PROPERTY AND DEVELOPMENT NSW (PDNSW)

COFFS HARBOUR JETTY FORESHORE STATE ASSESSED PLANNING PROPOSAL

STORMWATER MANAGEMENT AND FLOODING ASSESSMENT

FEBRUARY 2025

CONFIDENTIAL

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Coffs Harbour Jetty Foreshore State Assessed Planning Proposal
Stormwater Management and Flooding Assessment PLAN

Property and Development NSW (PDNSW)

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GLOSSARY

REFERENCE	DESCRIPTION
AEP	Annual Exceedance Probability
AHD	Australian Height Datum is the vertical reference height of Australia, and is approximately the mean sea level for the year 1970.
Canute 3	Canute 3 is an online tool developed by CSIRO, which estimates the likelihood of extreme sea level during this century.
DEM	Digital Elevation Model is the digital representation of ground surface topography.
LiDAR	Light Detection and Ranging is a remote sensing method that is used to derive the Digital Elevation Model (DEM)
MUSIC	Model for Urban Stormwater Improvement Conceptualisation. Industry standard computer program that simulates and assesses the performance of stormwater quality management systems.
OSD	On site stormwater detention. The practise of temporarily storing stormwater on site during a storm and releasing it slowly to reduce peak flow.
Overland runoff	Overland runoff is the amount of water moving across the ground surface after rainfall.
PMF	Probable Maximum Flood
RCP	Representative Concentration Pathway
SWL	Still Water Level (storm surge + tide)
Wave Setup	Wave setup is the increase in mean water level due to the presence of breaking surf waves.

EXECUTIVE SUMMARY

Property and Development NSW (PDNSW) is leading the revitalisation of the Coffs Harbour Jetty Foreshore Precinct (the Precinct) on behalf of the NSW Government. WSP have been engaged by PDNSW to prepare a Stormwater Management Plan (SWMP) to accompany the Coffs Harbour Jetty Foreshore State assessed planning proposal Submission. The Precinct is situated in Coffs Harbour City Council (CHCC) Local Government Area (LGA) in New South Wales (NSW). An Illustrative Masterplan has been developed by PDNSW to inform the Rezoning Application.

This report covers the following aspects:

- an assessment on any potential impacts of the Illustrative Masterplan on the hydrology and hydrogeology of the precinct and adjoining areas
- impact assessment of the Illustrative Masterplan on water quantity and water quality
- stormwater compliance with the DPI Water's Guidelines for Controlled Activities (2012)
- assessment of impact imposed by the Illustrative Masterplan on watercourses, wetlands and any riparian land on and adjoining the precinct
- assessment of existing water bodies and receiving water courses based on the proposed Illustrative Masterplan
- indicative stormwater drainage network based on the road topography and receiving downstream water quality treatment infrastructure
- conceptual stormwater management measures that consider Water Sensitive Urban Design (WSUD) principles
- assessment of costal flood risk for the site with the consideration of climate change
- flood associated design mitigation inputs
- summary of overarching outcomes associated with flood risk across the Illustrative Masterplan precinct

The proposed Illustrative Masterplan Precinct assessment entails the following key elements associated with stormwater management and flood impact assessment:

- Stormwater drainage system,
- Flooding, and
- Water Quality Management

Where possible, the stormwater strategy for the precinct intends to utilise the existing stormwater infrastructure or extend/divert the existing network, subject to the existing condition of the infrastructure drainage system. Part of the stormwater drainage system is expected to be in the vicinity of the adjacent trainline. It is recommended that all proposed stormwater infrastructure maintain a minimum clearance of 8 metres from rail cables and structures in the design stage.

An existing 1200mm DIA Stormwater Trunk drainage line which is situated within the Jetty Hub is to be diverted and discharged to the bioretention basin. In addition, the existing twin 750mm DIA stormwater pipes located east of Jordan Esplanade will require reconfiguration to suit the proposed bio-retention basin location. Refer to Appendix B for more detailed information.

It should also be noted that the subject site is outside the PMF flood extent as well as any major upstream overland flow paths. The site sits above the expected extreme sea level for the next century. Hence, the site is not subject to flooding and is considered to have low flooding risk according to CHCC’s DCP 2015.

INTRODUCTION

Property and Development NSW (PDNSW) is continuing to lead the revitalisation of the Coffs Harbour Jetty Foreshore Precinct (the Precinct) on behalf of the NSW Government. WSP has been engaged by PDNSW to prepare a Stormwater and flooding assessment for the proposed state assessed planning proposal that evaluates the impact of the planning on the stormwater quality and quantity of the Coffs Harbour Jetty Foreshore Precinct.

This Stormwater Management and flood impact assessment supports a Planning Justification Report that outlines proposed amendments to the Coffs Harbour Local Environmental Plan (CHLEP) 2013 and will be submitted to the Department of Planning, Housing and Infrastructure (DPHI) as part of a State Assessed Planning Proposal (planning proposal).

As Coffs Harbour continues to grow as a Regional City, the NSW Government and Coffs Harbour City Council have, through various strategic planning exercises, identified four key strategic priorities to reimagine its direction and respond to current and future challenges and opportunities:

- Deliver a regional economy (CHCC LSPS, 2020; CH Economic Development Strategy, 2017) that is diverse, sophisticated and able to retain businesses and skills
- Evolve the tourism offering CHCC LSPS, 2020) with improved attractions, activities and accommodation
- Provide more housing (CHCC LSPS, 2020) in accessible locations, including affordable housing
- Provide better connections between places with more sustainable movement choices (CHRCAP, 2021; CHCC, 2020)

As a large, strategically located and wholly government owned site, the Precinct represents a significant opportunity to deliver on each of these key regional priorities. In this rezoning application, PDNSW seeks to celebrate the unique location, history and culture of the Jetty Foreshore to deliver outcomes for the benefit of the Coffs Harbour community. The revitalisation will be staged and funded, over time, to deliver the shared community vision.

OUR SHARED COMMUNITY VISION

Coffs' family playground, a precinct of parks and places, that connects community with Country. The community is and always has been at the heart of creating a thriving regional economy and destination for Coffs Harbour. Shaped with the community, our vision is to ensure The Jetty Foreshore will become a world-class oceanfront precinct through the principles shown in **Figure 1**.

Figure 1 Vision for the Coffs Harbour Jetty Foreshore

THE PRECINCT

The Precinct, wholly owned by the NSW Government, is strategically significant to the State and to the Coffs Harbour region. The Precinct is located on the traditional lands of the Gumbaynggirr people, in saltwater freshwater Country. It encompasses approximately 62 hectares of foreshore land, 5km east of the Coffs Harbour CBD, located on the Coffs Harbour coast with direct access to the Pacific Ocean. Access is provided on Marina Drive in the north, and Camperdown Street in the south, with Jordan Esplanade bisecting the site north to south. A Precinct map showing existing conditions is provided at **Figure 2.**

The west boundary is generally defined by the railway line and Coffs Harbour Railway Station. To the north the Precinct borders a culturally significant site known as “Happy Valley”, which has been returned as freehold land to the Coffs Harbour and District Local Aboriginal Land Council (LALC). Gallows and Boambee Beaches are located to the south of the Precinct, where Littoral Rainforest occurs. Coffs Harbour itself, the Pacific Ocean, Muttonbird Island and South Coffs Island (Corambirra Point) form the eastern boundary.

The Precinct is a popular destination for both locals and tourists offering a variety of attractions and amenities. These include Jetty Beach and extensive parklands with biodiversity value, as well as items of heritage significance such as the Coffs Harbour Jetty and Ferguson’s Cottage, owned by the Coffs Harbour LALC. Further, the Coffs Harbour Fisherman’s Co-op, the Coffs Harbour Yacht Club, weekly Sunday markets, and community hub building (recently delivered by PDNSW) are located within the Precinct. Various public works including breakwater and boat ramp upgrades have been undertaken over recent years to support the marina function.

There are redeveloped and well-maintained parts in the area however, much can be done to enhance the Coffs Harbour Jetty Foreshore Precinct. A large portion of the Precinct is currently gravelled, and a large area of residual railway land is fenced off and inaccessible to the public, as shown in **Figure 3**. While gravelled areas provide informal overflow parking, they do not reflect the potential of this foreshore.

Figure 2 Coffs Harbour Jetty Foreshore Precinct

Source: SJB

Figure 3 Existing state of the Precinct rail lands and gravelled areas

Source: PDNSW

THE ILLUSTRATIVE MASTERPLAN

The planning proposal is supported by an Illustrative Masterplan (**Figure 4**) that presents a potential development outcome that could be realised at the Coffs Harbour Jetty Foreshore Precinct – it is not prescriptive nor is it determined. The Illustrative Masterplan builds on the shared vision created via extensive community and stakeholder consultation and provides further detail in relation to land use and development outcomes sought for the Precinct.

The Place Principles shown in **Figure 5** agreed with the community, guided the formation of the Illustrative Masterplan.

The Illustrative Masterplan is broadly organised across six sub-precincts that will each have a distinct character and function. These are identified as:

1. Foreshore Parklands – with improved amenities, proposed new board walk and nature-based playground.
2. The Marina – An active marina revitalised to accommodate local marine based businesses that reflect their regional importance.
3. North Park – Functional open space with recreational courts and formalised parking.
4. Jetty Hub – A hub of residential and tourist accommodation supporting activation, tourism and regional attraction located adjacent to the current Jetty Walkway, with massing capped at 6 storeys stepping down in scale when closer to public areas.
5. Activity Hub and Village Green – An active village green that delivers increased public open space connected to the existing foreshore parklands and may include family-friendly food and beverage, community uses and club houses or facilities to support events. A local business activity zone connected to the rail station.
6. Corambirra Point – A new regional tourist destination on the site of the former Deep Sea Fishing Club site including publicly accessible cafes and restaurants, a function space, activity centre and tourist accommodation.

A precinct map showing the Illustrative Masterplan and the six distinct zones is provided at **Figure 6**.

Figure 4 Illustrative Masterplan

Source: SJB

Gathering place

Become the premier place on the North Coast where all are welcome and feel at home, now and in the future

Seamlessly connected

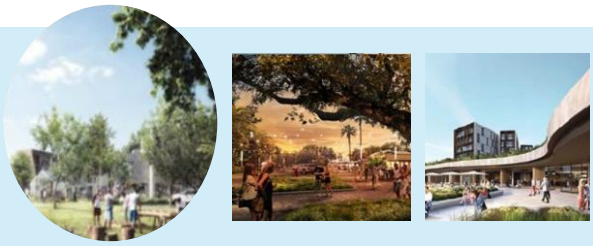
Tie the city structure and regional networks into the precinct and provide accessibility for all abilities throughout

Sustainable economy

Foster a wider mix of uses that leverage existing industry to create a balance of local employment opportunities and waterfront activation

Resilient environment

Be the exemplar for the North Coast on adapting to climate change by safeguarding existing assets and mitigating future risk



Choice destination

Enhance the precinct as a family friendly collection of local and regional destinations offering an accessible, engaging, safe, comfortable and inclusive environment day and night

Celebrate Country

Ensure opportunities for Gumbaynggirr people to Care for Country and heal Country, with long-term community involvement, cultural activation and education, and protection of significant heritage sites

Figure 5 Community-led place principles

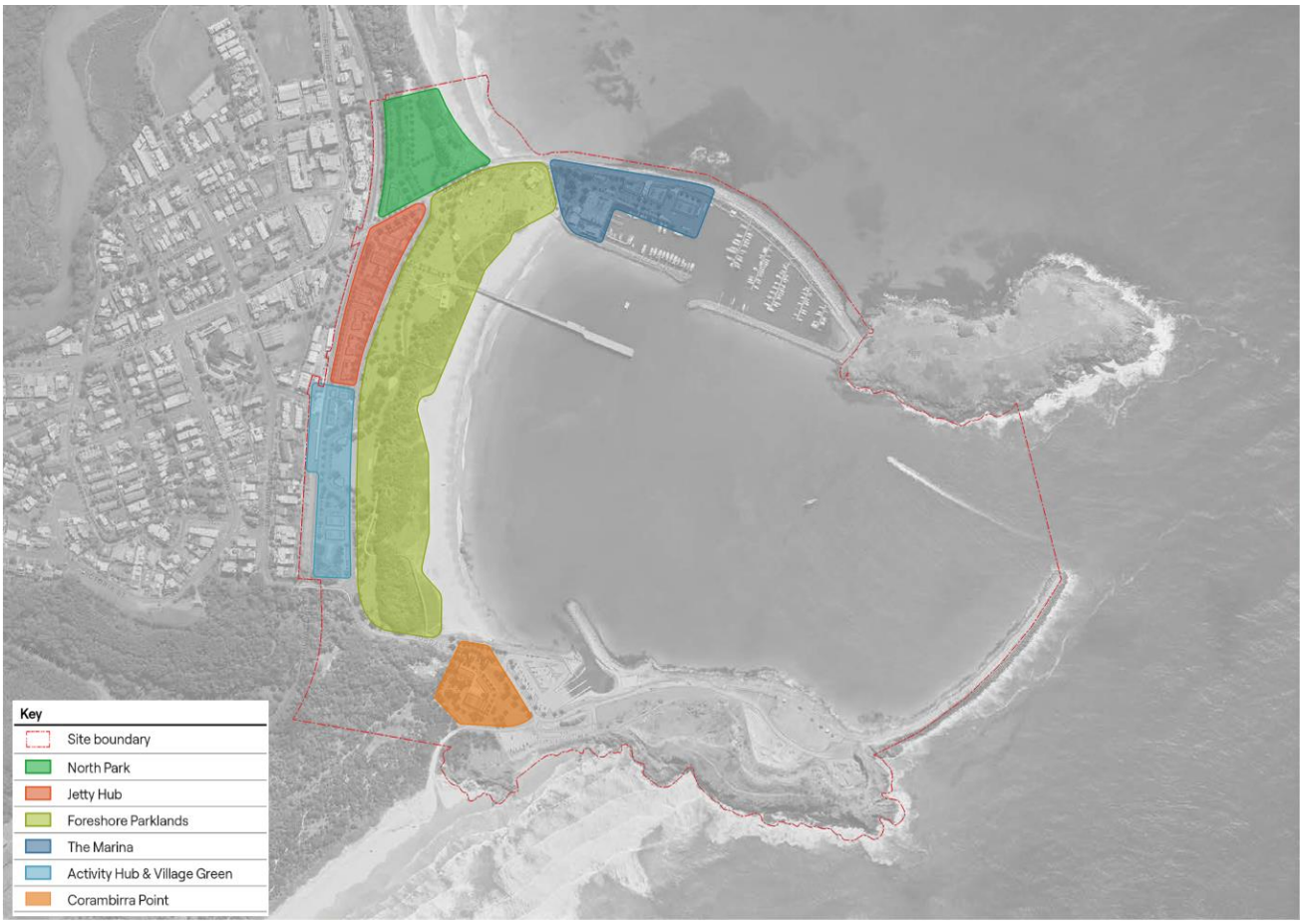


Figure 6 Sub-precinct map

Source: SJB

The planning proposal

The master planning of large-scale precincts follows a highly consultative and stepped approach. The current step, which paves the way for the revitalisation of the Coffs Harbour Jetty Foreshore Precinct, is the application for a State Assessed Planning Proposal, which is a legislated process.

PDNSW is lodging a planning proposal with the Department of Planning, Housing and Infrastructure that seeks approval for:

- Changes to permissible land uses
- Changes to permissible maximum building heights
- Planning controls for future State Significant Development Applications including design guidelines and design excellence processes

This Stormwater Management and Flooding Assessment supports this planning proposal.

BACKGROUND

This SWMP is intended to support the rezoning submission for the Precinct and is informed by the Indicative Illustrative Masterplan prepared by SJB. This report provides high level commentary on current site conditions and existing stormwater infrastructure. It outlines the proposed stormwater management strategy including a new stormwater network for the Precinct to form best practices moving forward. The strategy will address how both the water quality and quantity requirements, as defined within The CHCC Water Sensitive Urban Design (WSUD) Guideline, will be achieved with the post-developed runoff volumes.

This report was prepared in accordance with the current CHCC's Development Control Plan (DCP) 2015, Queensland Urban Drainage Manual (QUDM) 2016 and the Coffs Harbour Coastal Zone Management Plan (CZMP) 2019.

CONCEPT STORMWATER MANAGEMENT OBJECTIVES

The primary stormwater management objectives are to manage the additional runoff that is generated from development associated with the proposed rezoning. This can be achieved by constructing new stormwater infrastructure to convey runoff to stormwater quality basins (bio-retention basin) that limit the flow to the pre-developed volumes. By controlling and managing stormwater in this manner, the risk of erosion downstream is reduced. Stormwater design must comply with CHCC drainage design criteria and guidelines Relevant local authority approvals such as a Development Application may be required in the design phase in accordance with the consenting authority.

Minimum reduction in average annual pollutant loads determined as water quality targets and similar water quality improvement measures should be incorporated in accordance with the with relevant local authority requirements for new developments.

All developments to manage Flood Risk in accordance with the 'NSW Floodplain Development Manual 2005 (or its update) incorporating the NSW Flood Prone Land Policy', in consultation with the NSW Department of Planning and Environment and NSW State Emergency Services.

1.1 EXISTING CONDITIONS

1.1.1 EXISTING TOPOGRAPHY AND OVERLAND FLOW PATHS

Based on the 2018 LiDAR information available through the CHCC's online mapping services, the site generally falls towards the ocean from west to east. The site grading varies along each of the sub-catchments; the existing topography including surface levels and contours will be shown on the civil documentation in the upcoming phases of the project. The site is subject to overland flows from external upstream catchments west of the site which include but are not limited to runoff from residential subdivisions, commercial buildings, and the Coffs Harbour train line. Generally, runoff from these external upstream catchments flow overland from west to east prior to being collected by the existing stormwater infrastructure, passing through the site, and eventually discharging into the ocean. The upstream external catchments are predominately impervious and total approximately 18 hectares in area.

1.1.2 EXISTING STORMWATER INFRASTRUCTURE

Based on the information available through the CHCC's online mapping services data and data received from CHCC, there is existing stormwater infrastructure to drain and treat run-off from the subject site and the surrounding external upstream catchments. Council's infrastructure primarily consists of trunk drainage pipes and pits that generally discharge at the back of the surrounding beaches or onto rock shelves at a headland through the existing headwalls and outlets. There are six existing Gross Pollutant Traps (GPT) within council's stormwater network that are located throughout the site.

The existing stormwater pit and pipe network drains east across the Jetty Hub and connects to three stormwater headwalls east of Jordan Esplanade. These stormwater headwalls act as the lawful discharge locations for the site. An existing open channel drain located south of the Jetty Hub (Figure 10) collects runoff from the external catchments located to the west and diverts stormwater runoff before discharging into the pit and pipe network that leads to the lawful point of discharge.

1.1.3 POTENTIAL IMPACT ON EXISTING INFRASTRUCTURE

An existing 1200mm diameter stormwater pipe passes through one of the proposed development Lot's located at the centre of Jetty Hub as shown in Appendix B.

There are two existing detention basins (CHCC Asset ID 509211 & 509239) located at the northern part of Jetty Beach. The size and function of the existing detention basins will need to be further investigated, analysed, and verified for the expected increase of impervious area created along the Jetty Hub.

1.1.4 LAWFUL POINT OF DISCHARGE

The site primarily discharges into the ocean via the existing stormwater network outlined in Section 2.3.2.

1.1.5 COFFS HARBOUR TRAIN LINE

Based on the 2018 LiDAR information available through the CHCC's online mapping services, runoff from the sub-catchments within the Precinct are generally diverted away from the Coffs Harbour train line as the runoff drains east towards Jordan Esplanade. Runoff from the external catchments traverses through an existing culvert underneath the train line and eventually drains to the ocean. During the concept design phase, the existing culverts should be investigated to ensure culverts have adequate capacity to cater runoff from the external catchments to determine if upgrades are required to the existing infrastructure in or adjacent to the rail corridor.

The flows generated from the post-developed catchments along the Jetty Hub will be collected by a proposed stormwater network which will drain away from the rail corridor in accordance with Development Near Rail Corridors and Busy Roads Guidelines (NSW). It is recommended that all proposed stormwater infrastructure maintain a minimum clearance of 8 metres from rail cables and structures. An acoustic assessment that determines the level of noise and vibration impacts to all structures (i.e., detention basins, rainwater tanks and stormwater drainage pipes) and buildings located within proximity to the train line shall be provided in accordance with Development Near Rail Corridors and Busy Roads Guidelines (NSW). Refer to structural/acoustic report.

1.1.6 SITE INSPECTION

WSP conducted a site inspection on 1st May 2023 from 10am to 4:00pm. The weather was clear and sunny during the site inspection. The key items inspected during the site inspection are shown below in Figure 7:

Figure 7 – Coffs Harbour City Council online map with existing stormwater infrastructure and key items inspected. (Source: Nearmap -True North)

Select site photos are shown in Figure 8 to Figure 15. The following site observations were noted:

1. Headwall 1: An existing 900mm diameter stormwater pipe discharging to a stormwater headwall appears to have minor to moderate silt deposits within the pipe (Figure 8). The scour protection for this headwall appears to have deteriorated or eroded away (Figure 8) which may result in high velocity discharge and erosion at the lawful point of discharge (i.e., open channel towards Jetty beach). The implantation of scour protection will need to be further explored in the concept design stage.
2. As per the CHCC's online mapping services and data received from Coffs Harbour Council GIS team, Headwall 1 is shown to discharge into an existing open channel. However, during our site inspection it appeared there was no functional drainage channel to carry runoff from Headwall 1. The area where the drainage channel is supposedly located is highly saturated and densely vegetated (Figure 9). Outlet scour protection and swale will need to be designed and further investigated to be carried out in the concept design stage aligned with City of Coffs Harbour Council guidelines and in conjunction with biological diversity advise from ecologist.
3. Headwall 2: A twin 750mm diameter and a 1200mm diameter stormwater pipe discharge into an existing stormwater headwall that is approximately 2.7m wide with 2.3m long wingwalls located east to Jordan Esplanade (Figure 10). There appears to be major deposits and debris within the stormwater pipes and the apron of the headwall. As the outlet is protected by a trash rack, ponding of polluted/untreated water is apparent in Headwall 2, stagnant water is also observed at this headwall and along the drainage channel that leads to Jetty Beach (Figure 11). The trash rack fence appears to be ineffective in treating the runoff at this headwall. These components will need to be improved and assessed in the concept design. Options can be explored to remove this trash rack as there will be a new stormwater quality basin at the upstream
4. Outlet 3: Based on the information available through the CHCC's online mapping services, a headwall discharges into an existing detention basin (CHCC Asset Id 509239) as shown in (Figure 15). Twin 250mm diameter pipes act as the outlet for this detention basin, and the pipes appeared to be partially covered in grass (Figure 12). The twin pipes discharge onto large rocks prior to being collected by a drainage channel travelling towards the beach Figure 13 & Figure 14).

Figure 8: Headwall 1 located east to Jordan Esplanade toward south

Figure 9: Swale collecting runoff from Headwall 1

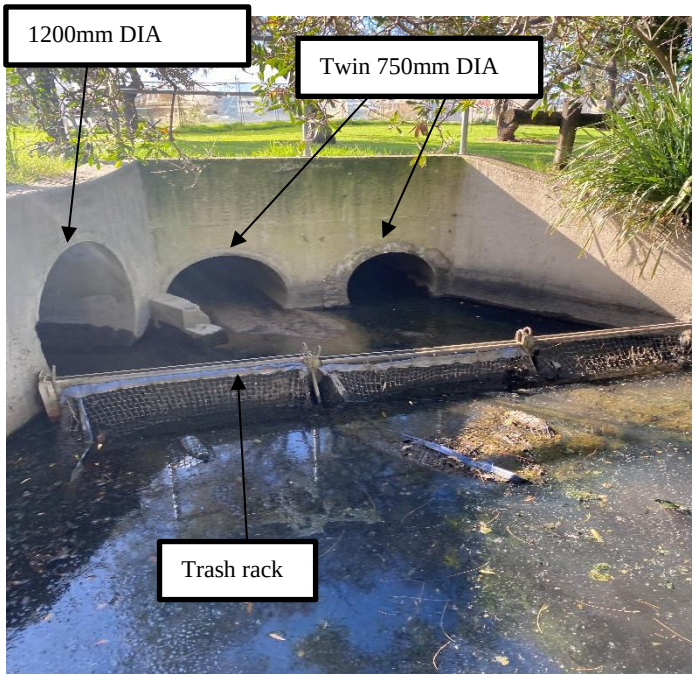


Figure 10: Headwall 2 located east to Jordan Esplanade toward North

Figure 11: Open channel collecting runoff from Headwall 2

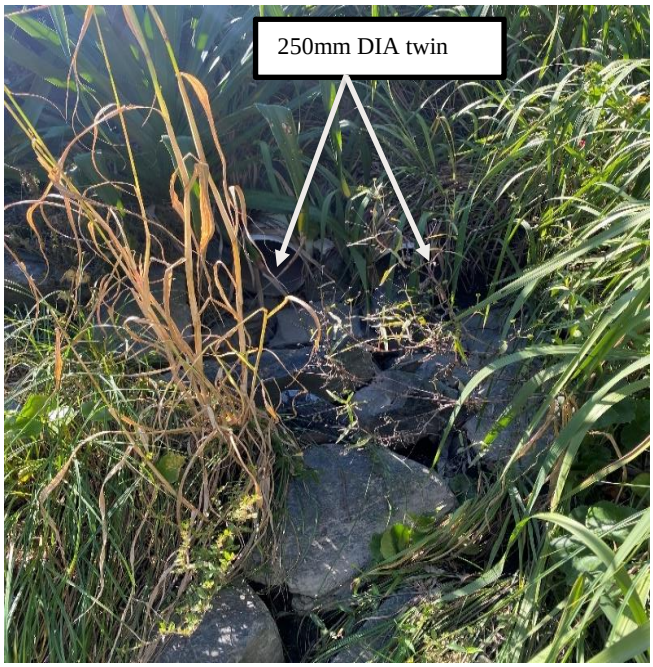


Figure 12: Outlet 3: Twin 250mm diameter stormwater pipe East of Marina Drive

Figure 13: Swale collecting runoff from twin 250mm stormwater pipes (Outlet 3)

Figure 14: Discharge location at Jetty Beach for the swale from Outlet 3

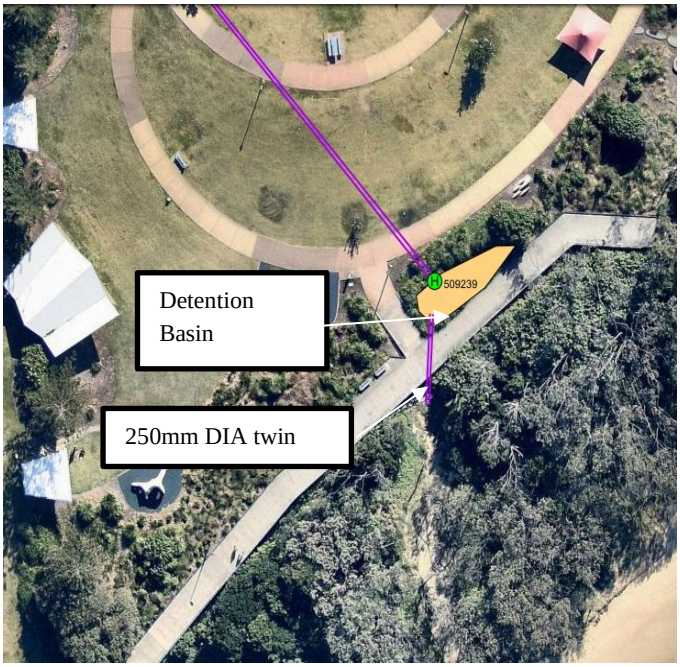


Figure 15: CHCC's online mapping services Outlet 3 and twin 250mm diameter stormwater pipes

1.2 POTENTIAL IMPACT ON EXISTING INFRASTRUCTURE

The proposed new buildings along the Jetty Hub as seen in Figure 6 above, may cause potential clashes with Council's existing stormwater network. The existing 1200mm diameter stormwater pipe located at the centre of Jetty Hub as shown in Appendix B is likely to be diverted and / or relocated as per the suggested alignment. Additional investigation and coordination with Council is required to confirm this alignment. In addition, existing Council trunk stormwater pipes pass through a proposed stormwater quality basin and the trunk pipes discharge via Headwall 2 (Figure 7). The interface between the existing trunk pipe and the proposed basin will result in a portion of the existing pipes and Headwall 2 to be removed. These alterations will need to be further developed during the next phase of the design.

The current volume of contaminants and sediments associated with stormwater discharge from the study area and immediate surrounds, into the marine habitat of the harbour (indirect impacts), will be substantially reduced and mitigated via the installation of vegetated stormwater bio-retention basins, and other mitigation measures (e.g. rubbish traps).

The current stormwater management infrastructure installed by Council is minimal and appears to be insufficient for the existing catchment. The proposed future stormwater treatment infrastructure, which forms part of the Illustrative Masterplan reference scheme has placed a high priority to improve and upgrade current water quality measures and to ensure future additional stormwater requirements are exceeded.

The installation and upgrading of stormwater management infrastructure is intended to be designed to accommodate the additional runoff from built infrastructure and potential debris from increased public recreational uses. The outlying objective is to improve the current water quality conditions, post construction.

It is anticipated that at completion of the Precinct development, the water quality discharging into the harbour will be of higher quality than what is currently being discharged from the existing stormwater infrastructure.

This in-turn, reduces the risk of indirect water quality impacts associated with stormwater discharge into the harbour and is anticipated to benefit / improve the water quality of the harbour and marine habitats over the longer-term. (Ref: Flora, Fauna and Coastal Management Strategy)

2 FLOOD MANAGEMENT

2.1 RIVER/CREEK FLOODING

The Coffs Creek and Park Beach Flood Study (BMT 2018) describes the flood conditions of Coffs Creek for 5%, 2%, 1%, 0.5%, 0.2% Annual Exceedance Probability (AEP) and Probable Maximum Flood (PMF) event.

Figure 16 was extracted from BMT's flood study and shows the Coffs Creek flood extent for different AEP events.

The subject site is outside the PMF flood extent and hence Coffs Creek does not pose a potential flooding risk to the site.

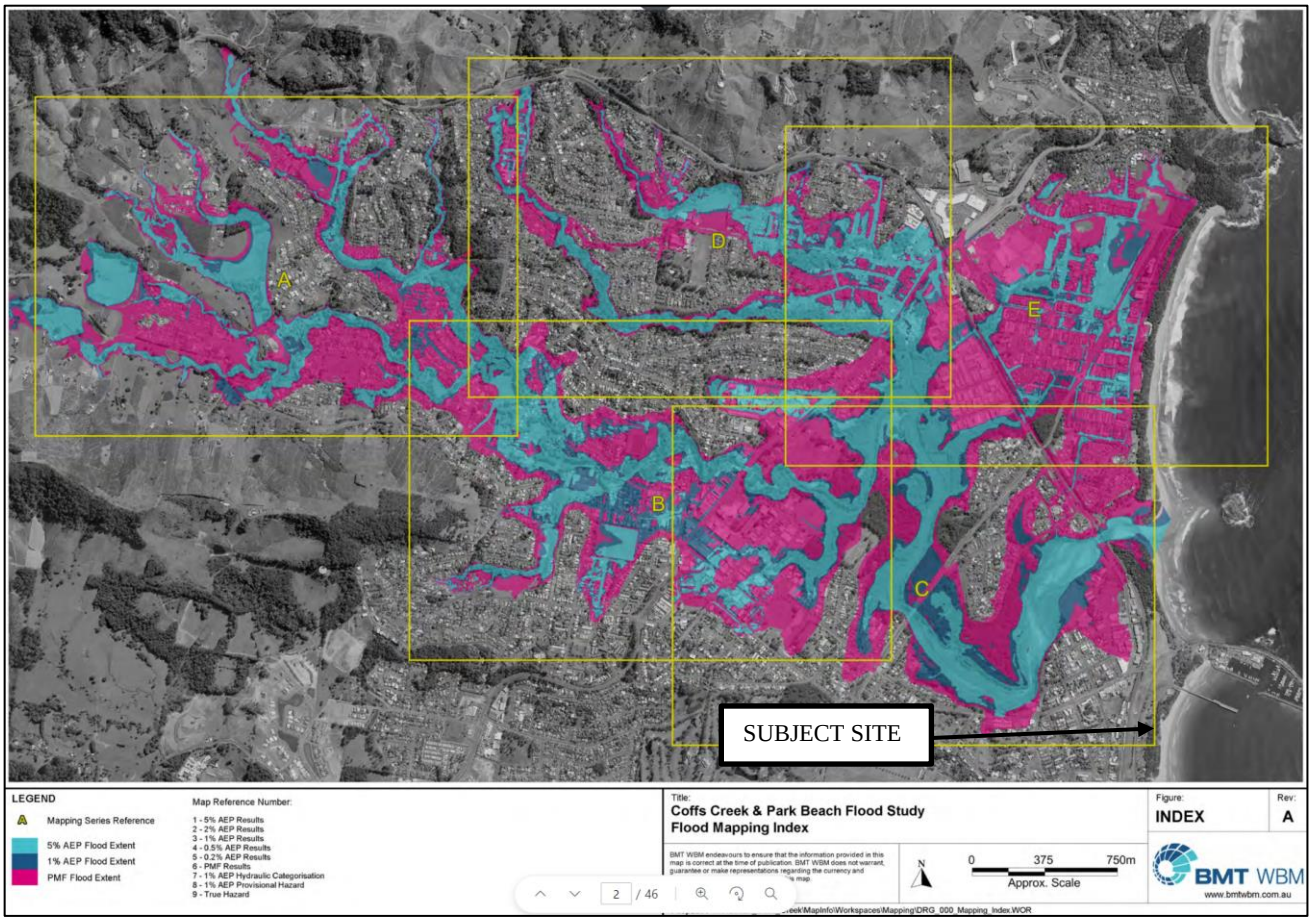


Figure 16: Coffs Creek flood extent (Source: BMT 2019 Coffs Creek and Park Beach Flood Study)

2.2 OVERLAND FLOODING

An external catchment upstream of the site are estimated to total approximately 15.25 hectares in size (refer to section 4.2.1). There is existing stormwater infrastructure (i.e., trunk drainage pipes and open drainage channel) that collects runoff from external upstream catchments and drains towards the beach.

Any overland runoff that flows through the site will be managed by onsite stormwater infrastructure that is described in Section 4.4 of this report. The overland runoff is not expected to generate any major flooding risk to the subject site.

2.3 TIDAL FLOODING

The Canute 3 tool created by CSIRO has been used to estimate the likelihood of extreme sea levels at the site, considering current and predicted sea level rises due to climate change.

Figure 17 shows the setup of the Canute 3 tool "Beach Wave Setup + Still Water Level" map Points have been selected for the analysis as they provides the most conservative estimated sea levels. Representative Concentration Pathway (RCP) 8.5 has been considered for the climate change scenario, which represents the "worst case" scenario in this climate change analysis.

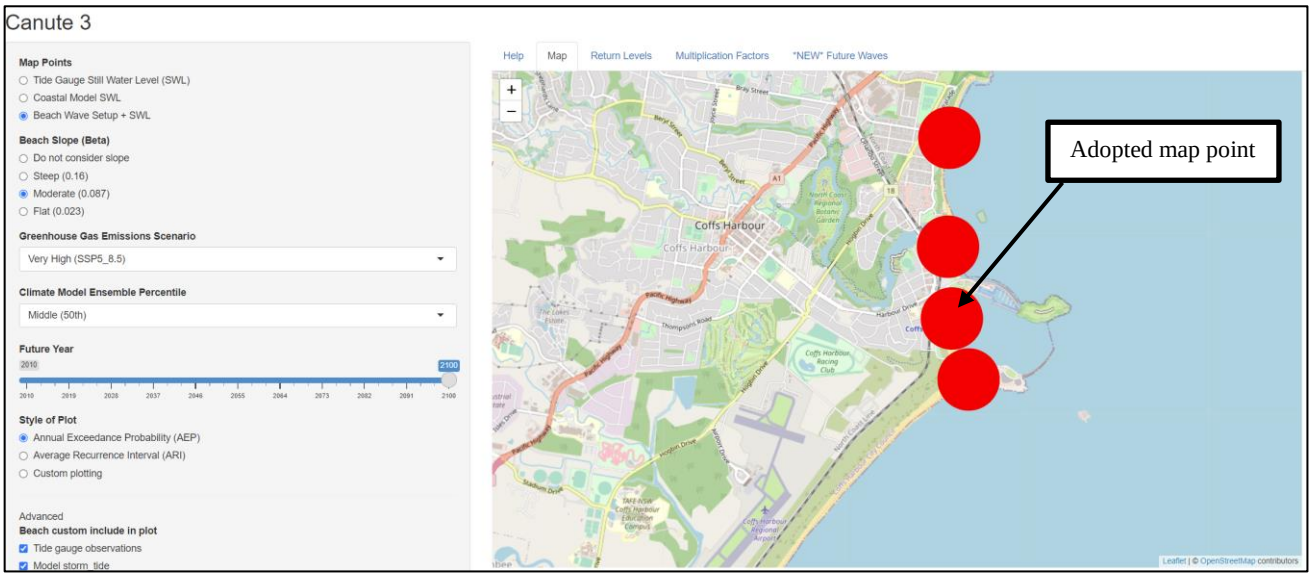


Figure 17: Canute 3 adopted parameters and map points

Figure 18 below presents the estimated existing sea level at the subject site and the projected sea level in year 2100. The table includes estimated sea levels up to 0.2% AEP event.

Return Level table

Dataset Very High (SSP5_8.5) Middle (50th) 153.1404E 30.306S	Year	Gumbel Location	Gumbel Scale	SLR/ALW	63.2%	9.5%	4.9%	2%	1%	0.5%	0.2%
storm_tide + rule of thumb wave setup + SLR	2100	2.209	0.23079	0.77	2.979	3.51	3.67	3.882	4.042	4.202	4.413
storm_tide + surf similarity wave setup + SLR	2100	2.05	0.17811	0.77	2.82	3.23	3.353	3.517	3.64	3.764	3.927
storm_tide	2005	1.266	0.03163	0	1.266	1.339	1.361	1.39	1.412	1.434	1.463
rule of thumb wave setup	2005	1.355	0.21473	0	1.355	1.849	1.998	2.195	2.344	2.492	2.689
surf similarity wave setup	2005	1.123	0.14529	0	1.123	1.457	1.558	1.691	1.792	1.893	2.026

Figure 18: Canute 3 estimated return level table (source: CSIRO)

As shown in Figure 18, the existing sea level (i.e. in year 2005) is estimated to be 2.344 m Australian Height Datum (AHD) in the 1% AEP event and 2.689 m AHD in the 0.2% AEP event. The projected sea level in year 2100 with climate change impact is 4.042 m AHD for the 1% AEP event and 4.413 m AHD for the 0.2% AEP event.

According to the Coffs Harbour 1m LiDAR (Spatial Services NSW 2013), the majority of site is above 4.5 m AHD and is considered to have minimal risk to tidal flooding up to 0.2% AEP event.

2.4 SUMMARY OF FLOOD CONDITIONS

Table 1 summarizes the flooding conditions at the subject site from different flooding sources.

Source of flooding	Flood conditions
Creek flooding (i.e. Coffs Creek)	Site is not affected by creek flooding up to PMF event.
Overland flooding	No major flooding risk identified at the site.
Tidal flooding	The site is not affected by tidal flooding up to 0.2% AEP event.

Table 1: Maximum flood level at the proposal site.

As shown in Table 1, the site is not subject to flooding and is considered to have low flooding risks. The site is also outside Coffs Harbour City Council's flood planning area.

Section E4 in Coffs Harbour Development Control Plan 2015 states that the flood planning level is at the height of 1% AEP flood level + 0.5 m freeboard for residential, tourist, commercial and industrial development.

As the site is not subject to flooding, it is recommended to seek confirmation from Coffs Harbour City Council whether a flood planning level is applicable to the proposed development.

3 STORMWATER QUANTITY MANAGEMENT

3.1 OBJECTIVES

To ensure the proposed development's stormwater runoff will not cause an actionable nuisance to the waterfront land, existing and developed stormwater peak flows from the separate areas of the subject site have been calculated and analysed. These have been modelled using the hydraulic software DRAINS. The ILSAX hydrological model was used in the DRAINS analysis. The ILSAX hydrological model uses hydrological losses and depression storage.

Australian Rainfall Runoff 2019 (ARR2019) rainfall data was used in the DRAINS analysis. To account for climate adjustments since this data was released, a climate change factor of 1.197 was applied to the analysis.

3.2 CATCHMENTS

3.2.1 EXISTING CATCHMENTS

The Precinct consists of approximately 62 hectares of land with a largely pervious area. It has been shown in the Illustrative Masterplan layout, that majority of the sub-catchments remain unchanged and for the purpose of this report, and hence DRAINS analysis will only consider the altered catchment. The areas within the site which are proposed to be developed are within the Jetty Hub, Activity Hub, Village Green, Corambirra Point and Marina, particularly west of Jordan Esplanade and north of Marina Drive. (Refer to Figure 16 below for the aerial view of the existing situation)

Figure 19: Aerial view of the study (Source: Nearmap -True North)

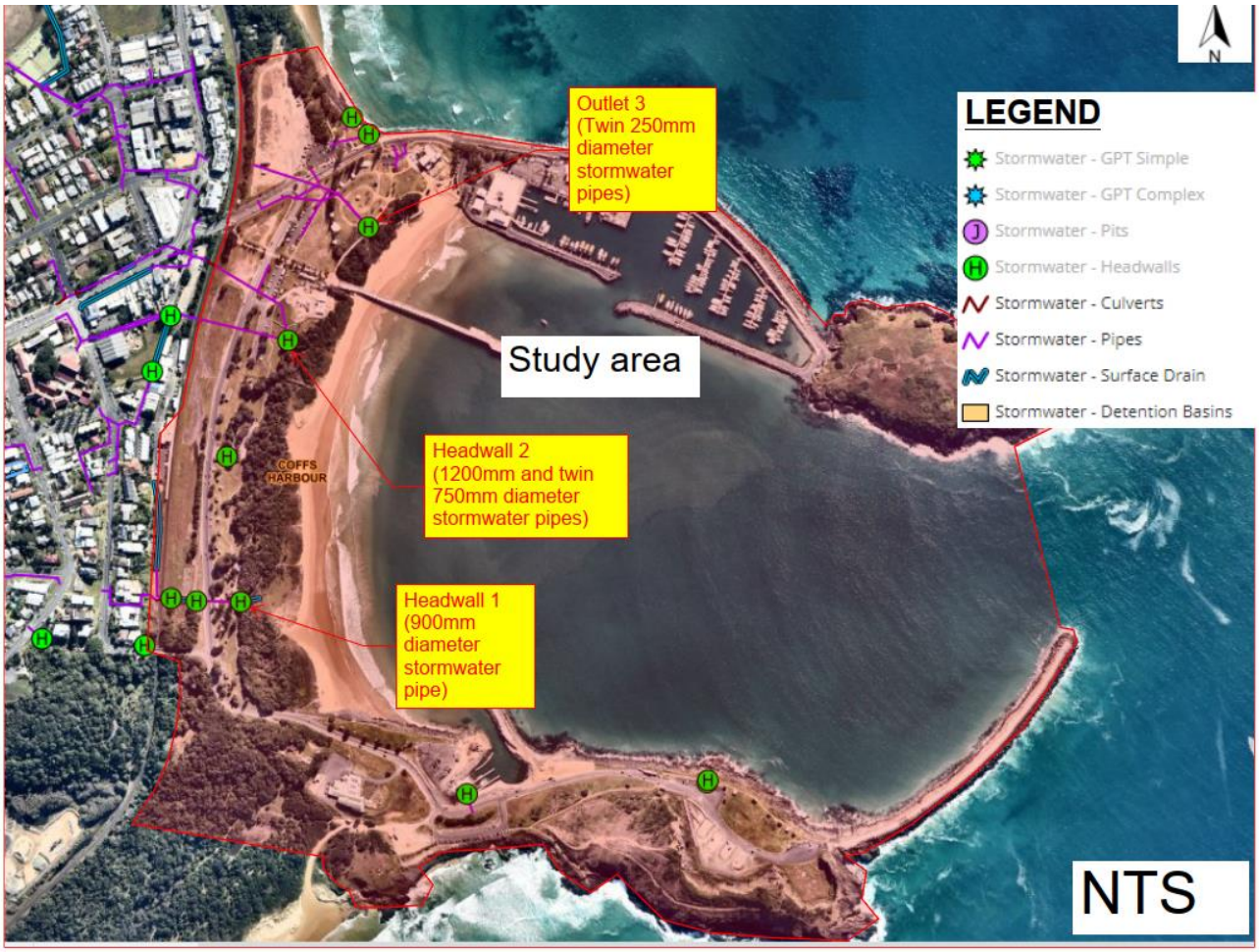


Figure 20: Existing catchment and associated outlets (Source: CHCC online map)

There are external upstream catchments as identified with LiDAR and aerial imagery bypass these sub-catchments consisting of an area of approximately 15 hectares. The existing catchment peak flows from the site were analysed for storms from the 2% AEP (50-year Annual Recurrence Interval (ARI)) and 1% AEP (100-year ARI) storms as per Table 7.3.1 from the Queensland Urban Drainage Manual (QUDM) 2016. DRAINS input parameters for the pre-developed catchments are depicted in Table 2 and Figure 21.

Catchments	Approximate Catchment Area (Hectares)	Approximate Imperviousness (%)
Existing Catchment	11	48
External Catchments	15	90

Table 2: DRAINS Input Parameters (Pre-Developed)

3.2.2 POST-DEVELOPED CATCHMENTS

The proposed Illustrative Masterplan development will reduce the pervious area within the site, while there are also sub-catchments with increased pervious area. Post-catchment peak flows from the site were analysed for storms from the 2% (50-year ARI) and 1% AEP (100-year ARI). Catchment areas and fraction impervious values were determined from the layout plan within Appendix A and utilising Table 4.5.1 of QUDM 2016. (refer to Table 3)

Catchments	Approximate Catchment Area (Hectares)	Approximate Imperviousness (%)
Post-Catchment	11	61
External Catchments	15	90

Table 3: DRAINS Input Parameters (Post-Catchment)

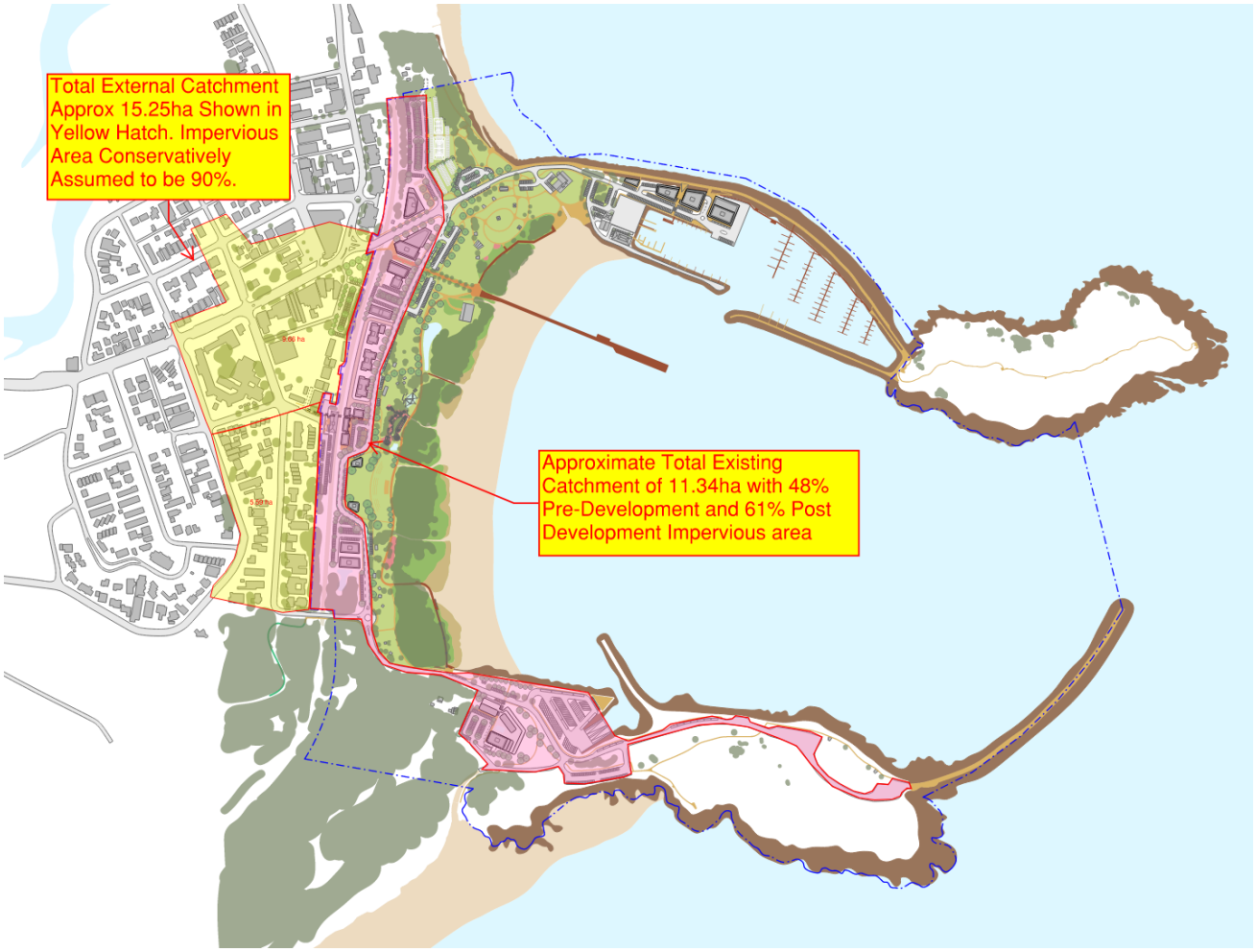


Figure 21: Approximate External and Existing Catchment Area

3.3 HIGH LEVEL DRAINS OUTPUTS – EXISTING VS POST-CATCHMENT

Table 4 below demonstrates the post-developed attenuated peak run-off will not exceed the pre-developed peak run-off due to the On-site detention basins. This included a 19.7% increase in the rainfall intensities based on the RCP 8.5 and 2090 scenario available in the BOM website.

AEP	Existing Catchment Peak Runoff (m^3/s)	Post-Catchment Peak Runoff (m^3/s)
2%	21.7	20.67
1%	25.0	23.76

Table 4: DRAINS Results For 2% and 1% AEP

3.4 PROPOSED INFRASTRUCTURE

3.4.1.1 PROPOSED PITS AND PIPES

The proposed stormwater network involves the installation of a pit and pipe network to capture the site runoff for minor events, and convey the stormwater flows to the proposed stormwater quality basins, stormwater headwalls and outlets at the waterfront land. The proposed bio-retention basins within the precinct Jetty Hub and surrounding areas will cause for parts of the existing stormwater network to be made redundant. (Refer to Appendix B) The pits have been located to maximise capture of overland flow from the sub-catchments within the site. To encourage and recognise the minimisation of peak stormwater flows and the protection of receiving waters from pollutants the proposed stormwater network shall comply with the 5-star green policy, refer to Appendix C.

For a high-level stormwater layout plan for the proposed pit and pipe network, refer to Appendix B.

3.4.1.2 PROPOSED OUTLETS AND HEADWALLS

The proposed pit and pipe network shall discharge to proposed headwalls and outlets located in the Deep Sea Fishing Site and on the Marina, or existing headwalls and open channels in the Foreshore Parklands and on the beach. site's back beach areas and prior to discharging into open channels. Proposed outlet structures on waterfront land are a controlled activity under the NSW Water Management Act 2000 (WM Act). Approval for proposed stormwater outlets and spillway which discharge into a watercourse or waterfront land must be obtained from the NSW Department of Planning and Environment (DPE) before commencing the controlled activity. Refer to Appendix D for the DPE Water's Guidelines for Controlled Activities (2012).

The use of flap gates or similar to prevent the intrusion of salt water and/or sediment into the stormwater outlet pipes will be investigated during the concept design phase.

3.4.1.3 PROPOSED OVERLAND FLOW STRATEGY

The proposed overland flow strategy involves the use of appropriate site grading and earthworks. Overland flow is directed to the pits, open channels, and stormwater quality basins. Localised overland flows attributed to stormwater runoff on the site must be taken into consideration. Indicative crest and sag points are identified throughout the precinct to divert flows away from the building and into designated bioretention basins or the outlets. Refer to Appendix B for indicative overland flow strategy.

3.4.1.4 STORMWATER QUALITY BASINS

Stormwater quality basins or bio-retention basins are proposed at natural low points of the site with the primary functions of treating stormwater runoff and improving discharge quality. The basins are sized to treat 4EY (3-month ARI flow) runoff from the proposed and upstream existing catchments. It is suggested that a portion of the stormwater quality basins are dedicated to the existing detention storage for the purpose of reducing water velocity in major events, reducing sedimentation at the outlet and help preventing erosion downstream. Prior to any future development applications, further investigations are required to ensure this issue is addressed appropriately. Refer to Appendix A for the location of the basins.

Location of the basins for stormwater detention, stormwater treatment or sedimentation purposes shall avoid areas that are known to be permanent or seasonal groundwater discharge areas. Any design needs to comply with Coffs Harbour Stormwater Management Policy. Wherever practical and in areas known to be affected by high water tables and/or salinity of groundwater, retarding basins shall be designed to be water retentive so that surface drainage water does not leak to the subsurface, recharging groundwater. Three main stormwater bio-retention basins are proposed with the approximate area of 1200m2, 130m2 and 600m2.

Stormwater features of the retarding basins as to be designed in accordance with AS/NZS 3500.1. Pipe systems containing the minor flow through the retarding basin wall shall be made of polyvinyl chloride (PVC), since coastal areas are highly susceptible to acid sulphate soils. Outlet pipes shall also be rubber ring jointed (RRJ) with lifting holes securely sealed, as this jointing system is more appropriate for pipes laid in sand and where the normal groundwater level is above the pipe obvert. Pipe and culvert bedding shall be specified to minimise its permeability and cut off walls and anti-seepage collars installed where appropriate. The high-level outlet to any retarding basin shall ensure that flooding of upstream properties is not worsened. Additional spillway capacity may be required to safely convey extreme outflows from the basin due to the hazard category of the structure. The low flow pipe intake shall be protected to prevent blockage.

Minimum building floor levels of shall have a freeboard of 0.5m above the 100-year ARI flood level in the basin.

The basin design shall consider the following aspects relating to public safety:

- Side slopes are to be a maximum of 1 in 6 to allow easy egress. Side slopes of greater than 1 in 4 may require handrails to assist egress.
- Water depth shall be where possible less than 1.2m in the 20-year ARI storm event. Where neither practical or economic greater depths may be acceptable. In that case the provision of safety refuge mounds should be considered.
- The depth indicators should be provided indicating maximum depth in the basin.
- Protection of the low flow intake pipe shall be undertaken to reduce hazards for people trapped in the basin.
- Signage of the spillway is necessary to indicate the addition hazard.
- Basins shall be designed so that no ponding of water occurs on to private property or roads.
- No planting of trees in basin walls is allowed.
- No basin spillway is to be located directly upstream of urban areas.
- Submission of design drawings to the NSW Dams Safety Committee is required where any of these guidelines are not met or Council specifically requires such submissions.

4 STORMWATER QUALITY MANAGEMENT

4.1 OBJECTIVES

Proposed water quality and treatment measures will subsequently improve the overall post development water quality that subsequently discharges into the adjacent harbour waterway. The proposed measures to be implemented include bio-retention basins, swales, water quality chambers with stormfilters, gross pollutant traps (GPT) and trash traps. These measures ensure the post-development pollutant load standards described in the CHCC Water Sensitive Urban Design (WSUD) Guideline (2018) are achieved. Details of the water quality control objectives are as follows:

- 80% reduction in total Suspended Solids
- 60% reduction in total Phosphorus
- 45% reduction in total Nitrogen
- 90% reduction in gross Pollutants (size >5mm)

To limit the impact of the anticipated pollutants, the WSUD Guidelines are to be adopted in the stormwater design. The WSUD guidelines nominate the use of stormwater quality measures such as bioretention basins, grassed swales, proprietary systems etc. Stormwater water quality measures reduce the impact of the contaminated runoff by treating the captured runoff to ensure the above quality criteria is achieved for the proposed development.

4.2 QUALITY MANAGEMENT STRATEGY

The strategy adopted for the site predominately involves the installation of bioretention basins, water quality chambers within the pipe network, swales and proprietary treatment devices installed within inlet pits. Alongside utilising the existing water quality treatment devices (i.e., swales, headwall scour production and gross pollutant traps) across the site and ensuring these devices are operating efficiently. It was noted during the site inspection conducted by WSP on 1st May 2023 that existing scour protection for headwalls and swales appeared to be ineffective in treating runoff. Also, sedimentation at outlet and deterioration of the scour protection was observed during the site walk. It is recommended that in the next design phase, existing stormwater infrastructure particularly in the outlets shall be assessed for effectiveness and a concept strategy be developed to ensure the final design at the site meets Council's stormwater quality targets. The longevity of the proposed solution will be assessed to ensure similar degradation does not occur.

For a high-level stormwater layout plan for the locations of the proposed detention basins and quality treatment devices, refer to Appendix B.

4.3 METEOROLOGICAL DATA

The 'CHCC' rainfall template was selected for the modelling as per MUSIC Link Coffs Harbour Council. The standard 6-minute time-step rainfall data is used in the model. The data period extends from 1985 to 1994.

4.4 MODELLING APPROACH

High level assessment of the stormwater quality and treatment devices for this Illustrative Masterplan was undertaken using industry-standard computer software MUSIC, version 6 published by the Australian Government-owned eWater

organisation. Catchments were modelled with the current CHCC WSUD guideline utilising a modified percentage impervious area, rainfall threshold, soil properties, and pollutant concentration.

For the purposes of this report, the MUSIC model includes only one lumped catchment for the entire site that is treated by bioretention basins, SPEL storm sacks (propriety product), GPT's, rainwater tanks and swales. The catchment area that is collected in the proposed bioretention basin has been defined using the same approach as the quantity (OSD) calculations, as the proposed detention basins will also be used for treating the additional runoff generated from the increase of impervious area along Jetty Hub. There is an internal sub-catchment located within the south portion of the Jetty Hub consisting of an area of 0.84 hectares which will not be treated by a bioretention basin. However, there are other treatment devices within the proposed stormwater network to treat this internal catchment (i.e., GPT's, rainwater tanks and swales). Refer to high level stormwater layout in Appendix B.

A MUSIC model which includes all existing and the above-mentioned treatment devices will be modelled during the concept design stage.

4.5 MODEL RESULTS

The MUSIC model results are shown below in the Table 5. Based on the strategy outlined in the section 5.4, the development will meet the reduction targets of the CHCC WSUD Guidelines. Further to this targets WSP was advised by the sustainability Consultant to meet Sydney Water stormwater targets (Version 3 dated 4/2/2021) as an extra measure to increase and enhance the water quality discharges into harbour.

Pollutant/Issue	**Percentage reduction targets CHCC**	**percentage reduction targets Sydney water**	**percentage Reduction RESULTS**
Total Suspended Solids (kg/yr)	80%	85%	86%
Total Phosphorous (kg/yr)	65%	60%	82.7%
Total Nitrogen (kg/yr)	45%	45%	64%
Gross Pollutants (kg/yr)	90%	90% (>5mm)	~99.9%

Table 5: MUSIC Model Results

5 CONCLUSION

This report addresses the stormwater quality and quantity for the proposed State assessed planning of the Coffs Harbour Jetty Foreshore Precinct, in conjunction with the indicative Illustrative Masterplan climate change objectives.

A preliminary high level hydraulic model is developed to investigate the proposed Illustrative Masterplan which has been modelled with DRAINS software, demonstrating that there is no increase in the site runoff due to the proposed infrastructure as outlined in Section 4.4.

The stormwater management plan strategy is developed to assist the investigation of the impact of the Illustrative Masterplan. High level hydraulic modelling is utilised to investigate water quantity impacts in various storm events. Runoff from pre to post scenario is modelled to assess the impacts of the runoff generated from the proposed Illustrative Masterplan.

It is appreciated that there will be minor increases in the impervious area in comparison to the current precinct. However as Coffs Harbour Jetty Foreshore is situated downstream of the proposed illustrative master planned Precinct and is the associated point of discharge, there is no requirements for the detention to be incorporated within the Illustrative Master planned Precinct. It is recommended to have additional detention within the in the bio-retention basins to avoid any erosion at the outlets at the coastal line in major events.

Stormwater quality has been considered in a holistic approach throughout the potential development. It is proposed to incorporate all stormwater treatment requirements outlined in Section 5.2 for the proposed sites upstream catchments to meet councils water quality targets. Water quality targets have been based on are revised based in Sydney Water stormwater quality targets which exceed the current CHCC objectives. This extended target objective will ensure the stormwater draining to the natural receiving water body (i.e. Coffs Harbour Jetty Foreshore) meets and exceeds the requirements and is protected from the majority of pollutants generated from the stormwater runoff.

The site is situated outside Coffs Harbour City Council's flood planning area. Section E4 in *Coffs Harbour Development Control Plan 2015* states that the flood planning level is at the height of 1% AEP flood level + 0.5 m freeboard for residential, tourist, commercial and industrial development. As the site is not subject to flooding, it is recommended to seek confirmation from Coffs Harbour City Council whether a flood planning level is applicable to the proposed development.

By following the recommendations of this report and implementing appropriate measures during construction and operation of the development, it can be predicted that there will be minimal impact on the existing environment because of the proposed development.

6 REFERENCES

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7 LIMITATIONS

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APPENDIX A

ILLUSTRATIVE MASTERPLAN OF THE COFFS HARBOUR JETTY FORESHORE PRECINCT

APPENDIX B

HIGH LEVEL STORMWATER NETWORK LAYOUT PLAN


Part of Existing Stormwater Pipe to be made redundant
Existing Culvert 2 under the Rail
Part of the Existing Trunk stormwater pipe to be made redundant
Part of Existing Stormwater Open Drain to be made redundant
Part of Existing Stormwater Line (including Headwalls) to be made redundant
Existing Culvert 1 under the Rail
Part of Existing Stormwater Lines (including Headwall) to be made redundant
Existing Detention 509231
Existing Detention 509239
Outlet 3 - Existing Twin 225mm UPVC pipes
Discharge to Ocean
Headwall 2 - Existing Twin 750mm RCP and Single 1200mm with Headwall
Headwall 1 - Existing 900mm RCP with Headwall
Weir with Rip Rap
Sag
Crest
Existing Stormwater line and headwall to be made redundant
LEGEND
Existing Stormwater Headwall
Proposed Stormwater Headwall
1.8m Lintel
2.4m Lintel
Surface Inlet Pit
WQ
Water Quality Chamber
RWT
Rainwater Tank
Proposed Stormwater Pipe
Existing Stormwater Pipe
Existing Stormwater Open Drain
Existing Stormwater Junction
Existing Stormwater Culvert
Existing Stormwater Detention Basin
Proposed Stormwater Open Drain
Proposed Stormwater Quality Basin

APPENDIX C

5-STAR GREEN POLICY

emi-5 stormwater | Points AvAilAble 3

Aim of Credit

To encourage and recognise the minimisation of peak stormwater flows and the protection of receiving waters from pollutants.

Credit CriteriA

Up to three points are available. Points are awarded where the post-development peak 1.5 year Average recurrence interval (Ari) event discharge from the site does not exceed the pre-development peak 1.5 year Ari event discharge;

AND

- For one point, all stormwater discharged from site meets the Pollution Reduction Targets in column A of table Emi-5.1;
- For two points, all stormwater discharged from site meets the Pollution Reduction Targets in column B of table Emi-5.1;
- For three points, all stormwater discharged from site meets the Pollution Reduction targets in column C of table Emi-5.1.

ComPliAnCe requirements

the peak flows requirements of this credit are to be applied to the state of the site that existed at the date of site purchase. in cases where the site has been owned by the current owner for more than five years (from the project's Green Star registration date), they are to be applied to the state of the site that existed at least five (but not more than ten years) prior to the project's Green Star registration date.

The following documentation, required in the General section of the Green Star submission forms part of the Compliance requirements for this credit:

where the site has been owned by the current owner for **less than five years** (from the project's Green Star registration date):

- Scaled site plans or aerial photographs generated prior to site purchase (but not more than ten years prior to site purchase), marked up as necessary to clearly show:
  - whether the site was a greenfield or brownfield site, and whether it contained any buildings;
  - the footprint area of any buildings that existed on the site;
  - the land types that were present on site in accordance with Eco-4 Change of Ecological Value Calculator; and
  - the areas that existed in a radius no less than 100 metres around the site.

  AND
- Evidence of site purchase clearly indicating the site purchase date and any relevant site attributes.

where the site has been owned by the current owner **for more than five years** (from the project's Green Star registration date):

- Scaled site plans or aerial photographs generated at least five years (but not more than ten years) prior to the project's Green Star registration date, marked up as necessary to clearly show:
  - whether the site was a greenfield or brownfield site, and whether it contained any buildings;
  - the footprint area of any buildings that existed on the site;
  - the land types that were present on site in accordance with Eco-4 Change of Ecological Value Calculator; and
  - the areas that existed in a radius no less than 100 metres around the site.

  AND
- Evidence of the fact that the site has been owned by the current owner for more than five years (from the project's Green Star registration date).

All other evidence should be submitted as per the documentation requirements of this technical manual. Project teams must ensure that the information in the short report is consistent with the information submitted in the General section of the submission, and is referenced clearly.

Pollution Reduction Targets

Currently, the use of biological treatment systems is generally considered the only method of achieving compliance with the Pollution reduction targets contained in column C of table Emi-5.1. where a treatment train that does not contain biological treatment is being used to achieve the Pollution Reduction Targets in column C of Table Emi-5.1, independently verified performance certification is required to show that the equipment is capable of achieving those targets.

Table Emi-5.1: Pollution reduction targets.

Pollutant	**Reduction Target** (% of the typical urban annual load).		
	A	B	C
total Suspended Solids (tSS)[1]	80%	80%	90%
Gross Pollutants	85%	90%	95%
total Nitrogen (tN)[2]	30%	45%	60%
total Phosphorus (tP)[2]	30%	60%	70%
total Petroleum Hydrocarbons[3]	60%	90%	90%
Free Oils[3]	90%	90%	98%

[1] Load based on the following particulate size distribution (by mass): 20% <20 µm; 20% 20-60 µm; 20% 60-150 µm; 20% 150-400 µm; 20% 400-2000 µm

[2] Load includes particulate and dissolved fraction.

[3] this requirement is not applicable where the site contains less than a total of 200m2 of uncovered areas where vehicles are likely to transit and/or park e.g. roads, loading docks, refuelling bays, car parking etc.

doCumentAtion: desiGn rAtinG

Submit all the evidence and ensure it readily confirms compliance.

□ Short report

□ tender drawings

where manufactured stormwater treatment equipment is being used:

□ Verification of performance

where a treatment train does not contain biological treatment and is being used to achieve the Pollution Reduction Targets in Table Emi-5.1 Column C, the following additional information is required:

□ independently verified performance certification

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Describing the site and stating the methodology used to calculate treatment train performance. Where applicable, the short report should clearly describe and justify the:
  - Software or calculation methods used;
  - Pollutant export modelling results; and
  - Data sets and tables that were applied.
- Stating the post-development peak 1.5 year Average Recurrence Interval (ARI) event discharge, and pre-development peak 1.5 year ARI event discharge, and showing that it is not exceeded by:
  - referencing the scaled site plans (or scaled aerial site photographs) with land types indicated and quantified, generated at or prior to site development (contained in the General section of the Green Star submission);
  - Describing the conditions of the site prior to any works commenced as part of the rated project; and
  - Providing the date that the project achieved DA approval (or equivalent).
- Describing the pre-development site usage and any changes to the impervious areas of the site;
- Describing the proposed strategy for addressing the stormwater. Where applicable, the short report should clearly state the:
  - quantity of stormwater captured and used on site (annually);

Continued >

  - water balance and total storage capacity of any systems that use stormwater on site;
  - quantity of stormwater discharge to be addressed by each stormwater treatment system (annually);
  - sizing of all stormwater treatment systems installed.
- Summarising how the Pollution Reduction Targets are achieved by comparing the results of the pollutant export modelling/calculations with the Pollution reduction targets in the relevant column of table Emi-5.1.
- Stating the total area (m^2) of uncovered areas where vehicles are likely to transit and/or park e.g. roads, loading docks, refuelling bays, car parking etc. and where applicable, summarising how hydrocarbons and free oils have been addressed.

Tender drawings:

- Showing the stormwater collection, storage and treatment facilities and detailing their functional elements;
- Where stormwater is being captured and used on site, highlighted hydraulic drawings showing all the capture, storage, piping and discharge routes; and
- Showing the total areas of uncovered areas where vehicles are likely to transit and/or park e.g. roads, loading docks, refuelling bays, and car parking etc.

Verification of performance for each manufactured stormwater treatment device showing its ability to achieve the nominated Pollution reduction targets. this verification must be publically available and specific to the treatment device(s) being used.

Independently verified performance certification for each manufactured stormwater treatment device, proving its ability to achieve the Pollution Reduction Targets nominated in Table Emi-5.1 Column C.

doCumentAtion: As built rAtinG

Submit all the evidence and ensure it readily confirms compliance.

□ Short report

□ As-built drawings

where manufactured stormwater treatment equipment is being used:

□ Verification of performance

where a treatment train does not contain biological treatment and is being used to achieve the Pollution Reduction Targets in Table Emi-5.1 Column C, the following additional information is required:

□ independently verified performance certification

Continued >

emi-5 stormwater

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Describing the site and stating the methodology used to calculate treatment train performance. Where applicable, the short report should clearly describe and justify the:
  - software or calculation methods used;
  - pollutant export modelling results; and
  - the data sets and tables that were applied.
- Stating the post-development peak 1.5 year Average Recurrence Interval (ARI) event discharge, and pre-development peak 1.5 year ARI event discharge, and showing that it is not exceeded by:
  - referencing the scaled site plans (or scaled aerial site photographs) with land types indicated and quantified, generated at or prior to site development (contained in the General section of the Green Star submission);
  - describing the conditions of the site prior to any works commenced as part of the rated project; and
  - providing the date that the project achieved DA approval (or equivalent).
- Describing the pre-development site usage and any changes to the impervious areas of the site.
- Describing the proposed strategy for addressing the stormwater. Where applicable, the short report should clearly state the:
  - quantity of stormwater captured and used on site (annually);
  - water balance and total storage capacity of any systems that use stormwater on site;
  - quantity of stormwater discharge to be addressed by each stormwater treatment system (annually);
  - sizing of all stormwater treatment systems installed.
- Summarising how the Pollution reduction targets are achieved by comparing the results of the pollutant export modelling/calculations with the Pollution reduction targets in the relevant column of table Emi-5.1.
- Stating the total area (m2) of uncovered areas where vehicles are likely to transit and/or park e.g. roads, loading docks, refuelling bays, car parking etc. and where applicable, summarising how hydrocarbons and free oils have been addressed.

As-built drawings:

- Showing the stormwater collection, storage and treatment facilities and detailing their functional elements;
- Where stormwater is being captured and used on site, highlighted hydraulic drawings showing all the capture, storage, piping and discharge routes; and
- Showing the total areas of uncovered areas where vehicles are likely to transit and/or park e.g. roads, loading docks, refuelling bays, and car parking, etc.

Verification of performance for each manufactured stormwater treatment device showing its ability to achieve the nominated Pollution reduction targets. this verification must be publically available and specific to the treatment device(s) being used.

Independently verified performance certification for each manufactured stormwater treatment device, proving its ability to achieve the Pollution Reduction Targets nominated in Table Emi-5.1 Column C.

AdditionAl GuidAnCe

In order to achieve the points in this credit, a combination of detention, treatment, and use on site may be employed. However, any stormwater discharged from site, must be treated to achieve the relevant Pollution reduction targets prior to discharge. in all cases where discharge occurs, the post-development peak 1.5 year Average Recurrence Interval (ARI) event discharge from the site must not exceed the pre-development peak 1.5 year Ari event discharge.

Stormwater impacts from a site result from runoff from impervious and semi-pervious surfaces. runoff from a site has impacts on both water quality and flow rates occurring offsite. Techniques which can reduce these offsite impacts include volume management, which slows runoff rates and/ or reduces the total volume of water that impacts on waterways, and pollutant management, which treats a range of pollutants in stormwater runoff.

To reduce the offsite impacts from stormwater runoff, pollutant management and flow management techniques can be considered individually or in combination to achieve the desired offsite impacts. In order to demonstrate compliance with the credit criteria, techniques which have sufficient levels of resolution to take into account localised climatic sequences, water balances and treatment train operation must be used.

The final stormwater management strategy should be chosen to suit site constraints, and has the potential to affect other Green Star credits, such as those in the Water Category.

in circumstances where this credit specifies levels or targets that are less stringent than those specified in relevant local legislation/regulations, the local legislation/regulations shall take precedence.

Definitions

- Average recurrence interval (Ari): The average, or expected value of the periods between exceedances of a given rainfall total accumulated over a given duration. Data can be obtained from the Bureau of Meteorology (BOM), or sources such as *Australian rainfall & runoff*, Engineers Australia (1999), National Committee for Water Engineering.
- modelling: Pollutant export modelling using computer programs such as MUSIC, STORM etc. predict the discharge pollutant loads from a given area. the results of the simulation must show a comparison against the relevant reduction targets for the specified treatment system/train. As an alternative to computer modelling, calculations can be done manually, in accordance with methodologies outlined in procedural manuals such as *WSUD Engineering Procedures – Stormwater, (CSIRO, 2005)*.

- Pre-development: The conditions of the site at the date of site purchase, or five years prior to the project's Green Star registration date (whichever is most recent).
- Stormwater: For the purposes of this credit, all rainwater falling on the site is stormwater. rainwater hitting the roof of a structure and running into the stormwater system (either directly or indirectly) is stormwater, and must comply with the credit criteria. For stormwater that is captured, used on site, and not discharged to the stormwater system, there is no requirement to treat the pollutants in that stormwater beyond those required under the relevant legislation. Rainwater hitting the roof of a structure, being captured, and then used in a system that discharges or overflows to the stormwater system, must be treated in accordance with the credit criteria prior to discharge.
- typical Urban Annual Load: typical urban annual loads can be estimated using continuous simulation modelling such as MUSIC. Where available, relevant guidelines values for pollutant concentrations for the catchment land use and surface type should be used. in areas where there are no specific guidelines reference can be made to sources such as Australian Runoff Quality (ARQ, 2006).

Aquifers

Discharging stormwater to groundwater systems (aquifer recharge) either directly or indirectly is a legitimate means of achieving compliance with the credit criteria, however it must be ensured that the stormwater being discharged meets the relevant Pollution reduction Targets, and that pollutants are not contaminating groundwater supplies.

Free Oils and Hydrocarbons

where the modelling program being used cannot model the levels of free oils and hydrocarbons in stormwater discharge, an alternative method must be used to show that the Pollution reduction targets have been achieved for these pollutants. e.g. manual calculation methods as per the *WSUD Engineering Procedures – Stormwater, (CSIRO, 2005)*.

Rainfall Data for Modeling Programs Using Continuous Simulation

the following approach to rainfall simulation should be adopted:

- continuous simulation of a minimum of 10 years; and
- a six minute time step (intervals).

Multiple Buildings Single Rating guidance

Table Emi-5.2: multiple Buildings Single rating guidance

Rating	Guidance
Design	No change from existing requirements.
As Built	No change from existing requirements.

bACKGround

Urban stormwater is a significant source of pollution and an environmental issue of growing concern. the strategic use of small scale and on-site controls on urban stormwater are embraced under the management strategies known as 'water sensitive urban design' (WSUD), and 'low impact development' (LID). These strategies aim to reduce the adverse impacts of urban stormwater by reducing, detaining, infiltrating, treating or reusing stormwater at its source (Brodie and Dunn, 2008).

WSUD is a framework for managing urban stormwater both as a resource, and in a way that protects receiving aquatic ecosystems (CSIRO, 2005). The main objectives of WSUD include; protecting existing natural features and ecological processes; maintaining the natural hydrologic behaviour of catchments; protecting water quality of surface and ground waters; minimising demand on the reticulated water supply system; minimising sewage discharges to the natural environment; and integrating water into the landscape to enhance visual, social, cultural and ecological values (eWater, 2010).

To achieve the Pollution Reduction Targets, it is often necessary to implement a "treatment train" of measures that can address a variety of pollutants with a range of particle sizes. It is widely acknowledged that there is no single device whether natural, constructed or manufactured that can achieve the highest Pollution reduction targets desired for urban stormwater (Humes, 2007).

Nitrogen (N) and phosphorus (P) are nutrients. These are essential to living organisms, but in excess levels they disrupt the natural balance of aquatic ecosystems. N and P can occur in dissolved or particulate form. in particulate form they attach to the fine fraction of total Suspended Solids (tSS). Although total nitrogen (tN) concentrations are usually lower in urban areas then in rural areas, rainfall is a significant contributor of TN in urban stormwater runoff (Chiew, F.H.S. et al, 1997). Total phosphorus (TP) concentrations in urban catchments are typically two to ten times that those in forested catchments (Chiew, F.H.S. et al, 1997). Rivers and bays can be particularly sensitive to nitrogen and phosphorus runoff. For example eutrophication (algal blooms) in melbourne's Port Phillip Bay is strongly controlled by nitrogen. rivers and coral reefs are also very sensitive to nutrient levels.

Standard practice in stormwater treatment systems is to require some form of particle separation process. this results not only in significantly improved water clarity in receiving waters, but also reduces the levels of heavy metals and other contaminants being discharged. this is because heavy metals and other contaminants have an affinity for fine particles (tSS) i.e. they bond to them. By removing the TSS, heavy metals and other contaminants are also removed.

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APPENDIX D

DEPARTMENT OF PLANNING AND ENVIRONMENT WATER'S GUIDELINES FOR CONTROLLED ACTIVITIES (2012).

Controlled activities – Guidelines for outlet structures on waterfront land

These guidelines relate to the design of stormwater outlets and spillways from infrastructure including roads, buildings, constructed basins/wetlands, swales or other drainage works into a watercourse or waterfront land.

Outlet structures on waterfront land are a controlled activity under the *Water Management Act 2000* (WM Act). The Department of Planning and Environment administers the WM Act and is required to assess the impact of any proposed controlled activity to ensure that no more than minimal harm will be done to waterfront land as a consequence of carrying out the controlled activity.

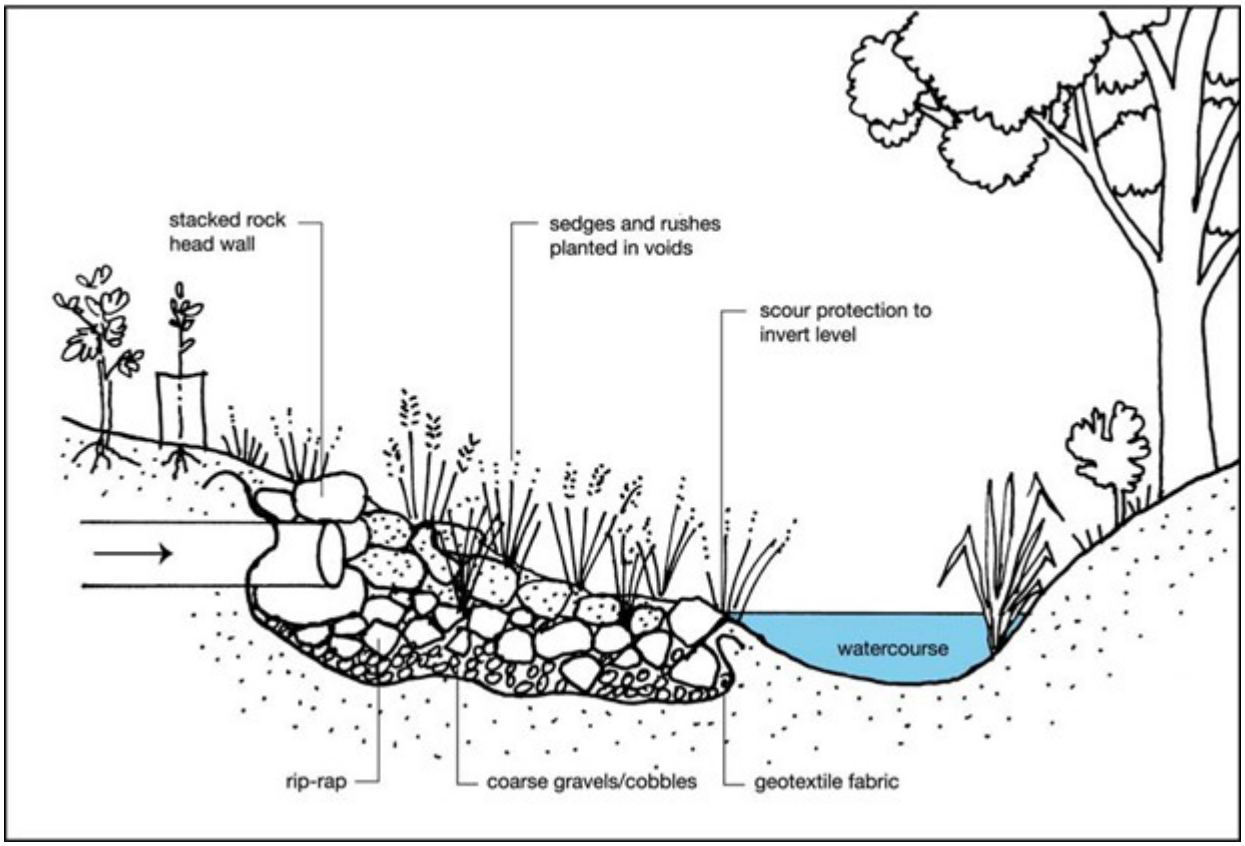
Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary.

This means a controlled activity approval must be obtained from the department before commencing the controlled activity.

Aims and objectives for outlet structures

The design and construction of stormwater outlets should aim to be natural yet provide a stable transition from a constructed drainage system to a natural flow regime as seen in Figure 1.

Figure 1: Natural outlet structure



INT22/159009

The design and construction footprint and extent of disturbance within the riparian corridor should be minimised even allowing for the intended discharge function to be achieved. Refer to the department's Guidelines for riparian corridors.

All ancillary drainage infrastructure, such as oil or grease interceptors, sediment and litter traps, constructed wetland, detention basins or any works requiring ongoing access or maintenance should be located outside the riparian corridor or in accordance with the department's guidelines for riparian corridors.

Water run-off from the site should be of appropriate quality and quantity before being discharged into a riparian corridor or watercourse.

Appropriate rehabilitation of disturbed areas following the installation of outlet structures should adequately restore the integrity of the riparian corridor.

Considerations in the design and construction of outlet structures

The design and construction of outlet structures should consider, but not be limited to, the following:

- Define the infrastructure route and identify the specific point of discharge. Where possible select a route along an existing cleared or disturbed area that avoids trees, preferably beyond their drip line.
- Choose a stable section of the stream for the discharge point, preferably mid-way between bends. Alternatively, incorporate outlet discharge points into disturbed/eroded areas which are to be stabilised or rehabilitated.
- Minimise construction footprint and proposed extent of disturbance to soil and vegetation within the watercourse or waterfront land.
- Demonstrate that changes to the hydrology of the receiving watercourse have been assessed and there is no detrimental impact on discharge volumes and channel velocities. Discharge velocities and flow rates should mimic natural flows and not initiate erosion.
- Discharge from an outlet should not cause bed or bank instability.
- Protect the bed of the watercourse below the outlet if not bedrock, or if bed scour is likely. Consider bank material and outlet jet effect and protect the opposite streambank if required.
- Point outlet structure and direct discharge downstream.
- The outlet should not protrude beyond the streambank but tie in with the adjoining bank alignment.
- Calculate tractive stresses generated from outlet discharges and from bank full discharges to determine appropriate rock size requirements for the structure.
- Rock rip-rap is the preferred material to provide a natural outlet. Rip-rap should extend for the full extent of the design scour apron and adjoining flanks/streambank. Rip-rap must be appropriately keyed in to withstand the velocities of runoff or discharge from the site and cut-off trenches should be provided where necessary.

- Rip-rap should consist of durable, angular run-of-quarry rock placed over a bedding layer of angular cobbles over geotextile. Where possible, incorporate vegetation such as sedges and rushes into scour management as Figure 1 for further stability.
- Grade scour apron to bed level of the watercourse or just below any permanent water created by any stable feature such as a rock bar within the watercourse.
- Stabilise and rehabilitate all disturbed areas including topsoiling, revegetation and regeneration, mulching, weed control and maintenance.

Information to be submitted for assessment

When seeking approval to outlet structures across a watercourse or waterfront land, the department will rely on the above information to undertake its assessment and to determine if the activity should be approved. All works and activities within watercourses should be designed by suitably qualified persons.

Additional information needed may include:

- detailed design drawings such as a surveyed plan, cross sections across the watercourse and a long section of the watercourse showing proposed works relative to existing and proposed bed and bank profiles and water levels. The cross-section is to extend to the landward limit of the identified riparian corridor. All plans must include a scale bar
- detailed plans showing the location, plan, plan view, elevation view and cross-section of the proposed outlet structure
- detailed plans of any permanent bed and bank stabilisation works for scour protection.
- a sediment and erosion control plan
- detailed report of pre- and post-construction hydraulic, hydrologic and geomorphic conditions
- photographs of the site should be supplied. To assist with future monitoring and reporting, all photo points should be identified by GPS coordinates or by survey, particularly for large-scale earthworks or extractive industries
- a vegetation management plan prepared in accordance with the department's guidelines for vegetation management plans
- a site management plan incorporating a works schedule, sequence and duration of works, contingencies such as in case of flooding, erosion and sediment controls and proposed monitoring and reporting periods
- costing of all works including materials and labour and stages of works including outlet structure installation and rehabilitation
- copies of other relevant approvals, for example development consent.

Maintenance period

Applicants may need to allow for a minimum maintenance period of 2 years after practical completion of each stage or until the site is stable. The maintenance period will depend on the

scope, size and level of risk. Engineering certification may be required at the end of the maintenance period. Maintenance until stable includes sediment and erosion control; the replacement of any works, vegetation or areas damaged or destroyed by flows and flooding or vandalism; and any other requirements necessary to ensure a naturalised stable watercourse system is functioning by the end of the maintenance period.

Security deposit may be required

Applicants should note that if the likelihood of significant impact on the watercourse or waterfront land is identified, security (as bank guarantees) may be required before the controlled activity is commenced. The amount of security is usually based on the costings provided.

More information

- For more information about controlled activities on waterfront land, visit the department's website at water.dpie.nsw.gov.au/licensing-and-trade/approvals.
- Copies of the Acts and associated regulations are available on the NSW Government legislation site at www.legislation.nsw.gov.au.

If you think you need to make a controlled activity application, our easy-to-use online support tool Water Assist can help you. Visit www.dpie.nsw.gov.au/water/water-assist.

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