen levels were below WQO at all sites. Note that DO% is highly variable and can change significantly during a 24 hour period. Typically DO% values that are below the WQO indicate higher rates of respiration, which may be associated with either bacterial or algal production.

3.2.6 pH

Mean pH values were below (acidic) the WQO at Sites 2, 3 and 6, but within the acceptable pH ranges for Sites 1, 4 and 5. Of note, the mean pH value at the reference site (Site 6) was the lowest (pH 5.4) of all sampling sites.

3.2.7 Salinity (Total Dissolved Solids and Electrical Conductivity)

Mean electrical conductivity levels varied between 235-622 µS/cm. These values are within the normal ranges expected for freshwater streams.

3.2.8 Temperature

Mean water temperatures varied between 23.2-25.2°C. Stream water temperatures are highly variable depending upon season and prevailing weather conditions. The observed water temperatures are within the ranges expected for freshwater streams.

3.2.9 Redox Potential

Mean redox potential levels varied between 114-207 mV, indicating that the water quality is marginally oxidising at each site.

3.3 SUMMARY

The baseline water quality monitoring confirms that the site's existing surface water quality discharges are generally poor, with Sites 1 - 5 exceeding the WQOs for at least seven of the ten water quality parameters listed in Table 2. Water quality at the reference site (Site 6) also exceeded the WQOs for six of the ten measured water quality parameters, albeit only marginally for some. Elevated nutrient concentrations (total nitrogen and phosphorus), suspended solid concentrations and turbidity levels were observed at all sampling sites, indicating that the current land uses within the proposed development site (and adjacent sub-catchments) has resulted in a detrimental impact on water quality within the waterways.

4 PROPOSED DEVELOPMENT

4.1 PROPOSED LAND USE CHANGES

The planned future land use for the Shoreline Redlands development is shown in Figure 6. It is proposed to convert the site to a mix of residential and commercial land uses with interconnected open spaces. Waterways and remnant vegetation (mapped as open space) and the Moreton Bay foreshore will be preserved. Cleared drainage lines within existing agriculture and grazing areas will be retained as open space and provide locations for stormwater management, including the application of water sensitive urban design measures.

4.2 POTENTIAL IMPACTS OF PROPOSED DEVELOPMENT

The conversion of agriculture and grazing land to urban uses will result in a change to the sites' water quality and hydrology during both 'construction' and 'operational' phases of the development.

4.2.1 Construction phase

Construction phase impacts relate to the civil and landscape works associated with the subdivision of the site from large rural blocks to smaller residential allotments and associated roads and services. This transitional phase involves earthworks and modification of the existing landform and presents the greatest potential for impact to receiving waterways due to increased risk of soil loss through erosion and subsequent sedimentation and downstream water quality impacts. Left unmanaged, construction phase activities represent a significant risk to the health of the receiving waterways and Moreton Bay.

4.2.2 Operational Phase

The operational phase reflects the ultimate land use following the completion of the construction and building works within each catchment. Operational phase impacts relate to the changes in hydrology and runoff quality associated with the built urban environment, i.e. roads, roof areas and ground level areas). The change to catchment runoff is a result of the increased impervious area (buildings and roads) and the creation of efficient piped drainage.

Table 3 summarises the water quality impact of runoff to receiving environments of both of these phases of development if not appropriately managed.

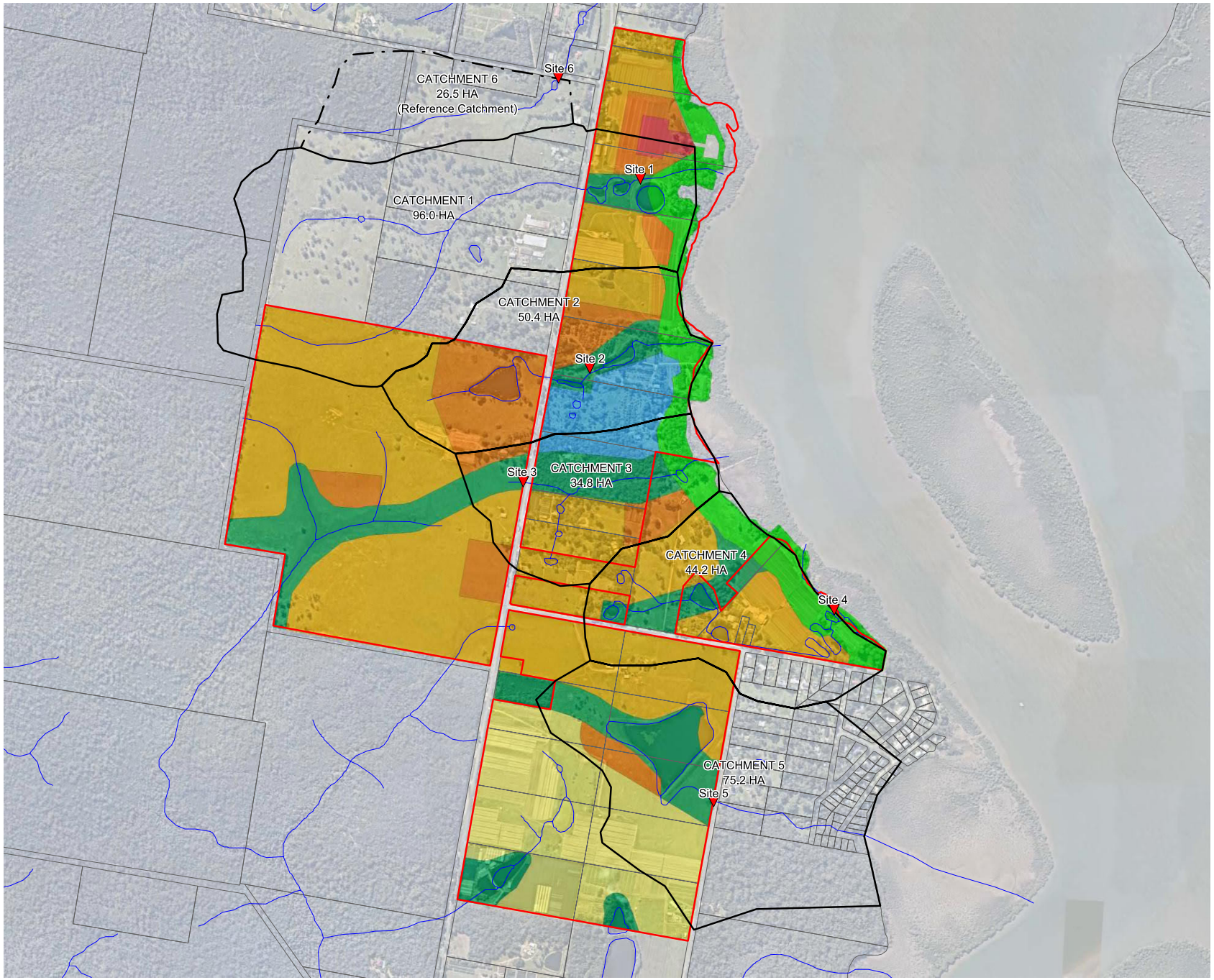
Table 3. Potential water quality impacts associated with the construction and operational phases of the Shoreline Redlands development.

Pollutant	Impacts
Gross pollutants	• Water quality impacts • Aquatic health impacts • Costs associated with removing
Coarse sediments	• Smothering of benthic flora and fauna • Loss of habitat • Change in species composition • Costs associated with desilting
Fine sediments	• Water quality impacts • Smothering of benthic flora and fauna • Aquatic health impacts • Increased turbidity
Nutrients	• Eutrophication / water quality impacts • Change in species composition • Algal blooms • Aquatic weeds

Potential water quality impacts to Moreton Bay primarily relate to the loads of pollutants being delivered from the site during and following development. In the case of the Shoreline development, this WQMP recommends the application of stormwater management objectives in accordance with regulatory requirements to ensure the protection of receiving environments (refer Section 5). These objectives will be achieved through the implementation of contemporary stormwater quantity and quality management measures. All development site runoff will receive appropriate treatment through a combination of measures including sediment basins, vegetated swale, bioretention basins and wetlands. These measures are proven to deliver management of stormwater and have been designed using MUSIC modelling in accordance with relevant guidelines for South East Queensland. The combination of stormwater measures provides surety that appropriate treatment of post development stormwater will be delivered and the receiving environment will be protected.

In addition to the above, the site in its current condition (i.e. largely agricultural/grazing) has been shown by recent water quality monitoring to be exporting significant concentrations and associated loads of sediments and nutrients. Following conversion of the site from agricultural/grazing to urban land uses with stormwater management, this will no longer be the case. It is likely that the conversion of the site from agricultural/grazing to urban with stormwater management will see a reduction in sediment and nutrient loads being exported to Moreton Bay.

Given the above considerations, water quality impacts on Moreton Bay due to stormwater discharges from the site are expected to reduce as a result of the Shoreline development.



DesignFlow

LEGEND

- Shoreline Application Boundary
- RP Boundary
- Drainage line
- Catchment boundary

- Foreshore Open Space
- High Density Res
- Medium Density Res
- Open Space
- Small Lot Res
- Traditional Res
- Village Centre

N W E S

Scale:
1 : 12,500 (A3)

FIGURE 6

PROPOSED FUTURE LAND USE

Project: 4235

Shoreline Redlands

Date:
21 June 2018

Client:
Lend Lease Pty Ltd

5 PROPOSED DEVELOPMENT MITIGATION MEASURES

5.1 APPROACH

The following section outlines design and operational requirements for the Construction and Operational Phases of the development to mitigate potential water quality impacts associated with the site's development (as identified in Section 4.2). These mitigitation measured are based on the load based design objectives established by the SPP (DSDIP, 2017), which are mandatory in Queensland. They allow the sizing of stormwater treatment systems as per best practice stormwater approaches. To achieve these design objectives will require implementing best practice stormwater management mitigation measures in accordance with the following documents:

- *State Planning Policy (DSDIP, July 2017): Appendix 2 – Stormwater management design objectives*
- *Redland City Council Planning Scheme: Part 8 General Codes, Division 6 Erosion Prevention and Sediment Control*
- *Best Practice Erosion and Sediment Control (IECA, 2008)*
- *Water Sensitive Urban Design Technical Design Guidelines for SEQ (*Water by Design 2006 and association suite of Guideline documents*)*

5.2 DESIGN OBJECTIVES

Design objectives presented below are to be used to demonstrate how the proposed development will comply with the mandatory stormwater management objectives required by the SPP (DSDIP, 2017). The developer must demonstrate via modelling and reporting in SQMPs how these objectives will be met prior to the development being approved and constructed.

Stormwater management design objectives for the Construction Phase are outlined in Table 4.

The stormwater quality management design objectives that apply to the Operational Phases of Shoreline Redlands are listed in Table 5. These load reduction targets are aimed at protecting the environmental values of Moreton Bay from the impacts of urban stormwater runoff. The objectives and load targets will be achieved through a combination of stormwater treatment measures including bioretention and wetland systems, sediment basins and revegetated waterways. These are to be documented in Stormwater Quality Management Plans (SQMPs) which will be submitted to Redland City Council for approval with each development application.

Table 4. Minimum stormwater management design objectives for Construction Phase for Shoreline Redlands (Source: SPP Code: Appendix 2 - Table A).

ISSUE	Management Objective
Drainage Control	1. Manage stormwater flows around or through areas of exposed soil to avoid contamination. 2. Manage sheet flows in order to avoid or minimise the generation of rill or gully erosion. 3. Provide stable concentrated flow paths to achieve the construction phase stormwater management design objectives for temporary drainage works. 4. Provide emergency spillways for sediment basins to achieve the construction phase stormwater management design objectives for emergency spillways on temporary sediment basins.
Erosion Control	1. Stage clearing and construction works to minimise the area of exposed soil at any one time. 2. Effectively cover or stabilise exposed soils prior to predicted rainfall. 3. Prior to completion of works for the development, and prior to removal of sediment controls, all site surfaces must be effectively stabilised using methods which will achieve effective short-term stabilisation.
Sediment Control	1. Direct runoff from exposed site soils to sediment controls that are appropriate to the extent of disturbance and level of erosion risk. 2. All exposed areas greater than 2500 m² must be provided with sediment controls which are designed, implemented and maintained to a standard which would achieve at least 80% of the average annual runoff volume of the contributing catchment treated (i.e. 80% hydrological effectiveness) to 50mg/L Total Suspended Solids (TSS) or less, and pH in the range (6.5–8.5).
Litter, hydrocarbons and other contaminants	1. Remove gross pollutants and litter. 2. Avoid the release of oil or visible sheen to released waters. 3. Dispose of waste containing contaminants at authorised facilities.
Waterway stability objective and flow management	1. Where measures are required to meet post-construction waterway stability objectives (refer to Table B, SPP Code: Appendix 2), these are either installed prior to land disturbance and are integrated with erosion and sediment controls, or equivalent alternative measures are implemented during construction. 2. Earthworks and the implementation of erosion and sediment controls are undertaken in ways which ensure flooding characteristics (including stormwater quantity characteristics) external to the development site are not worsened during construction for all events up to and including the 1 in 100 year ARI (1% AEP).

Table 5. Minimum stormwater quality design objectives for Operational Phase stormwater quality (source: SPP code: Water Quality, Appendix 2, Table B).

Pollutant	Design objectives (% reduction in mean annual load)
Total suspended solids (TSS)	80%
Total phosphorus (TP)	60%
Total nitrogen (TN)	45%
Gross pollutants (GP)	90%

6 WATER QUALITY OBJECTIVES

6.1 REGIONAL WATER QUALITY OBJECTIVES

The surface water quality discharges from the proposed Shoreline development have been compared to the water quality objectives (WQOs) for 'lowland freshwater streams' provided in the *Environmental Protection (Water) Policy 2009 Redland Creeks environmental values and water quality objectives. Basin No. 145 (part), including Coolnwynpin, Eprapah, Hilliards, Lota, Moogurrapum, Tarradarrapin, Tingalpa and Wynnum creeks. July 2010* (DEHP) (Table 1).

The baseline water quality monitoring completed to date for the undeveloped site (refer Section 3) identified that the surface water quality discharges currently do not meet the WQOs for turbidity, suspended solids and nutrients (which are all well above the objectives listed in Table 2). Therefore, it was deemed inappropriate to adopt these regional WQO values to assess the potential water quality impacts from the proposed development. Instead, site specific water quality 'trigger thresholds' have been adopted for the site using the derivation methods outlined in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2018) and the *Queensland Water Quality Guidelines* (DERM, 2009).

6.2 DERIVATION OF WATER QUALITY TRIGGER THRESHOLDS

The ANZECC (2018) guidelines recommend 24 months of water quality data to derive site based trigger thresholds (from 1-2 reference sites). The intent of the 24 month period is to cover two complete annual cycles. However, regular monthly sampling is not possible as the site drainage lines are highly ephemeral and dependent on rainfall to enable sampling. Section 4.3.3.1 of the Queensland Water Quality Guidelines (DERM, 2009) recommend a minimum of 18 samples be collected. To date the baseline water quality monitoring has resulted in 48 sampling events across six sites, which have been used to establish surface water trigger values for the site. This is considered reasonable to establish initial trigger threshold values based on DERM (2009). Trigger thresholds are to be reviewed once 24 months of wate quality data is available.

Surface water quality monitoring trigger thresholds have been derived from the site baseline water quality data for the following parameters:

- Turbidity
- Total Suspended Solids
- Total Nitrogen
- Total Phosphorus

These parameters are considered representative of the potential impacts identified in Section 4.2 (i.e. the key site pollutants being nutrients and sediments). In accordance with the DERM (2009) guidelines, trigger thresholds were derived for each parameter by calculating the 80th percentile from the baseline water quality dataset.

6.3 WATER QUALITY PERFORMANCE STANDARDS

The following water quality performance standards apply to both the construction and operational phases of the development.

6.3.1 Construction Site Discharges

The *State Planning Policy* (DSDIP, July 2017) requires that runoff from areas greater than 2500m² must be provided with sediment controls that are designed to demonstrate compliance with the construction site discharge standards provided in Table 6. These standards are to apply at the point of release of flows from the construction site.

Table 6. Construction site water quality discharge standards.

Parameter	Limit	Limit Type
pH	6.5-8.5	Minimum-maximum
TSS	50 mg/L	80% of the average annual runoff volume of the contributing catchment treated (i.e. 80% hydrological effectiveness) < 50mg/L Total Suspended Solids (TSS)

In practice this objective requires the developer to implement High Efficiency Sediment basin (HES Basin) systems during construction phases. HES basins include automatic dosing of flocculants to ensure that the majority of construction runoff will be treated to a high standard. The HES basin monitoring and auditing requirements are described in futher detail in Appendix A.

6.3.2 Surface Water Quality Trigger Thresholds

The surface water quality trigger thresholds (80th percentile concentrations) for each parameter are shown in Table 7. Monitoring of water quality against trigger thresholds during construction and operational phases of the development will be used to initiate investigation and implementation of corrective actions. Where a trigger threshold is exceeded corrective measures will be undertaken to investigate the causes and identify actions to resolve or mitigate the non-compliance.

Table 7. Surface water quality trigger thresholds.

Pollutant	Trigger threshold[1]	WQO[2]
Turbidity (NTU)	51.8	<50
Total suspended solids (mg/L)	28.6	<6
Total nitrogen (mg/L)	3.8	<0.5
Total phosphorus (mg/L)	1.1	<0.05

[1] 80th percentile concentrations from baseline water quality monitoring based on the full 24 rounds of baseline sampling data.

[2] Subset of representative parameters derived from Table 1.

7 WATER QUALITY MONITORING PROGRAM

The surface water quality monitoring program provides a process for identifying and responding to potential impacts associated with site development. Monitoring will also enable review of trigger thresholds as the baseline monitoring reference dataset is improved. The following sections outline the proposed water quality parameters to be monitored, sampling locations and frequency as well as reporting requirements.

7.1 SAMPLING LOCATIONS

Six water quality monitoring locations are proposed (Table 8, Figure 3). Sites 1 to 5 were used to collect baseline water quality data (discussed in Section 3) and are located within the proposed development areas. Site 6 has been selected as the reference (control) site for comparison with Sites 1-5 as each sub-catchment is developed.

The sampling locations have considered a number of issues as outlined below:

- Monitoring of water quality in the foreshore / intertidal zone, where the stormwater enters the bay below highest astronomical tide, will not produce robust data due to tidal influences and rainfall-runoff event timings (i.e. high versus low tide and how this relates to run-off events and influences water quality).
- The ephemeral nature of the waterways and the influence of existing dams on stormwater volumes.
- Difficulties involved in accessing the waterways due to current private land ownership.

The sampling sites were selected to ensure access for sample collection, capturing as much of the development catchment as possible and being above tidal influence. This ensures the quality of the stormwater runoff is assessed prior to entering Moreton Bay and more accurately/ reliably assess the impacts or benefits associated with the change in land use from grazing to residential (without tidal influence associated dilution influence).

Table 8. Water quality monitoring site location details.

Site ID	Access	Comments
1	194-214 Serpentine Creek Rd	Shoreline Development catchments used for baseline impact monitoring.
2*	260-280 Serpentine Creek Rd	
3*	304-324 Serpentine Creek Road	
4	74A Scenic Road	
5	50-56 Orchard Road	
6	15-23 Kidd Street	Reference site within Catchment 6, external to the development and has no urban development proposed.

* Sites 2 and 3 may be moved further downstream closer to the discharge point of the catchment to Moreton Bay once access is available

7.2 FREQUENCY AND DURATION

The frequency and duration of the proposed water quality monitoring is summarised in Table 9. Due to the ephemeral hydrology of the waterways, post-event based sampling is proposed rather than ambient water quality monitoring. The triggers for all sampling will be following

runoff producing rainfall and sampling will be completed following the rainfall event (prior to the cessation of flow flow). Typically rainfall events >10-15mm will generate runoff depending on farm dam levels and catchment conditions.

Where additional rainfall events re-occur within 48 hours of the preceding event, no additional sampling is deemed necessary. A maximum number of twelve (12) pre-construction water quality sampling events are proposed within any year (between months of October through September).

Table 9. Water quality monitoring frequency and duration

Development Phase	Frequency	Commencement	Cessation
Pre-construction / Control sites (baseline)	Event based (up to 12 times per year)	Minimum of 24 months prior to construction phase	Commencement of development works
Construction Phase	Event based Construction site discharge monitoring	During construction phase activities	Completion of construction activities
Operational Phase	Event based (up to 12 times per year)	Completion of construction activities	12 months after development works have been completed

7.3 PARAMETERS

A range of physico-chemical parameters has been selected for water quality monitoring that reflect the potential water quality impacts discussed in Section 6.2, including:

- Nutrients (nitrogen and phosphorus)
- Sediments (turbidity and suspended solids)
- Related physico-chemical water quality parameters including DO%, salinity, Redox, temperature.

Physico-chemical parameters to be monitored at Sites 1-6 are summarised in Table 10. All samples are to be collected, stored and transported via clear chain of custody and analysed by a NATA approved laboratory.

Concurrent with and in addition to the event based sampling, Construction Phase activities are required to undertake site discharge monitoring in accordance with the *Best Practice Erosion and Sediment Control Guidelines* (IECA, 2008). Discharge monitoring is to occur at the discharge location from each construction site and be sufficient to demonstrate compliance with the design objectives listed in Table 6. More detailed requirements for Construction Phase monitoring are outlined in **Appendix A**. All monitoring data is to be logged and stored and made available for the reporting requirements listed in Section 7.4.

Table 10. Post-event based sampling water quality parameters

Parameter	Reporting Units	Method
LABORATORY MEASUREMENTS1		
Total Dissolved Solids	mg/L	EA01H
Suspended Solids (SS)	mg/L	EA025H
Total Nitrogen	mg/L	EK062G
Ammonia	mg/L	EK055G
Nitrite	mg/L	EK057G
Nitrite + Nitrate	mg/L	EK059G
Total Kjeldahl Nitrogen (TKN)	mg/L	EK061G
Organic N	mg/L	TKN minus ammonia
Total Phosphorus	mg/L	EK067G
Reactive Phosphorus	mg/L	EK071G
FIELD MEASUREMENTS		
pH	pH Unit	Field measurement
Electrical Conductivity	µS/cm	Field measurement
Dissolved Oxygen	% saturation	Field measurement
Temperature	°C	Field measurement
Turbidity	NTU	Field measurement
Redox Potential (ORP)	mV	Field measurement

[1] Chlorophyll-a was omitted from the sampling parameters as it was deemed to be an inapplicable parameter given the ephemeral natural of the waterways and the presence of large dams within each of the development sub-catchments.

7.4 PERFORMANCE STANDARDS

Surface water quality trigger thresholds are provided in Table 7 (Refer Section 6.2). The water quality trigger thresholds apply to construction and operational phases of the development. Where a non-compliance is detected (i.e. exceedance of a trigger threshold), corrective measures will be undertaken to investigate the causes of the non-conformance, and identify actions to resolve or mitigate the non-compliance (Refer Section 8).

7.5 REPORTING AND REVIEW

An Annual Environmental Report is to be prepared and published on the development website upon commencement of the Construction Phase and for the life of the project. The report will document:

- Demonstrated compliance with project development conditions
- Actions and activities undertaken during the 12 month period
- Summarise results of event and construction site water quality monitoring activities

The monitoring of triggers for further investigation, implementation of corrective actions and reporting will be overseen by the superintendent for the site.

Any non-compliance events that occur must be reported within two business days (or as specified) to the relevant government authority in accordance with development conditions.

An independent audit of the monitoring program will occur every three (3) years after commencement of the project to evaluate the performance of the monitoring program in relation to the conditions of approval.

8 CORRECTIVE MEASURES

8.1.1 Construction phase

Where monitoring indicates the construction phase standards identified in Table 6 are not being achieved, corrective actions will be undertaken to ensure that standards are achieved in future.

Where the construction phase objectives decribed in Section 6.3.1 are not being met, the following corrective actions are to be implemented:

- Undertake third party investigation by a Certified Professional in Erosion and Sediment Control (CPESC) to identify inadequacies in the erosion and sediment control strategy and prepare a Rectification Plan in consultation with Redland City Council. This assessment will be completed in accordance with the Department of Environment and Resource Management Procedural Guideline: *Standard Work Method for the Assessment of the Lawfulness of Releases to Waters from Construction Sites – South-East Queensland.*
- Clean, reset, repair and amend erosion and sediment control measures as necessary to address any identified inadequacies and ensure the water quality objectives are not exceeded.
- Construction works in the relevant catchment will cease if corrective measures proposed for that catchment are not implemented in accordance with the Rectification Plan.

8.1.2 Construction and Operational Phase

Corrective measures associated with the operational phase of the development will be related to the function and operation of the stormwater treatment devices (such as bioretention systems, sediment ponds and constructed wetlands) that will be located within each development area.

Where performance criteria outlined in Section 6.3.2 are not being met, the following corrective actions are to be implemented:

- Review water quality data to identify trends in water quality parameters and inspect constructed stormwater treatment systems to identify the source of non-compliance issues.
- Where sources are identified, investigate and identify rectification measures to improve water quality discharges. Rectification measures are to be documented in a Rectification Plan and be based on the approaches and methods outlined in the *Rectifying Vegetated Stormwater Assets* (Water by Design, 2012).

8.2 ADAPTIVE MANAGEMENT

Required maintenance will be completed within 24 hours, subject to site accessibility and health and safety requirements..

Additional temporary controls, for example temporary works until permanent measures can be installed will be implemented until maintenance can be completed.

Potential contamination, such as loss of sediment from construction areas, shall be contained and investigated. Water is not to be released until investigation has shown that water is of a suitable quality to comply with the discharge standards listsed in Table 6.

From the investigation, a course of action will be derived, including notification of relevant stakeholders, including Redland City Council.

Incidents shall be documented, investigations conducted and action plans established so as to minimise the likelihood of the event recurring.

9 RESPONSIBLE PERSONNEL

9.1.1 Shoreline Redlands (Principal)

The roles and general responsibilities of the Principal are to:

- Comply with this Water Quality Management Plan (WQMP);
- Comply with legislation and Council policy;
- Nominate a Project Manager who will represent the Principal in reviewing the performance of contractors and assess implementation of the construction and operation phase measures;
- Provide appropriate and adequate resources to allow effective implementation and review of the WQMP;
- Conduct periodic reviews of environmental performance;
- Promptly notify regulatory authorities of any changes to this WQMP and its implementation, reporting or monitoring, and any breaches and proposed corrective actions[1];
- Report any environmental incidents that may have a significant impact on the surrounding environment to the relevant authorities (Redland City Council); and
- Provide employees and contractors with relevant environmental instruction in relation to the WQMP and awareness and understanding of their obligations and duties.

It will be the responsibility of the Principal to ensure that the contents of the WQMP are adequately communicated to all contractors, and that they are advised of the seriousness of potential impacts if the recommended actions are not taken.

9.1.2 Project Manager

This Water Quality Management Plan (WQMP) will be overseen by the Project Manager.

- The Project Manager is responsible for implementation of the WQMP, including;ensuring mitigation measures detailed in this plan are implemented;
- ensuring a review of this WQMP is undertaken in year 3 in the first instance and then at intervals of not less than five years or or that align with commencement/conclusion of construction or operational phases. Any significant or unexpected alteration in the proposed development may require the WQMP to be revised and amended accordingly. Any changes or amendments proposed to the WQMP will be forwarded to DES for comment/approval prior to their adoption;
- keeping up-to-date records of all disturbance incidence reports, monitoring events, results and corrective actions;
- reviewing and advising DES of any proposed changes to the WQMP; and
- designating suitably experienced persons for the management and auditing of the WQMP as required.

9.1.3 Designated Person (DP)

The roles and responsibilities of the Designated Person are to:

[1] Any changes to the plan are subject to Condition 14 of EPBC Act approval (EPBC 2016/7776).

- Liaise with the Project Manager to facilitate compliance with legislation, Council policy and conditions during the development;
- Conduct audit inspections as required /requested during earthworks, and clearing or other inspections as triggered by environmental events or incidents;
- Advise the Project Manager on the compliance and effectiveness of the WQMP /Site Instructions and its implementation;
- Immediately contact the Project Manager regarding any environmental incidents that have the potential to cause environmental harm to Moreton Bay, request written details within 24 hours of occurrence, and issue Site Instructions for rectification/remediation to the Project Manager as soon as possible;
- Issue Site Instructions (for correction of non-compliance) to the Project Manager within seven (7) days of inspections and completion of the Inspection Procedures and Checklist(s); and
- Maintain accurate reports (incidents, near miss, results of monitoring) to be provided to DES within ten days of request.

10 REFERENCES

ANZECC (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), Canberra. http://www.waterquality.gov.au/anz-guidelines/ (Site accessed: 19 December 2018).

DEHP (2010) *Environmental Protection (Water) Policy 2009 Redland Creeks environmental values and water quality objectives*.

DEHP (2011) *Procedural Guideline: Standard work method for the assessment of the lawfulness of releases to waters from construction sites in South East Queensland EM1135*. Department of Environment and Heritage Protection.

DERM (2009) Department of Environment and Heritage Protection *Queensland Water Quality Guidelines*, Version 3, ISBN 978-09806986-0-2.

DLGIP (July, 20157). *State Planning Policy*

EPBC referal (2016/7776) Shoreline Redlands Pty Ltd/Residential Development/Serpentine Creek Rd and Orchard Rd Redland Bay/Queensland/Shoreline urban village development, Redland Bay, Qld

Healthy Waterways (2010). *MUSIC Modelling Guidelines*IECA (2008) *Best Practice Erosion and Sediment Control Document*

National Water Quality Monitoring Guideline (2018) http://www.waterquality.gov.au/ (Site accessed: 19 December 2018).

QUDM, (2016). *Queensland Urban Drainage Manual*. 2016. Department of Natural Resources and Water

Water by Design (2006 and later versions) *Water Sensitive Urban Design Technical Design Guidelines for SEQ*

Water by Design (2012) *Rectifying Vegetated Stormwater Assets*

APPENDIX A: CONSTRUCTION PHASE MONITORING AND AUDITING

Construction Phase

Construction phase stormwater management design are defined in Appendix 2, Table A (part 1) in the SPP (2017). These have not been reproduced in full here as most are descriptive drainage and erosion control 'best practice' approaches to site management that need to be integrated into construction site management plans (generally in accordance with the IECA ESC Guideline (2008). A key requirement of the construction phase sediment control is however:

> All exposed areas greater than 2500 m2 must be provided with sediment controls which are designed, implemented and maintained to a standard which would achieve at least 80% of the average annual runoff volume of the contributing catchment treated (i.e. 80% hydrological effectiveness) to 50mg/L Total Suspended Solids (TSS) or less, and pH in the range (6.5–8.5).

This will require an appropriately designed Type A or B High Efficiency Sediment basin in line with the latest design guidance.

HES Sediment Basin Design and Operation

HES Basins will be designed and operated in accordance Type A or B sediment basins as per the current versions of *Appendix B Sediment basin design and operation* (June Revision) of *IECA* (2008).

Flocculant Dosing and Monitoring

Automated flocculant dosing will be undertaken in response to inflow and outflow turbidity monitoring.

Design Maximum Flowrate

The design flowrate has been selected as the flowrate which will ensure >80% of the annual average runoff volume is treated by the system (i.e. 80% hydrologic effectiveness or HE).

Location and method of flow monitoring

Flow monitoring is typically achieved using a depth sensor, with depth readings converted to flow via a rating curve. The depth sensor therefore needs to be positioned in a location where accurate depth readings can be established and where a reliable rating curve (depth-flow relationship) is known. In order to deliver all flows from the disturbed catchment to a single point for flow gauging and dosing, a bund and culvert system will be required.

Requirements for pH and turbidity monitoring

pH and turbidity monitoring is to occur at the inlet and the outlet of HES Basins to verify the performance of the systems.

Automated Monitoring and Flocculant Dosing System Requirements

The developer is required to supply, install and operate the automated monitoring and flocculant dosing system for the duration of the period of the works. The system is required to meet the following requirements:

- The system must be able to treat at the required Design Maximum Flow rate
- Continuous inflow depth/flow, pH and turbidity monitoring is required.
- Automated flocculant dosing of the inflow is required and must be proportional to the flowrate and level of contamination (turbidity) of the incoming flow.
- A chemical flocculant is to be provided which is fast-acting and which can achieve a concentration of 50mg/L of TSS within a 250mL jar within a maximum of 3 hours. The flocculant must have low ecotoxicity and the MSDS and any environmental toxicity reports must be provided to the Principal prior to use
- An adequate supply of the chemical flocculant is to be maintained on site at all times
- Continuous turbidity and pH monitoring must be undertaken of the outflow from the basin.
- All monitoring sensors and anchoring points must be suitable for the expected flowrates, debris loadings and water quality for the duration of the period of the works
- All monitoring data is to be logged and stored and made available for reporting
- Turbidity and pH data to be recorded and sent real time to cloud based system via telemetry. Where data indicates non-compliance with discharge standards (Section 6.3.1) the Principal Contractor and developer are to be notified via text message (SMS).
- The system is to be provided with a roofed shelter, mains power plus a back-up power supply. Bunding of all areas where chemicals are stored is to be provided based on 110% of the maximum chemical volume.
- The system is to be sited and provided with an adequate access track such that is remains accessible to service vehicles such as flocculant delivery during all weather.

Principal Contractor

The developer will nominate a Principal Contractor to undertake the works and to act as the clients representative. Site inspections and monitoring are to be undertaken by the principal contractor in accordance with Sections 6.17 and 7.4 of the *Best Practice Erosion and Sediment Control Document* (IECA, 2008) as detailed below. Best practice site management requires all ESC measures to be inspected at the following frequencies and include the following checks as a minimum:

Daily site inspections (during rainfall):

- All drainage, erosion and sediment control measures
- Occurrences of excessive sediment deposition (whether on-site or off-site)
- All site discharge points (including dewatering activities as appropriate)

Weekly site inspections (even if work is not occurring on-site)

- All drainage, erosion and sediment control measures
- Occurrences of excessive sediment deposition (whether on-site or off-site)
- Occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements
- Litter and waste receptors
- Oil, fuel and chemical storage facilities

Prior to anticipated runoff producing rainfall (within 24 hours of expected rainfall)

- All drainage, erosion and sediment control measures

- All temporary flow diversion and drainage works

Following runoff producing rainfall (within 18 hours of rainfall event)

- All drainage, erosion and sediment control measures
- Occurrences of excessive sediment deposition (whether on-site or off-site)
- Occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements

CPESC Compliance Audits

The ESC measures implemented at the site are to be inspected on a monthly basis by a *Certified Professional in Erosion and Sediment Control* (CPESC) who is independent of the principal contractor and an audit report kept on file. The purpose of the audits to is to ensure the developed and the contractors are meeting their obligations for ESC under the *Environmental Protection Act* (EP Act). The site will be assessed against these requirements in accordance with *Procedural Guideline: Standard work method for the assessment of the lawfulness of releases to waters from construction sites in South East Queensland EM1135* (DEHP, 2011).

The compliance audits will involve:

- Site inspection with the contractors to assess ESC actions on the site against the ESC plans and the requirements of EP Act and Procedural Guideline: Standard work method for the assessment of the lawfulness of releases to waters from construction sites in South East Queensland EM1135 (DEHP, 2011).
- Identifying non-compliances on the site, photographing and recording these for reporting.
- Where the rectification action is simple, these will be recorded and verbally communicated to the contractor for action.
- Review of any water quality and rainfall information for the site
- Compilation of a ESC Audit report which:
    - Identifies the ESC obligations
    - ESC issue and non-compliances
    - Actions (simple) to be taken to rectify the issues and non-compliances.

The triggers for inspections and reporting by the CPESC are as follows:

- Prior to the commencement of clearing works in each catchment
- Prior to the commencement of bulk earthworks;
- Prior to the commencement of civil works; and
- At regular monthly intervals during works.