

Flood Risk Assessment and Flood Emergency Response Plan

120 Carrs Drive, Yamba, NSW



Final Report

P229302JR01V01

February 2024

Prepared For Clifton Yamba Land Pty Ltd

Project Details

Report Title	Flood Risk Assessment and Flood Emergency Response Plan: 120 Carrs Drive, Yamba, NSW
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Document History

Issue	Issue Date	Status	Description / Comment	Author	Reviewer	Approved
1	20/02/2024	Final	Development Application	RD	SL / DM	SL

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Executive Summary

Martens & Associates Pty Ltd (**MA**) have prepared this flood risk assessment and flood emergency response plan (**FERP**) to support a development application (**DA**) for a proposed manufactured housing estate (**MHE**) development and communal facilities at 120 Carrs Drive, Yamba, NSW (the **site**). The FERP has been prepared to minimise exposure to flood risks at the site to acceptable levels, as summarised below:

1. The development is a manufactured housing estate and will be managed by the owner/operator who will implement in perpetuity the FERP and its requirements.
2. The site may become isolated for up to approximately 8 days in very rare extreme flood events. However, there will be sufficient warning time for all flood events, ensuring complete evacuation of the site either towards Maclean/M1 or to the Yamba Bowling Club, considering the minimum warning times of approximately 6 hours and 22 hours.
3. A community refuge building, situated above the Probable Maximum Flood (**PMF**) level documented in 2013, will be equipped with adequate resources to facilitate 'shelter in place' for any occupants who were unable to leave the site before or during a flood event.
4. The owner/operator will install and operate flood risk management measures including provision of flood risk awareness information, flood level indicators, informative signs, and a flood warning device, in addition to a public address and alarm system to co-ordinate site flood response.
5. Flood wardens will be appointed by the owner/operator and will be trained to monitor floods, manage responses, and ensure maximum evacuation opportunities for site occupants during extreme flooding, in addition to SES services.

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Glossary of Terms

AEP	Annual exceedance probability: the probability of a flood event occurring within a year. A 1% AEP flood has a 1% chance of occurring in any given year.
ARI	Average recurrence interval: the average time between flood events occurring. A 1 in 100 year ARI flood occurs on average once every 100 years.
ARR	Australian Rainfall & Runoff
BoM	Bureau of Meteorology
Council	Clarence Valley Council (CVC)
DA	Development Application
DCP	Development Control Plan
FERP	Flood emergency response plan
FFL	Finished floor level
FLI	Flood Level indicator
FPL	Flood Planning Level
LEP	Local Environmental Plan
MA	Martens & Associates Pty Ltd
PMF	Probable maximum flood: the most extreme flood event possible for a certain location, with an approximate ARI of 100,000 to 10,000,000 years.
SIP	Shelter-in-place

1 Introduction

1.1 Overview

Martens & Associates Pty Ltd (**MA**) have prepared this flood risk assessment and flood emergency response plan (**FERP**) to support a development application (**DA**) for a proposed manufactured housing estate (**MHE**) development and communal facilities at 120 Carrs Drive, Yamba, NSW (the **site**). Refer to Appendix A for the proposed site layout.

1.2 Project Scope and Objectives

Project scope and objectives are:

1. Review and assess site conditions, available flood data and flood risks at the site.
2. Prepare a FERP that guides flood risk management for the site including:
 - a. Flood warning mechanisms and flood engineering controls.
 - b. Details of shelter-in-place (**SIP**) and / or evacuation requirements.
 - c. Details of roles and responsibilities.
 - d. Flood response phases and triggers.

1.3 Relevant Guidelines

This report has been prepared in accordance with the following guidelines and policies:

1. Clarence Valley Council (2011a), *Clarence Valley Development Control Plan (DCP)*.
2. Clarence Valley Council (2011b), *Clarence Valley Local Environmental Plan (LEP)*.
3. Commonwealth of Australia (2019), *Australian Rainfall and Runoff – A Guide to Flood Estimation*.
4. NSW Department of Infrastructure, Planning and Natural Resources (2005), *Floodplain Development Manual*.
5. NSW Department of Planning and Environment (2023), *Flood Risk Management Manual*.
6. NSW State Emergency Service (2017), *Clarence Valley Flood Emergency Sub Plan*.

2 Site Description & Background Data

2.1 Location and Site Description

A summary description of the site in its existing conditions is provided in Table 1

Table 1: Existing site description summary.

Item	Description
Address	120 Carrs Drive, Yamba, NSW
Lot / DP	Lot 2 in DP733507, Lot 32 in DP1280863
Site Area	Approximately 18 ha
Local Government Area (LGA)	Clarence Valley Council (CVC)
Current Land Use	Rural residential
Current Zoning	R1 – General Residential, C3 – Environmental Management & C2: Environmental Conservation
Site Description	Lot 32 (DP128063) in the centre east of the site is comprised primarily of marinated grass areas with some scattered trees. Lot 2 (DP733507) is comprised primarily of dense bushland and shrubland with an existing residential dwelling surrounded by maintained grass areas in the southeast corner of the site and includes a driveway connecting to Carrs Drive. There is an approximately 935 m long drainage channel that runs westwards from the centre of the site's eastern boundary, along its southern boundary to Oyster Channel.
Surrounding Land Uses	The site has an eastern frontage with Carrs Drive and a western frontage with Oyster Channel. There is an existing residential lot adjacent to the sites northeast corner and rural residential properties to the south and southeast of the site. The site is located within the West Yamba Urban Release Area (WYURA) and has a northern frontage with an under-construction MHE to its north. A partially approved low density residential development is located east of the site which contains a reserved floodway area adjacent to Carrs Drive opposite the site.
Site Elevation	Approximately 0.1 mAHd at southwestern site boundary rising to 1.5–2.0 mAHd at the eastern site boundary.
Site Grading & Aspect	Approximately 0.2%, WSW aspect
Site Drainage	The site drains to the west to Oyster Channel via local depressions and the existing drainage channel within the site. During high tides, Oyster Channel flows can reverse flows in the drainage channel, traveling eastwards until they combine with westward traveling flows from the floodway area to the east of the site which also originate from Oyster Channel.

2.2 Previous Flood Studies

A review of previous flood investigations was undertaken to assess likely local flood behaviour and characteristics for the site and the Clarence River catchment. Our review identified four previous flood studies which would be relevant to this assessment.

2.2.1 BMT WBM (2013) Lower Clarence Flood Model Update 2013

BMT WBM conducted a flood assessment for the lower portion of the Clarence River catchment on behalf of CVC, and summarised the assessment in the report *Lower Clarence Flood Model Update 2013*, hereafter referred to as the **2013 flood study**. As part of their study, BMT WBM used TUFLOW for hydraulic modelling with a multiple domain setup consisting of 10 m, 30 m, and 60 m topographic grids to model the lower approximately 500 km² portion of the Clarence River catchment including the towns of Grafton, MacLean and Yamba for the 20%, 5%, 2%, and 1% AEP flood and PMF ('extreme flood') events.

2.2.2 BMT (2022) 120 Carrs Drive, Yamba, Regional Flood Impact Assessment

BMT conducted a flood assessment for the Clarence River catchment on behalf of Clifton Yamba Land Pty Ltd ATF Yamba Land Trust and summarised the assessment in the report *120 Carrs Drive, Yamba, Regional Flood Impact Assessment* (2022), hereafter referred to as the **2022 FIA**. As part of their study, BMT utilised a truncated version of the 2013 TUFLOW model which adopted TUFLOW's 'Quadtree' feature to simulate 2.5 m, 10 m, and 40 m topographic grids and included details of model inputs and results.

The 2022 FIA PMF results data has been provided to MA by BMT. The PMF level of 3.9 mAHd based on the 2013 extreme flood event has been used as the planning level for flood safe refuge above the PMF in accordance with Council's DCP.

2.2.3 BMT (2023) Lower Clarence Flood Model Updated 2022

BMT conducted a flood assessment for the Clarence River catchment on behalf of CVC and summarised the assessment in the report *Lower Clarence Flood Model Update 2022*, hereafter referred to as the **2022 flood study**. As part of their study, BMT updated the TUFLOW hydraulic model used as part of the 2013 flood study including:

1. Changes to TUFLOW model software and schematisation adopting a variable 'Quadtree' mesh with grid cell sizes of 20 m for rural areas, and 10 m for urban areas and key topographic features within the floodplain.
2. Revision of 2013 tidal storm surge boundary conditions and climate change scenarios.
3. Addition of the 0.2% and 0.5% AEP flood events along with the events modelled in the 2013 study.
4. Revision of the PMF ('extreme flood event') adopting a 1% AEP scaling factor of 3.00 over the 2013 factor of 1.53.

We note that 2022 flood study was adopted by Council on 27 June 2023 following the submission of this MHE development application, which was lodged on 4 May 2023. Based on this, we understand that whilst the 2022 flood study results do not apply to this application, the client has agreed to meet several development criteria for flooding detailed in Council's RFIs sent to the client on 22 June 2023 and 25 October 2023.

2.2.4 BMT (2024) 120 Carrs Drive Yamba Flood Impact and Risk Assessment

BMT conducted a flood assessment on behalf of Clifton Yamba Land Pty Ltd and summarised the assessment in the draft report *120 Carrs Drive Yamba Flood Impact and Risk Assessment* (2024), hereafter referred to as the **2024 FIA**. As part of their study, BMT utilised the updated Lower Clarence TUFLOW model (2022) and undertook the following:

1. Updated the 2022 TUFLOW model surface by adding additional detail in the vicinity of West Yamba including extending the Yamba 10m grid to cover the WYURA and adding a higher resolution grid (2.5 m) over key features such as Carrs Drive, and Miles Street.
2. Assessed flood impacts for the post-development scenario for the entire WYURA compared with pre-development flood conditions.
3. Assessment was conducted for the 10%, 5%, 1%, 0.5%, 0.2% AEP and Probable Maximum Flood (PMF) events, and the 1% AEP 2100 Climate Change event.
4. The study identified no adverse changes to flow velocity, flood hazard, or duration and frequency of inundation as a result of the proposed development.

BMT have provided to MA the 2024 study flood results including the 2% AEP flood event for the pre and post development scenarios. MA have relied on this data for hydraulic comparison purposes and design of site flood emergency management and response procedures.

MA has conducted a comprehensive review of this flood impact assessment and supports the conclusion that the proposed development will not result in significant adverse changes in flow velocity, flood hazard category, duration, and frequency of inundation throughout the study area. In summary, when assessing the Site individually and as part of the wider WYURA, an increase in flood levels ranging from 10 mm to 20 mm was identified on adjacent lots to the north and south during the 10% AEP event. However, these increases, occurring in areas already subject to inundation, do not extend the overall flood extent, nor within the residential area, therefore having limited significance on the adjoining lots. The assessment also found no significant change in flood hazard categories pre- and post-development across all modelled events.

During the PMF event, observed changes included a 10 to 20 mm rise in water levels on southern adjacent lots and a similar reduction northeast of the Site, which are both considered to be minor and not significant given that the PMF informs flood emergency planning, with no alterations in flood hazard categories noted due to the high existing flood depths (over 6m in depth) in the PMF scenario. Further comparative analysis between a fully developed WYURA with and without the development at the Site indicated no other incremental effects on the cumulative flood behaviour due to the proposed Site development.

2.3 Proposed Development

Proposed site layout and is provided in Appendix A and grading design in Appendix B. The proposed development is summarised as follows:

1. Construction of 216 manufactured homes, parking, pedestrian pathways, security fencing and landscaping.
2. Proposed dwellings' finished floor levels (**FFLs**) range from 3.5 mAHD at the western site boundary to 4.1 mAHD at the northeastern site boundary, all above the flood planning level (**FPL**) of 3.5 mAHD.
3. Construction of a community refuge building ('club house') with an FFL of 4.1 mAHD including lawn bowls facility, café, lounge, and nurses' room.
4. Construction of internal circulation roads with elevations ranging from approximately 3.2 mAHD in the west of the site to 4.0 mAHD in the north of the site.
5. Construction of driveway access with Carrs Drive in the southeast of the site.
6. Construction of a drainage channel through the southeast of the site and along the southern boundary.

2.4 Water Level gauges

Several water level gauges operated by Manly Hydraulics Laboratory (**MHL**) are strategically positioned throughout the lower Clarence River catchment area. These gauges are used to monitor flood levels and aid in flood forecasting and emergency response planning.

The locations of key gauges near the site are shown in Figure 1, including water level gauges at Maclean (Station no. 204410), Palmers Island (204426), and Oyster Channel (204451), and a tidal gauge at Yamba (204454), with the Oyster Channel gauge being the nearest to the Site.

The Maclean gauge serves as the primary reference for flood warnings and forecasts on the Lower Clarence River, based on specific gauge height values for flood level classifications. The flood water level and warning timing from this gauge have been relied upon in the assessment for evacuation and emergency response of the site.



Figure 1: Location of water level gauges

3 Site Flood Characteristics

3.1 Overview

We note the following regarding the catchment upstream of the site and flood mechanisms:

1. The site is located within the Clarence River catchment, with a total area of approximately 22,700 km², and is primarily bushland, rural, and rural residential areas, with a small number of urban areas including the towns of Yamba, Grafton, and Maclean.
2. The primary source of site flooding is overbank flows from the Oyster Channel to the west of the site which propagate eastwards via the site drainage channel until combining with westwards flows from the floodway east of the site which also originate from Oyster Channel southeast of the site.
3. The site is also affected by ocean storm tides causing upstream flows to back up onto the site via the Oyster Channel.

3.2 Design Flood Levels

Based on the BMT 2024 flood results, design flood levels at the site and Maclean gauge are detailed in Table 2. The proposed FPL of 3.5 mAHd is determined to be 500 mm above the 1% AEP flood level with climate change at 3.0 mAHd.

Table 2: Design flood levels.

Event	Flood Level @ Site (mAHd)	Maclean Gauge Level (mAHd)
20% (5 year)	1.00 ¹	2.41 ³
10% (10 year)	1.16 ²	2.95 ²
5% (20 year)	1.37 ²	3.18 ³
2% (50 year)	1.93 ²	3.41 ³
1% (100 year)	2.07 ²	3.55 ³
1% (100 year) with climate change	3.00 ²	4.02 ³
0.5% (200 year)	2.25 ²	3.69 ³
0.2% (500 year)	2.43 ²	3.85 ³
PMF / 2013 PMF	7.16 ² / 3.90 ⁴	8.72 ³

1. Based on BMT 2022 Flood Levels from Council online maps.
2. Based on BMT 2024 120 Carrs Drive FIA flood model results.
3. Based on BMT 2022 Flood Report.
4. Based on BMT 2022 120 Carrs Drive FIA.

We make the following comments in relation to the design flood levels based on BMT 2024 flood results:

1. The majority of the proposed development, elevated at or above the FPL of 3.5 mAHD, would remain flood-free up to an event between the 0.2% AEP (500 year ARI) to 0.2% AEP (2,000 year ARI).
2. In the PMF event, the site and its surrounding areas would be inundated by high hazard floodwaters with a peak flood level of 7.2 mAHD, and flood depths could reach up between 3.2 m and 4.0 m across the developed portion of the site.
3. The site and Yamba area can become isolated from Maclean and the M1 in flood events more frequent than the 20% AEP (5 year ARI) flood. Refer to Section 4.2 for more details.
4. The site can become isolated from the Yamba township in flood events between the 5% AEP (20 year ARI) and 2% AEP (50 year ARI) flood events. Refer to Section 4.2 for more details.
5. In the PMF event, the site may become isolated for up to approximately 8 days. Refer to Section 4.2 for more details.

4 Evacuation Assessment

4.1 Overview

There are two evacuation routes identified for the site which are detailed in the following sections.

4.1.1 Evacuation Route 1 - Out of Yamba to Maclean or M1

4.1.1.1 Evacuation Destinations

Evacuation Route 1 (refer to Figure 2) is designated for site occupants who wish to leave Yamba or require medical attention and need to go to Maclean District Hospital, which is the nearest hospital and emergency medical facility to the site.



Figure 2: Evacuation route 1 from site to Maclean District Hospital (Google Maps, 2023)

4.1.1.2 Route Description and Travel Time

The route from the site to Maclean District Hospital goes north via Carrs Drive, west via Yamba Road, and then east via Union Street. The total length of the route is approximately 17.1 km, with an anticipated travel time of around 18 minutes under typical traffic conditions.

4.1.1.3 Low Point

A low point along this evacuation route, which is the first to become inundated during a flood event, has been identified on Yamba Road adjacent to Palmers Channel South Bank Road, at an elevation of 1.75 mAHd.

4.1.2 Evacuation Route 2 - Site to the Yamba Bowling Club

4.1.2.1 Evacuation Destination

Evacuation Route 2 (refer to Figure 3) is designated for site occupants to evacuate to the Yamba Bowling and Recreation Club located in the east part of Yamba on the southern headland, this is the main area of flood-free land above the 2013 PMF for the site. It serves as the primary evacuation centre as outlined in the Clarence Valley Local Flood Plan (SES, 2017).

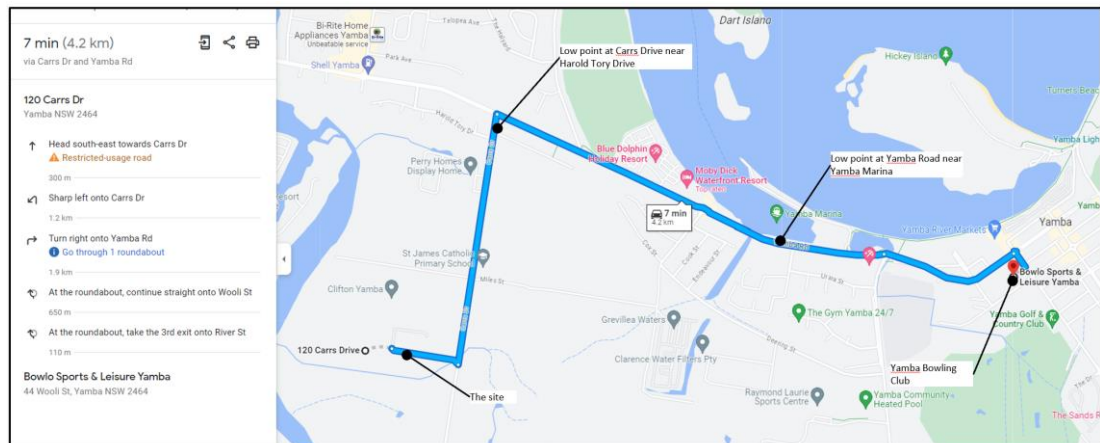


Figure 3: Evacuation route 2 from the site to Yamba Bowling Centre (Google Maps, 2023).

4.1.2.2 Route Description and Travel Time

This route leads from the site to the Yamba Bowling Club, heading north via Carrs Drive, turning east onto Yamba Road, continuing east through Woolli Street, and finally southeast onto River Street. The route has a total length of approximately 4.2 km, with an anticipated travel time of roughly 7 minutes under typical traffic conditions.

4.1.2.3 Low Point (s) Along the Route

The 2011 Clarence Valley Council Residential Zones Development Control Plan (**DCP**) identifies Carrs Drive as a primary access and evacuation route for the West Yamba Urban Release Area (**WYURA**) leading to the Yamba township. The DCP requires that as part of development, WYURA developments along Carrs Drive are to upgrade the road level to a minimum elevation of 1.7 mAHD (BMT 2013 20 year ARI flood level).

However, two low points below the 1.7 mAHD threshold have been identified along this route: one at the northern end of Carrs Drive near Harold Tory Drive (just outside the WYURA's northern boundary) and another on Yamba Road near the Yamba Marina. There is no confirmation on whether Council plans to elevate these points. As a conservative approach this assessment has adopted the current elevations of 1.30 mAHD at Carrs Drive near Harold Tory Drive and 1.50 mAHD at Yamba Road near the Yamba to evaluate evacuation warning times and inundation duration.

4.2 Duration of Isolation

According to the flood hazard classification scheme developed by Smith *et al* (2014) and subsequently adopted by the Australian Institute for Disaster Resilience (2017) and the NSW Department of Planning and Environment (2022), the depth at which flood waters become unsafe for large vehicles where flow velocity is ≥ 2 m/s is 0.3 m (hazard greater than H2, in). Where velocities are ≤ 1 m/s, small vehicles are capable of traversing through flood water of 0.3 m. On this basis, a floodwater depth of 0.3 m has been adopted as the upper threshold for road cutoff effectiveness.

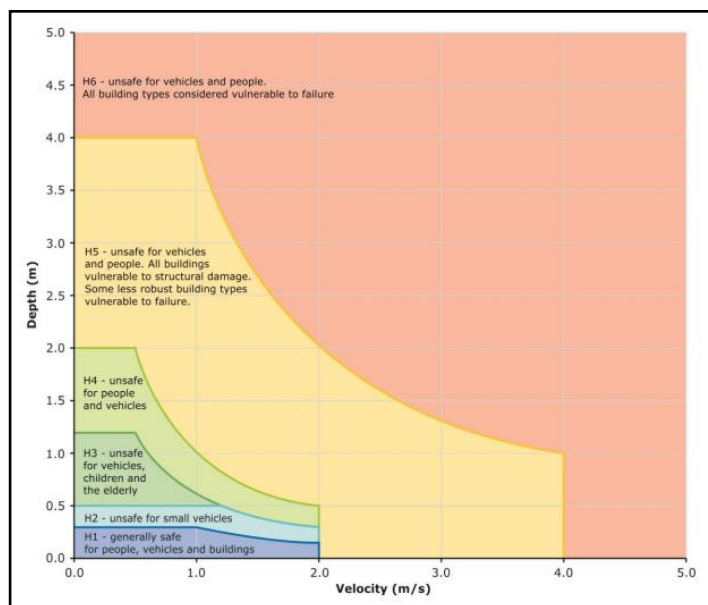


Figure 4: Flood hazard classification scheme, Smith *et al* (2014).

The potential cutoff duration for the evacuation routes during flood events was determined using time-series flood results from BMT (2024) for the post-developed scenario. Cut off times and durations for both evacuation routes are summarised in and , which indicate:

1. Evacuation Route 1: The site and Yamba would not be able to evacuate to Maclean or M1 for approximately 3 to 4 days for events between the 10% AEP and 5% AEP floods. For events larger than the 0.2% AEP, the site and Yamba would be isolated for more than 6 days.
2. Evacuation Route 2: The site would not be able to evacuate to the Yamba Bowling Club for 2 to 3 days for events between the 2% AEP and 0.2% AEP floods. The site could be isolated for up to 8 days in the PMF event.

Table 3: Evacuation Route 1 (to Maclean or M1) cut off time and duration.

Event	Yamba Road near the Palmers Channel South Bank Road intersection		
	Start time (hrs) of road cutoff	End time (hrs) of road cutoff	Cut-off Duration (days)
10% AEP	38.9	108.3	2.9
5% AEP	35.3	131.6	4.0
2% AEP	28.1	145.0 ¹	4.9
1% AEP	27.3	154.0 ¹	5.3
0.5% AEP	26.0	157.0 ¹	5.5
0.2% AEP	24.1	160.0 ¹	5.7
PMF	16.0	225.0 ¹	8.7

1. Inundation end times greater than 140 hours were estimated based on extrapolation of BMT (2024) timeseries data which only induced the first 140 hours of the design flood events.

Table 4: Evacuation Route 2 (to Yamba Bowling Club) cut off time and duration.

	Carrs Drive near Harold Tory Drive			Yamba Road near Yamba Marina		
Event	Start time (hrs) of road cutoff	End time (hrs) of road cutoff	Duration (days)	Start time (hrs) of road cutoff	End time (hrs) of road cutoff	Duration (days)
10% AEP	N/A	N/A	N/A	N/A	N/A	N/A
5% AEP	N/A	N/A	N/A	N/A	N/A	N/A
2% AEP	66.4	123.0	2.4	65.6	94.8	1.2
1% AEP	65.6	132.4	2.8	65.3	118.6	2.2
0.5% AEP	64.3	135.4	3.4	64.8	119.3	2.3
0.2% AEP	58.2	141.0 ¹	3.5	64.4	119.9	2.3
PMF	28.1	215.0 ¹	7.8	36.7	205 ¹	7.0

1. Inundation end times greater than 140 hours were estimated based on extrapolation of BMT (2024) timeseries data which only included the first 140 hours of the design flood events.

4.3 Evacuation Warning Time

The Bureau of Meteorology advise the following target warning lead times for trigger water levels at the Maclean Gauge:¹

1. 6 hrs for flood waters expected to exceed 2.2 mAHD.
2. 24 hrs for flood waters expected to exceed 3.3 mAHD.

Evacuation warning times were calculated based on the above warning lead times for trigger water levels at the Maclean gauge. The warning times for both evacuation routes for each storm event are outlined in Table 5 and Table 6.

Table 5: Evacuation warning time for Evacuation Route 1.

Event	Time when Maclean Gauge exceeds 2.2 mAHD (hrs)	Time SES Warning Issued (hrs) ¹	Start time (hrs) of road cutoff ²	Warning Time (hrs)
10% AEP	39.8	33.8	52.1	18.4
5% AEP	35.1	29.1	41.3	12.3
2% AEP	29.6	23.6	37.9	14.4
1% AEP	28.3	22.3	32.3	10.0
0.5% AEP	26.9	20.9	16.8	8.7
0.2% AEP	25.4	19.4	29.6	9.0
PMF	17.4	11.4	28.4	6.3

1. Time when warning would be issued by BoM based on the warning lead time to the trigger water level at

¹ Based on BoM (2013) *Service Level Specification for Flood Forecasting and Warning Services for New South Wales and the Australian Capital Territory – Version 3.13*.

MacLean (i.e. 6 hours before water level of 2.2 mAHD and 24 hours before water level of 3.3 mAHD).

- Based on BTM 2024 results, time when the evacuation route low point (Yamba Road near the Palmers Channel South Bank Road intersection) is cut-off by flood water (0.3 m depth).

Table 6: Evacuation warning time for Evacuation Route 2.

Event	Time when Maclean Gauge exceeds 3.3 mAHD (hrs)	Time SES Warning Issued (hrs) ¹	Time Evacuation Route Cut-off (hrs)	Warning Time (hrs)
10% AEP	N/A	N/A	N/A	N/A
5% AEP	N/A	N/A	N/A	N/A
2% AEP	66.1	42.1	65.6 ²	23.6
1% AEP	61.2	37.2	65.3 ²	28.1
0.5% AEP	56.7	32.7	64.3 ³	31.6
0.2% AEP	54.0	30.0	58.2 ³	28.2
PMF	29.6	5.6	28.1 ³	22.4

- Time when warning would be issued by BoM based on the warning lead time to the trigger water level at MacLean (i.e. 6 hours before water level of 2.2 mAHD and 24 hours before water level of 3.3 mAHD).
- Time evacuation route cut-off by flood water at Yamba Road near Yamba Marina.
- Time evacuation route cut-off by flood water at Carrs Drive near Harold Tory Drive.

These tables indicate that the PMF event produces the shortest warning times before evacuation route cut-off for both evacuation routes with warning times of **6.3 hours for Evacuation Route 1** (to Maclean District Hospital and M1) and **22.4 hours for Evacuation Route 2** (to the Yamba Bowling Club).

4.3.1 Estimated Time Required for Off-Site Evacuation

The time required (**TR**) for evacuation was determined based on the SES Timeline Evacuation Model (TEM, Molino et al, 2013) where:

$$\mathbf{TR = WAF + WLT + TT + TSF}$$

MA adopted values were determined as follows:

- Warning Acceptance Factor (**WAF**):
 - 1 hour as recommended by SES.
- Warning Lag Time (**WLT**):
 - 1 hour as recommended by SES.
- Travel Time (**TT**):
 - 0.12 hours based on the approximately 7 minutes drive to Yamba Bowling Club.

- 0.3 hours based on the approximately 18 minutes drive to Maclean District Hospital.
4. Traffic Safety Factor (**TSF**):
- As recommended by SES for an evacuation route with a journey time of up to 3 hours, the TSF is determined to be 1 hour for both evacuation routes, as the TT of both routes is less than 3 hours.

Based on the above, the time required (TR) for the two evacuation routes are as follows:

1. TR for Evacuation Route 1 to Maclean / M1= 3.12 hours
2. TR for Evacuation Route 2 to Yamba Bowling Club= 3.3 hours

4.3.1.1 Allowance for Internal Vehicle Traffic Movement

Additional time has been allowed for to accommodate internal vehicle traffic movements in the event that all vehicles attempt to leave in quick succession. On the basis of an estimated maximum 378 people on site (refer to section 5.2) with 1 vehicle each, and a rate of 600 vehicles per hour,² it may take up to 40 minutes for all vehicles to exit the site.

4.3.1.2 Total Evacuation Time:

The total time required for evacuation is the TR plus the site internal vehicle movement time are provided below for both evacuation routes:

1. Total time required for Evacuation Route 1 to Maclean / M1= 3.78 hours (< minimum warning time of 6.3 hours))
2. Total time required for Evacuation Route 2 to Yamba Bowling Club= 3.96 hours (< minimum warning time of 22.4 hours)

Therefore, there will be sufficient warning time in all flood events to achieve full evacuation of the site for both evacuation to Maclean / M1 and to the Yamba Bowling Club considering the minimum (worst case) warning times of 6.3 hours and 22.4 hours.

² Adopting 600 vehicles per hour per lane of traffic (Molino *et al*, 2013).

5 Shelter-in-Place Assessment

5.1 Overview

Proposed dwelling FFLs are above the flood planning level at 3.5 mAHD (equivalent to approximately a 0.07% AEP (1500 year ARI) flood level), enabling site occupants to SIP in their homes as a flood emergency response for any people on site who were not evacuated prior to evacuation route inundation for flood events.

The proposed community refuge building (**CRB**) will be above the 2013 PMF level (3.9 mAHD) at 4.1 mAHD (equivalent to approximately a 0.03% AEP (3,000 year ARI) flood level) allowing any occupants on site to relocated from their residents and evacuate to the CRB where they can continue to SIP.

5.2 Community Refuge Building (CRB)

A community refuge building (**CRB**) has been included as part of the proposed development, which will be equipped with adequate resources for any site occupants needing to evacuate from their homes and who have not been able to leave the site before or during a flood emergency. The following features of the proposed CRB will enable site occupants to safely SIP:

1. Adequate space to allow for at least 25% of site occupants to SIP notwithstanding that the primary flood response would be to evacuate the area. The following is noted:
 - a. Based on the client's advice and assuming 1.75 people per lot, the maximum expected number of site occupants including visitors and staff is 378, based on the total number of proposed lots (216). The CRB will therefore provide shelter for at least 95 people.
 - b. The proposed architectural plans indicate a floor space of approximately 760 m² for the CRB, excluding bathrooms, changing rooms, and the kitchen. By adopting an area of 4 m² per person, this space could adequately accommodate SIP for 95 people.
 - c. This is considered adequate and conservative for SIP, considering that the occupants are expected to have been evacuated prior to isolation of the site.
2. Sufficient number of amenities including restrooms, showers and laundry facilities.
3. CRB will be appropriately stocked to accommodate at least 25% of site occupants for up to 10 days, including:
 - a. Food supplies including sufficient stock of non-perishable items.

- b. Adequate beds, bedding, and sleeping arrangements.
- c. Medical supplies.
- d. Cleaning and sanitary supplies.
- d. Backup power encase of a power outage.
- e. Water supply tank(s):
 - a. Suitable number of flood kits which are to include a first aid kit, portable radio and spare batteries, megaphone, torch and spare batteries, hi-vis vests.
- 4. The community refuge building will be designed such that all required services, food, water and emergency kits will be located above the 2013 PMF level.
- 5. Signage within the CRB will notify occupants not to enter flood waters and to stay within the building until flood waters have receded from outside the premises.

5.2.1 Rate of Evacuation to the Community refuge building

Rate of evacuation to the CRB is based on the following:

- 1. Evacuation to the CRB will be via a foot.
- 2. The maximum distance to the entrance of the CRB from a site lot is approximately 440 m.
- 3. SES recommended pedestrian evacuation walking speed is 2 km/hr.
- 4. Maximum time for a pedestrian to evacuate to the CRB from the furthest lot is therefore approximately 15 minutes.
- 5. Plus 1 hour for Flood wardens to notify site occupants.

Therefore, the rate of evacuation to the CRB for all site occupants is approximately 1.25 hours.

Rate of evacuation to the CRB only accounts for occupants without mobility issues or other issues that would prevent on foot evacuation within the 1.25 hour window. These occupants will need to be assisted by flood wardens via a shuttle service or other means before the evacuate to the CRB order is issued.

5.2.2 Draft Shelter-in-Place Guideline

The NSW Department of Planning and Environment (DPE) *Draft Shelter-in-Place Guideline* (2022) came off exhibition on 28 February 2023. We note that the draft guideline is not finalised nor is it adopted government policy. We have however considered the draft guideline for the sake of completeness. The SIP considerations are summarised in along

with a response to each. Table 7 demonstrates that all SIP considerations have been effectively addressed by this assessment.

Table 7: Consideration of NSW Draft Shelter-in-place Guidelines (2022).

Draft Shelter-in-Place Guideline Consideration	Compliance Assessment
<ul style="list-style-type: none"> The department proposes the following when considering whether to apply SIP controls, noting that evacuation off-site is always preferable. If this cannot be achieved, then SIP may be used if: <ul style="list-style-type: none"> The duration for flood inundation is less than six hours The development is not located in an area of high-risk (eg, floodways and H5 or H6 flood hazard areas) Access to on-site systems to provide power, water and sewerage services during and beyond the event for the full range of flooding The location of storage of food, water and medical emergency for SIP purposes should be above the PMF level and available during and beyond the event for the full range of flooding SIP floor level is above PMF SIP provides a minimum floor space per person SIP must be structurally safe and accessible during floods up to the PMF. Education is critical to ensuring that the community is aware of actions to be taken before, during and after SIP and the key triggers that require SIP. If SIP is proposed there needs to be ongoing community education campaigns for the areas where SIP will apply. 	<p>(1) As discussed in Section 4, an off-site evacuation route is available. SIP is only provided as a secondary flood response in the event that evacuation is incomplete.</p> <p>(2) Evacuation of the site is available and isolation should therefore not be likely. The provisions of a community refuge building above the 2013 PMF provides residents who have not evacuated an alternative to sheltering in their home.</p> <p>(3) Refer to BMT 2024 Flood Impact and Risk Assessment (not attached to this report) for the proposed development flood details and maps. BMT hydraulic model results demonstrate that the proposed buildings are not subject to high flood risk, as they are located outside of floodway and high flood hazard areas in all events up to and including the 0.2% AEP.</p> <p>(4) The community refuge ground floor is located above the 2013 PMF level.</p> <p>(5) The community refuge building will be designed such that all required services, food, water and emergency kits will be located above the 2013 PMF level.</p> <p>(6) Refer to point 5 above.</p> <p>(7) Refer to Point 4 above.</p> <p>(8) Refer to Section 5.2 .</p> <p>(9) The CRB will be constructed from flood compatible materials and will be design by a suitably qualified structural engineering to withstand flood forces including from debris in all floods up to and including the 2022 PMF.</p> <p>(10) As discussed in Section 6, the site will be managed, and part of the ongoing management will be to ensure there are sufficient flood wardens who will be trained in the execution of this FERP.</p>

6 Flood Emergency Response Plan (FERP)

6.1 Overview

This FERP makes recommendations, based on a review of available flooding information and applicable flood planning controls and guidelines, to ensure that in the event of a flood at the site, risk to personal safety and the environment is appropriately managed. The FERP provides strategic level advice and assumes that detailed design of various site controls will be undertaken prior to issue of construction certificate and implemented as part of the site's construction and on-going operation.

When extreme flood events occur at the site, the site will become isolated for several days. The site will become isolated in events greater than the 5% AEP flood due to inundation of the adopted evacuation route (refer to Section 4). In very rare extreme events, flood waters will inundate internal site roads isolating site occupants in their homes and may exceed ground floor levels of site dwellings. Therefore, the primary response is evacuation of people and vehicles from the site prior to a flood occurring.

Large scale regional flood events will be widely anticipated days in advance, which would enable sufficient warning time for residents to prepare to evacuate.

The secondary response in the event of an extreme flood would be for people to evacuate to the proposed site CRB which will act as a flood emergency shelter for site occupants to SIP (refer to Section 5). This would only be required if evacuation is incomplete and flooding approaches hazardous levels on the site.

Residents will occupy the site full time and we understand that there may be workers, contractors, or visitors on site at any time. If a flood warning is received, all non-residents should leave the site to return to their own residences (if safe to do so) or to evacuation centres. If it is unsafe to leave the site, non-residents can be accommodated in the CRB which includes a large lounge room, kitchen, café, and amenities.

6.2 Flood Warning Mechanisms

Monitoring weather forecasts and conditions near the site will help to manage the flood risk. A number of methods to monitor the risk of flooding are detailed in the following sections.

6.2.1 Bureau of Meteorology Warnings

The Bureau of Meteorology (BoM) generates a number of information sources useful for monitoring the weather forecast and conditions near the site:

1. Rainfall maps (<http://www.bom.gov.au/jsp/watl/rainfall/pme.jsp>) can be used to estimate the daily rainfall expected to occur over the next 24, 48, 72, and 96 hours as well as the total rainfall for the next 4 and 8 days.

2. Recent weather data for weather stations in the Northern Rivers region can be observed on the BOM website (<http://www.bom.gov.au/nsw/observations/nswall.shtml#NR>). Rainfall over the last 72 hours at hourly intervals can be observed by clicking on individual weather stations, and can be used to assess whether there has been recent heavy rainfall across the upstream catchment. Specifically, rainfall should be monitored for the Grafton Airport (058161) and Grafton AgRS (058077) weather stations.
3. Observed daily rainfall totals can be obtained from the BoM website for weather stations across the upstream Clarence River catchment (<http://www.bom.gov.au/climate/data/>). Rainfall data is typically updated once a day at 9am and includes the total rainfall over the previous 24 hour period (from 9am to 9am). Recorded rainfall for individual weather stations can be obtained by selecting a location within the upstream catchment and selecting a nearby weather station.
4. Occasionally BoM issues weather warnings for NSW via their website (<http://www.bom.gov.au/nsw/warnings/>). These warnings provide both general warnings across NSW and warnings for more specific locations. There are two types of warnings that may indicate that flooding is imminent for the site: severe weather warnings and severe thunderstorm warnings. Specifically, these warnings should be monitored for references to flooding in the Clarence River. Warnings are generally issued with up to 60 minutes notice, however for very large events (i.e. east coast lows), warnings may be issued with 24 hours' notice or more.
5. BoM may also issue a flood watch via their website (<http://www.bom.gov.au/nsw/warnings/>) and via the media. The Bureau will issue flood watches when the combination of forecast rainfall and catchment conditions indicates flooding is possible. Flood watches are issued to provide early advice to communities and emergency services about a potential flood threat from a developing weather situation. A flood watch is typically issued within 1 to 4 days before an anticipated flood event depending on the confidence in rainfall forecasts.
6. BoM may also issue a flood warning via their website (<http://www.bom.gov.au/nsw/warnings/>) and via the media. Flood warnings are issued for specific locations such as the Clarence River at Grafton or Maclean and will normally include predictions on the expected flood class (minor, moderate or major) with specific information on the height and time of water levels at that location. Flood warnings typically start with more generalised information with more specific quantitative (flood level and time) and qualitative (flood level or class) information provided as data becomes available. The target lead time for flood warnings to be issued for the MacLean gauge is 6 hours for floods expected exceed 2.2 mAHd, and 24 hours for floods expected to exceed 3.3 mAHd.
7. The radar service operated by BoM shows current rainfall location and intensity for Northern NSW (<http://www.bom.gov.au/products/IDR282.loop.shtml#skip>).

The responsible Flood Warden in charge will monitor the BoM website and media for heavy rainfall, weather warnings, flood watches, and flood warnings issued for the Clarence River. If any of these are issued the responsible Flood Warden in charge will undertake alert phase procedures detailed in Section 6.4.

6.2.2 Other Warnings

Site management will also be alerted to flood warnings via the following mechanisms:

1. The Clarence Valley Council Disaster Dashboard provides live information about disasters in the CVC LGA including flooding, bushfires, health events and road closures (<https://emergency.clarence.nsw.gov.au/dashboard/flood>). The Dashboard summarises emergency warnings from a range of services such as the SES, and BoM including social media posts.
2. SES emergency alert telephone warning system: <https://www.ses.nsw.gov.au/>
3. HazardWatch: <https://hazardwatch.gov.au/>
4. Police and / or SES door knocking.
5. Weather apps (e.g. 'Early Warning Network', 'Hazards Near Me NSW').

If site management, Flood Wardens or site occupants receive a flood warning via any of the mechanisms described above, they should undertake preparations to follow flood emergency procedures.

6.2.3 Flood Level Monitoring and Warning Devices

6.2.3.1 Maclean Flood Gauge

Water level recording equipment is currently installed on the Clarence River at Maclean. The gauge is managed by Manly Hydraulics Laboratory (MHL), which publishes the automatically collected water levels approximately every 15-30 minutes. Recent data is shown on the MHL website (<https://mhl.nsw.gov.au/Station-204410>).

The gauge indicates the following flood level alert classifications:

- Minor flooding 1.60 mAHD
- Moderate flooding 2.20 mAHD
- Major flooding 2.50 mAHD

The responsible flood warden will use the MHL website to monitor the Maclean (204410) water level station to be informed of any rise in water levels that may affect the site or the adopted evacuation route.

6.2.3.2 Flood Level Indicator

Flood level indicators (**FLIs**) are proposed to be installed at the site entrance, within the site drainage channel and other key locations around the site. During heavy rainfall events, site occupants and Flood Wardens can visually monitor for flood water and decide whether to evacuate to the community refuge building to SIP.

6.2.3.3 Flood Warning Device

An automatic flood warning device and water level gauge is to be installed adjacent to the site's western boundary with the purpose of continuously monitoring water levels within the Oyster Channel. The device will be connected to a digital app that Flood Wardens can access to obtain recently recorded river levels, and time estimates for when water levels may inundate Carrs Drive and/or the site. The device will provide automatic alerts to Flood Wardens in the event of a flood and will act as a backup to Maclean gauge monitoring and observation of flood conditions along the evacuation route (refer to Appendix E – Flood Warning Device Details for more details).

6.2.3.4 Flood Signage

Flood signage will be placed at the site entrance driveway to advise people not to enter flood waters if present on roads. Additional signage will be placed at key locations within the site to advise people of flood risks and to move to the community refuge building if floodwaters are observed on site.

6.3 Roles and Responsibilities

6.3.1 Site Operator / Manager

The managers of the site have the responsibility to implement and maintain the requirements of this FERP. Specifically, they are to ensure that:

1. FLIs and other flood related signage are maintained and legible at all times.
2. There is a functioning PA system, alarms, and flood warning device on site at all times.
3. The site PA system, alarms and flood warning device are tested at a minimum every 12 months.
4. A Chief Flood Warden is appointed.
5. The Chief and Deputy Chief Flood Wardens are trained in the application of the FERP, and the interpretation of rainfall and weather warning information published by BoM.
6. Provide a communication system (hardware and software) to the Chief and Deputy Chief Flood Wardens capable of sending bulk SMS messages to residents and workers.

7. The CRB is appropriately stocked to accommodate site occupants for up to a week, including food supplies, beds and bedding, suitable amenities, and medical supplies.
8. A suitable number of flood kits are kept at the community refuge building which are to include a first aid kit, portable radio and spare batteries, megaphone, torch and spare batteries, hi-vis vests.
9. The FERP is kept up to date.
10. The FERP is reviewed a minimum of every 5 years or following major flood events which trigger an emergency response.
11. The site is cleaned and checked following a flood event.
12. Sufficient financial resources are provided for the above.

Site management at its discretion may delegate some of the above tasks to the Chief Flood Warden or others. Site management will however remain legally responsible to ensure that these tasks are occurring.

6.3.2 Chief Flood Warden

The Chief Flood Warden will report to site management. It is anticipated that the site manager or similar will be the Chief Flood Warden. The Chief Flood Warden will:

1. Familiarise themselves with the FERP procedures.
2. Appoint a Deputy Chief Flood Warden(s) such that the Chief or a Deputy Chief Flood Warden is always on duty (but not necessarily on site).
3. Appoint a number of Flood Wardens such that a Chief, Deputy Chief, or Flood Warden is on site during all hours and there are sufficient flood wardens to carry out doorknocking and other flood emergency procedures in the event of a flood.
4. Organise training for themselves, the Deputy Chief Flood Warden, and Flood Wardens in the ongoing implementation of the procedures detailed in this FERP.
5. Ensure residents and site workers are educated in the flood risks and procedures associated with the site by distributing the Flooding Information Pamphlets (Appendix E) to new residents / workers and to all residents / workers once per year.
6. Monitor weather forecasts, weather warnings, flood warnings, media alerts, and MHL gauge levels daily.
7. A communication log including contact details for site occupants, emergency and other services is kept up to date and available to flood wardens.

8. Ensure any alerts received from the flood warning device, Early Warning Network app, BoM, SES, or otherwise are issued directly to the Chief Flood Warden, Deputy Chief Flood Warden, and Flood Wardens.
9. Ensure the flood response kits are equipped with all required equipment.
10. Keep hard and soft copies of this FERP on site and accessible to all Flood Wardens and staff.
11. Implement the procedures in this FERP in the event of a flood, including informing residents, workers, and visitors to the site.
12. Liaise with site occupants and emergency services in the event of a flood.
13. Direct the Deputy Flood Warden and other Flood Wardens to enact various aspects of this FERP as required.
14. Review the FERP at a minimum every five years or following flood events which trigger an emergency response.

6.3.3 Deputy Chief Flood Wardens

The Deputy Chief Flood Wardens will:

1. Familiarise themselves with this FERP and the procedures within it.
2. Follow the procedure within this FERP in the event of a flood.
3. Fulfil the role of the Chief Flood Warden in their absence.
4. Monitor weather forecasts, warnings, media alerts, and MHL gauge levels in the absence of the Chief Flood Warden.

6.3.4 Flood Wardens

The Flood Wardens will:

1. Familiarise themselves with this FERP and the procedures within it.
2. Follow the procedures within this FERP in the event of a flood.
3. Follow the directions of the Chief and Deputy Chief Flood Wardens, including directions in respect of flood risk management and FERP training.
4. Monitor weather forecasts, warnings, and flood levels on site in the absence of the Chief Flood Warden or Deputy Chief Flood Wardens.

6.3.5 Residents

Residents should maintain their flood preparedness at all times by ideally keeping a battery-operated radio, torch, spare batteries, non-perishable food, bottled water, and a week's supply of any prescription medications in their household.

Residents are to follow the directions of Flood Wardens and signage related to flooding during a flood event on site. If Flood Wardens have indicated that it is safe to leave the site residents may choose to leave the site if they wish.

During a flood which isolates the site, all residents on the site are to SIP in their residences or the CRB and follow the directions of site management, the Flood Wardens and signage related to flooding during a flood event on site.

6.3.6 Non-Residents (Workers / Contractors / Visitors)

During a flood, all non-residents on the premises are to follow the directions of site management, the Flood Wardens and signage related to flooding during a flood event on site. Non-residents should leave the site if Flood Wardens have indicated that it is safe to do so.

6.4 Flood Response Phases and Triggers

6.4.1 Overview

There are four flood response phases for flooding on the site:

1. **Prepared** – applies at all times.
2. **Alert** – this is triggered when there has been heavy rainfall or heavy rainfall is forecast, when a severe weather warning is issued indicating potential flooding in the Clarence River or at the site, and / or when a flood warning is issued for the Clarence River or Yamba areas.
3. **Respond** – this occurs when a flood response is triggered by one of several means indicating a flood is occurring or is likely to occur in the Yamba area.
4. **Recover** – this occurs following a flood response operation of any scale and lasts until operations have returned to normal.

Refer to Appendix C for the Flood Actions Checklist which details the four phases, actions and responsibilities, and Appendix D for the Flood Response Phases and Triggers diagram.

6.4.2 Prepared

During the prepared phase, recorded & forecast rainfall for the upstream catchment, warnings, media alerts, and Clarence River levels at the Maclean gauge are checked daily and the FERP arrangements are maintained including flood signage and FLIs. The bulk

SMS communication system, site alarm system, and flood warning device should be tested annually.

6.4.3 Alert

The alert phase is triggered by any of the following:

1. Heavy rainfall is forecast for the Clarence River catchment (200 mm or more in the next 24–72 hours).
2. BoM issues a severe weather warning with reference to potential flooding in the Clarence River or Yamba areas.
3. BoM issues a flood watch or flood warning for the Clarence River.
4. SES or other emergency service issues a flood or evacuation warning for the Clarence River or Yamba areas.

In the alert phase, warnings, media alerts, Oyster Channel levels, Clarence River levels, and information on road conditions along the adopted evacuation routes are monitored every 2 hours. Monitoring is conducted until warnings have been rescinded and BoM advises that heavy rainfall has passed.

6.4.4 Respond

The respond phase is triggered by any of the following:

1. BoM or SES issue a flood alert indicating moderate flooding is expected for the Clarence River at Maclean and / or Clarence River levels at Maclean are expected to exceed or peak at 2.2 mAHD.
2. BoM or SES issue a flood alert indicating Clarence River levels at Maclean are expected to exceed 3.3 mAHD.
3. SES issues an evacuation order which covers the site.
4. The flood warning device issues an alert indicating the site is likely to be isolated by flood waters.
5. FLI's indicate site flood levels are approaching hazardous levels.

In the respond phase, warnings, and media alerts, are monitored every 2 hours, and Oyster Channel and Clarence River levels are monitored every hour. Monitoring is conducted until warnings have been rescinded and BoM advises that heavy rainfall has passed.

In the respond phase, the Chief or Deputy Chief flood warden will:

1. If BoM or SES issue a flood alert indicating moderate flooding is expected for the Clarence River and / or Clarence River levels at Maclean are expected to exceed

2.2 mAHD, undertake 'evacuation to Maclean or M1' procedures detailed in Section 6.4.4.1.

2. If BoM or SES issue a flood alert indicating Clarence River levels at the Maclean gauge are expected to exceed 3.3 mAHD, undertake 'evacuation to Yamba Bowling Club' procedures detailed in Section 6.4.4.2.
3. If the SES have issued an evacuation order for the site, undertake emergency service managed evacuation procedures, refer to Section 6.4.4.3.
4. Undertake SIP procedures if evacuation is cut off, refer to Section 6.4.4.4 and Section 6.4.4.5.

6.4.4.1 Evacuation to Maclean and M1 (Site Managed)

Site managed evacuation to Maclean or M1 is triggered by any of the following:

1. BoM or SES issue a flood alert indicating moderate flooding is expected for the Clarence River and / or Clarence River levels at Maclean are expected to exceed 2.2 mAHD.

When evacuation to Maclean or M1 is triggered, the Chief or Deputy Chief flood warden will:

1. Continue to monitor warnings and media alerts every 2 hours.
2. Monitor Maclean gauge levels every hour.
3. Issue warnings and advice via the site PA system, SMS and (where necessary) doorknocking. Warnings include the following information:
 - That the Clarence River is expected to experience moderate flooding that may isolate the Yamba area precluding access to M1 and Maclean District Hospital.
 - A timeframe of when flooding is expected to affect the Yamba to M1 route if provided (typically 6 – 24 hours).
 - Anyone requiring access to Maclean District Hospital or who wishes to leave Yamba should leave the site immediately.
 - This warning should emphasise that residents' homes and local Yamba area are above the current predicted peak flood level, and that they do not need to evacuate unless ordered to by the SES but may choose to do so if they wish to leave the Yamba area. The alert message should also emphasise that it is not a test message.
4. If the Maclean gauge records a level of 2.1 mAHD or more or if SES, emergency services, or Council advise that the Yamba Road towards Maclean has been closed or cut off:

- Issue a message alert to all residents and workers to notify them that evacuation out of Yamba is no longer possible.
- This alert message should emphasise that the resident's homes are above the level of the current predicted peak flood level, and they do not need to evacuate unless ordered to by the SES.

6.4.4.2 Evacuation to Yamba Bowling Club (Site Managed)

Site managed evacuation is triggered by any of the following:

1. BoM or SES issue a flood alert indicating Clarence River levels at the Maclean gauge are expected to exceed 3.3 mAHD.

When evacuation is triggered, the Chief or Deputy Chief flood warden will:

1. Continue to monitor warnings and media alerts every 2 hours.
2. Monitor Maclean gauge and site gauge levels every 30 minutes.
3. Issue an evacuation warning to site occupants via the site PA system, text message and (where necessary) doorknocking informing them that the site may become isolated by flood water for up to several days and to evacuate to the Yamba Bowling Club.
4. Organise flood wardens to monitor conditions around the site and on Carrs Drive and provide updates every 2 hours and when changes in flood and road conditions are observed.
5. Liaise with SES, emergency services, and local business to obtain information about conditions along the evacuation route.

6.4.4.3 Evacuation (Emergency Services)

Emergency services managed evacuation is triggered when the SES or other emergency service issues an evacuation order covering the site.

When emergency services order an evacuation of the site the Chief or Deputy Chief Flood Warden will:

1. Issue warnings and advice via the site PA system, SMS and (where necessary) via doorknocking.
2. Inform site occupants that an evacuation order covering the site has been issued and to evacuate and follow directions of emergency services.
3. Liaise with emergency services.
4. Organise for Flood Wardens to monitor the site and Carrs Drive for flood water and provide updates on any changes in road or flood conditions while the site is evacuated.

5. Liaise with SES, emergency services, and local business to obtain information about conditions along the evacuation route.

6.4.4.4 Shelter-in-place (Site Wide)

Site wide shelter-in-place phase is triggered by any of the following:

1. The offsite evacuation route becomes inundated by flood water.
2. SES, emergency services, or Council advise that the evacuation route has been closed or cut off.
3. The flood warning device issues an alert indicating that the offsite evacuation route is likely about to be or is cut-off by flood water.

When shelter-in-place is triggered, the Chief or Deputy Chief flood warden will:

1. Notify occupants via the PA system, SMS, and (where necessary) doorknocking, that it is no longer possible to evacuate and to prepare to shelter-in-place in their homes.
2. Ensure site occupants are informed about SIP arrangements and to move to the CRB if they need assistance, flood waters are identified as reaching hazardous levels near the site, or if notified.
3. Prepare the CRB for SIP.
4. Notify the Police, SES and site management that there are occupants SIP on site.

6.4.4.5 Shelter in Place (Community Refuge Building)

Community refuge SIP phase is triggered by any of the following:

1. Flood level indicators show flood waters as approaching site levels.
2. The flood warning device alert 4 is issued indicating there is 4 hours until site internal road access to the CRB is cut off by flood water.

When the Community refuge SIP phase is triggered, the Chief or Deputy Chief flood warden will:

1. Notify occupants via the PA system, SMS and doorknocking that it is no longer safe to stay in their homes and to evacuate to the community refuge building.
2. Organise assistance for any site occupants with mobility issues, or other issues that may affect their ability to evacuate to the community refuge building in a timely manner.
3. Ensure site occupants are informed about SIP arrangements.

4. Notify the Police, SES and site management that there are people SIP on site in the CRB.
5. Liaise with emergency services.

6.4.5 Recovery

The recovery phase occurs once the flood situation has ended and is triggered by the following:

1. Flood waters have receded from the site and Carrs Drive.
2. The flood warning device issues an all clear alert.
3. SES or other emergency service gives the all clear.

In the recovery phase the Chief or Deputy chief flood warden will:

1. Notify site occupants that the flood event has passed, and it is now safe for them to return to their homes or leave the site when it becomes safe to do so.
2. Inspect the site and ensure utilities and services are restored and there are no immediate hazards.
3. If necessary, isolate hazardous areas and arrange for the site to be cleared and any repairs to roads and infrastructure undertaken.
4. Organise a debrief with site management and all Flood Wardens, to review the FERP. If any changes or improvements are considered necessary, a suitably qualified flood engineer should be engaged to amend the FERP as necessary.

In any flood event a debrief with site management and all Flood Wardens to review the FERP should be held. If any changes or improvements are considered necessary, the FERP should be updated and if necessary, a suitably qualified flood engineer should be engaged to assist with these amendments.

7 References

Australian Institute for Disaster Resilience, Attorney-General's Department, Commonwealth of Australia (2017), *Australian Disaster Resilience Handbook Collection, Flood Hazard, Guideline 7-3*.

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors) (2019), *Australian Rainfall and Runoff: A Guide to Flood Estimation*, Commonwealth of Australia.

Molino, S. Morrison, T. Howard, M. Opper, S. A (2013), *Technical Guideline for the use of the SES Timeline Evacuation Model in Flood Evacuation Planning*, Proceedings of the 2013 Floodplain Management Association Conference.

Clarence Valley Council (2011a), *Clarence Valley Development Control Plan*.

Clarence Valley Council (2011b), *Clarence Valley Local Environment Plan*.

NSW Department of Infrastructure, Planning and Natural Resources (2005), *Floodplain Development Manual*.

NSW Department of Planning and Environment (2023), *Flood Risk Management Manual*.

NSW SES (2017), *Clarence Valley Flood Emergency Sub Plan*.

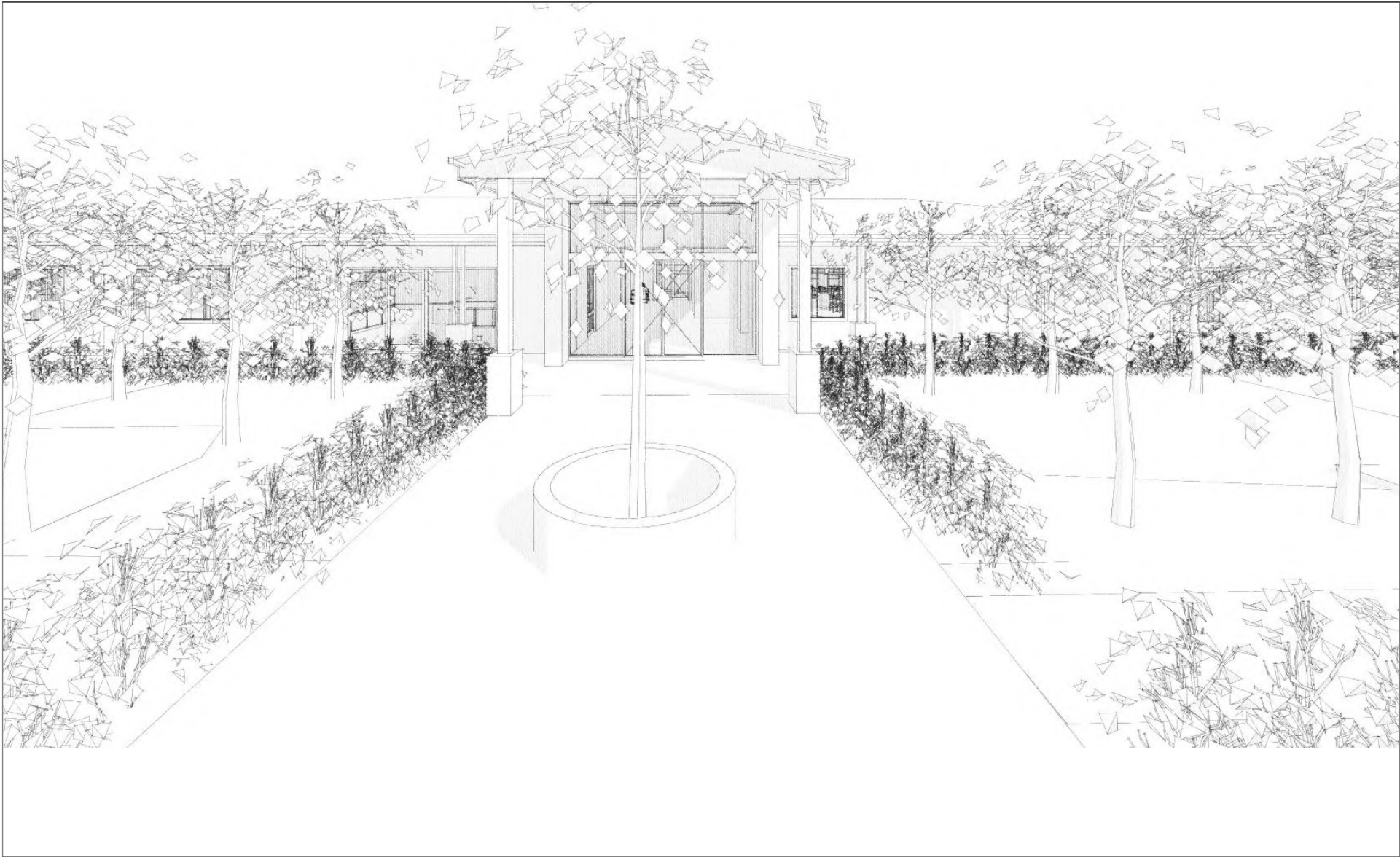
Smith GP, Davey EK and Cox RJ (2014), *Flood hazard, Technical report 2014/07*, Water Research Laboratory, University of New South Wales, Sydney.

8 Appendix A – Proposed Development Plans

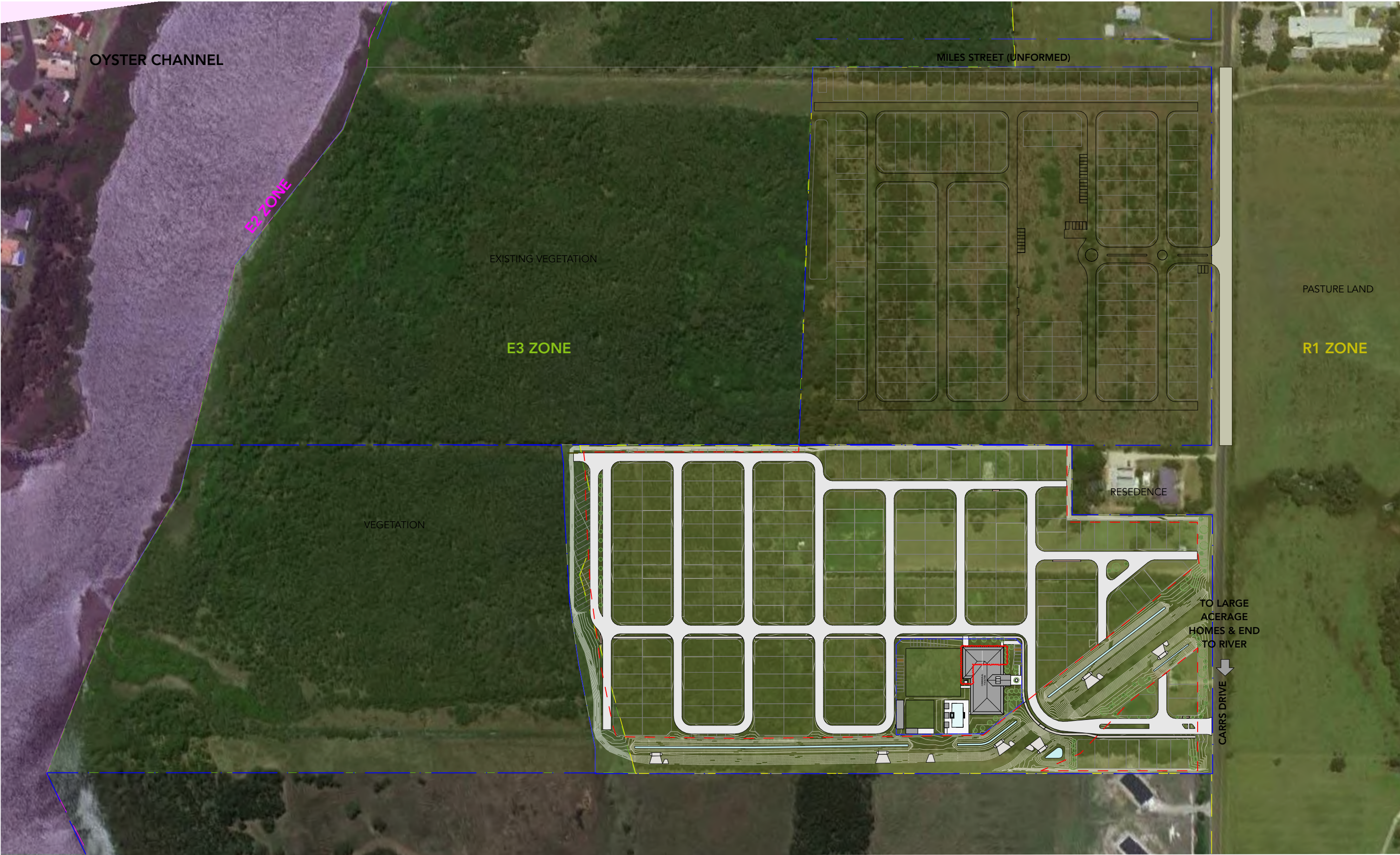
Clifton Yamba

Carrs Drive Yamba NSW 2464

DRAWING No	DRAWING NAME	SCALE	REV
DA0000	COVERPAGE		C
DA1000	SITE LOCATION / ANALYSIS PLAN	1:2500, ...	C
DA1001	MASTER SITE PLAN	1:2000	C
DA1002	SITE SETOUT PLAN	1:1500	C
DA1003	STAGING PLAN	1:1500	C
DA2000	SITE ROOF PLAN	1:500	C
DA2001	COMMUNAL FACILITIES FLOOR PLAN 1	1:250	C
DA2002	COMMUNAL FACILITIES FLOOR PLAN 2	1:250	C
DA2003	KITCHEN PLAN	1:25	C
DA2004	KITCHEN ELEVATIONS	1:50	C
DA2300	MAJOR SECTIONS	1:200	C
DA2400	NORTH & SOUTH ELEVATIONS	1:200	C
DA2401	EAST & WEST ELEVATIONS	1:200	C



DEVELOPMENT APPLICATION



1 SITE LOCATION PLAN
1:2500



MARK SHAPIRO ARCHITECTS
T 0421 996 467
W markshapiro.com.au
E mark@markshapiro.com.au

NSW REG. 9789
ABN 646 2000 7678

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C	13/2/2024	DA RFI
ISSUE	DATE	REVISION

CLIENT:
Clifton Yamba Land Pty Ltd as Trustee for Yamba Land Trust
401/407 New South Head Road,
Double Bay 2028

PROJECT:
Clifton Yamba
Carrs Drive, Yamba NSW 2464

DRAWING:
SITE LOCATION / ANALYSIS PLAN



PROJECT NO:
21001
PLOTTED: 13/2/2024
DRAWING NO:
DA1000
REV: **C**

LOT 2 DP 733507
CARRS DRIVE, YAMBA, NSW

SITE INFORMATION

TOTAL SITE AREA: 100,744 m²
NETT SITE AREA: 78,358.58 m²
ROAD FRONTAGE: 183m
ALLOWABLE GFA (0.5:1): 50,372 m²

DWELLING LOTS: 216
TOTAL: 216 DWELLING LOTS

SITE CONTROLS

ALL COMMON AREAS, INCLUDING CLUBHOUSE AND POOL AREAS, TO BE WHEELCHAIR ACCESSIBLE.
REFUSE COLLECTION WITHIN SITE ONCE A WEEK BY PRIVATE CONTRACTOR.

ALLOTMENT CONTROLS

CONTROL FOR MIN. LOT SIZE: 130 m²
PROPOSED MIN. LOT SIZE: 9.4m x 20.7m = 194.5 m²¹
MAX. LOT COVERAGE: 2/3 OF INDIVIDUAL LOT²
MIN. LANDSCAPE AREA: 30 m² OF PRIVATE OPEN SPACE
MAXIMUM BUILDING HEIGHT: 2 STOREY
MIN. BUILDING SETBACK: 1000mm HABITABLE ROOM WALLS TO BOUNDARY
NIL SETBACK FOR GARAGE / CARPORT³
PRODUCT DIVERSITY: WALL FINISHES (COLOURS), LOT ORIENTATION, AND HOUSE TYPE
FENCING: COLORBOND FENCE TO 3 SITE BOUNDARIES OF DEVELOPED AREA
PERMEABLE FENCE TO REAR OF DEVELOPED AREA
NOTE NO FENCING TO SITE BOUNDARIES OF VEGETATION ZONE

¹ PROPOSED MINIMUM LOT SIZE, LOT CONFIGURATIONS AND AREAS MAY DIFFER

² MEASURED AS CONSTRUCTED FLOOR AREA

³ NON-COMBUSTIBLE EAVES OVERHANGING OF 450MM ALLOWABLE WITHIN 1000MM SIDE AND REAR SETBACK AREAS. THERE IS NO ROADSIDE BOUNDARY SETBACK REQUIREMENT.

COMMUNITY & LANDSCAPE AREAS

INDIVIDUAL LOTS (MINIMUM REQUIREMENT)

NOMINAL LOT SIZE: 9.4m x 20.7m = 194.5 m²
MINIMUM REQUIRED AREA: 30 m² (3m x 3m MIN. IN ONE AREA)
TOTAL LANDSCAPING: 216 ALLOTMENTS x 30m² = 6,480 m²

WHOLE SITE (MINIMUM REQUIREMENT)

TOTAL SITE AREA: 100,744 m²
NETT USE SITE AREA: 78,358.58 m²
MIN. REQUIRED AREA: 30% OF NETT (INCLUDING LOTS) = 23,507.57m²
COMMUNAL SPACE: 5,744 m² (7.33% OF NETT)¹
PLANTING: 18,838.62 m² (24% OF NETT)²
LOT AREAS: 49,729.06 m² (63.4% OF NETT)³
TOTAL: 74,311.85 m² (94.8% OF NETT)

¹ THE COMMON OPEN SPACE AREA INCLUDES ALL COMMON BUILDING STRUCTURES, ACCESS WAYS, MAIN SHED, AND SPORTING AMENITIES

² INCLUDES REMNANT VEGETATION WITHIN THE SITE. DRIVEWAY / DEEP PLANTING AREAS ARE INTERCHANGEABLE TO ACCOMMODATE HOME SELECTION AND PLACEMENT

³ ALIGNMENT, POS, COMMUNITY SPACE, AND DEEP PLANTING FIGURES ARE FLEXIBLE (APART FROM ANY SPECIFICALLY NOMINATED MINIMUM REQUIREMENTS) IF NO LESS THAN 50% OVERALL COMBINED LANDSCAPE AREA IS ACHIEVED

CAR PARKING & ROADS

RESIDENT PARKING
11 SPACES PER 10 DWELLINGS: 238 REQUIRED SPACES
MIN. 22 DWELLINGS WITH DOUBLE GARAGE: 44 COVERED SPACES
MIN. 194 DWELLINGS WITH SINGLE GARAGE: 194 COVERED SPACES

VISITOR PARKING (UNCOVERED)

FIRST 140 DWELLINGS: 11 REQUIRED
OVER 140 DWELLINGS (1 PER 7): 20 REQUIRED
= 31 REQUIRED SPACES (INC. THREE ACCESSIBLE)
PROVIDED: 50 SPACES PROVIDED (INC. FOUR ACCESSIBLE)

CLUBHOUSE FACILITIES PARKING (UNCOVERED)

CALCULATED IN VISITOR PARKING

ALL MINOR CARRIAGEWAY WIDTHS ARE 6M CLEAR
NO ROAD RESERVE WIDTHS ARE TO BE LESS THAN 6M CLEAR
ROLL-OVER KERB TO ENTRY ROAD ONLY

NOTE

REFER TO THE SITE MASTERPLAN BY MDE PTY LTD FOR FURTHER ALLOTMENT DETAILS

LOTS & SETBACKS

ROAD FRONT BOUNDARY SETBACK: 1m²
SIDE & REAR SETBACK: CALSS 1 ALLS 1 m MINIMUM
CLASS 10 WALLS 0m MINIMUM



1 MASTER SITE PLAN
1:2000



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C	13/2/2024	DA RFI
ISSUE	DATE	REVISION

CLIENT:
Clifton Yamba Land Pty Ltd as
Trustee for Yamba Land Trust
401/407 New South Head Road,
Double Bay 2028

PROJECT:
Clifton Yamba
Carrs Drive, Yamba NSW 2464

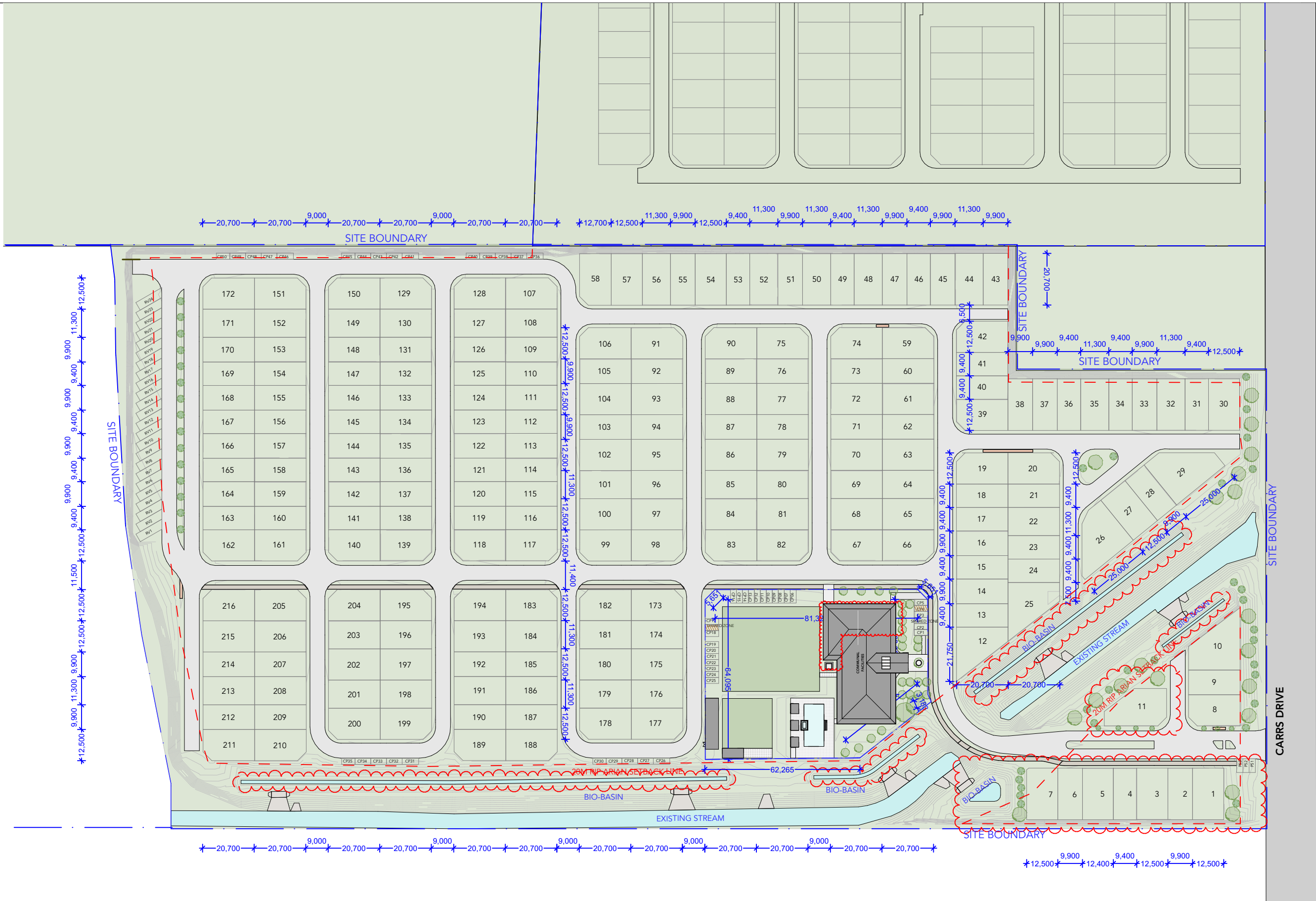
DRAWING:
MASTER SITE PLAN



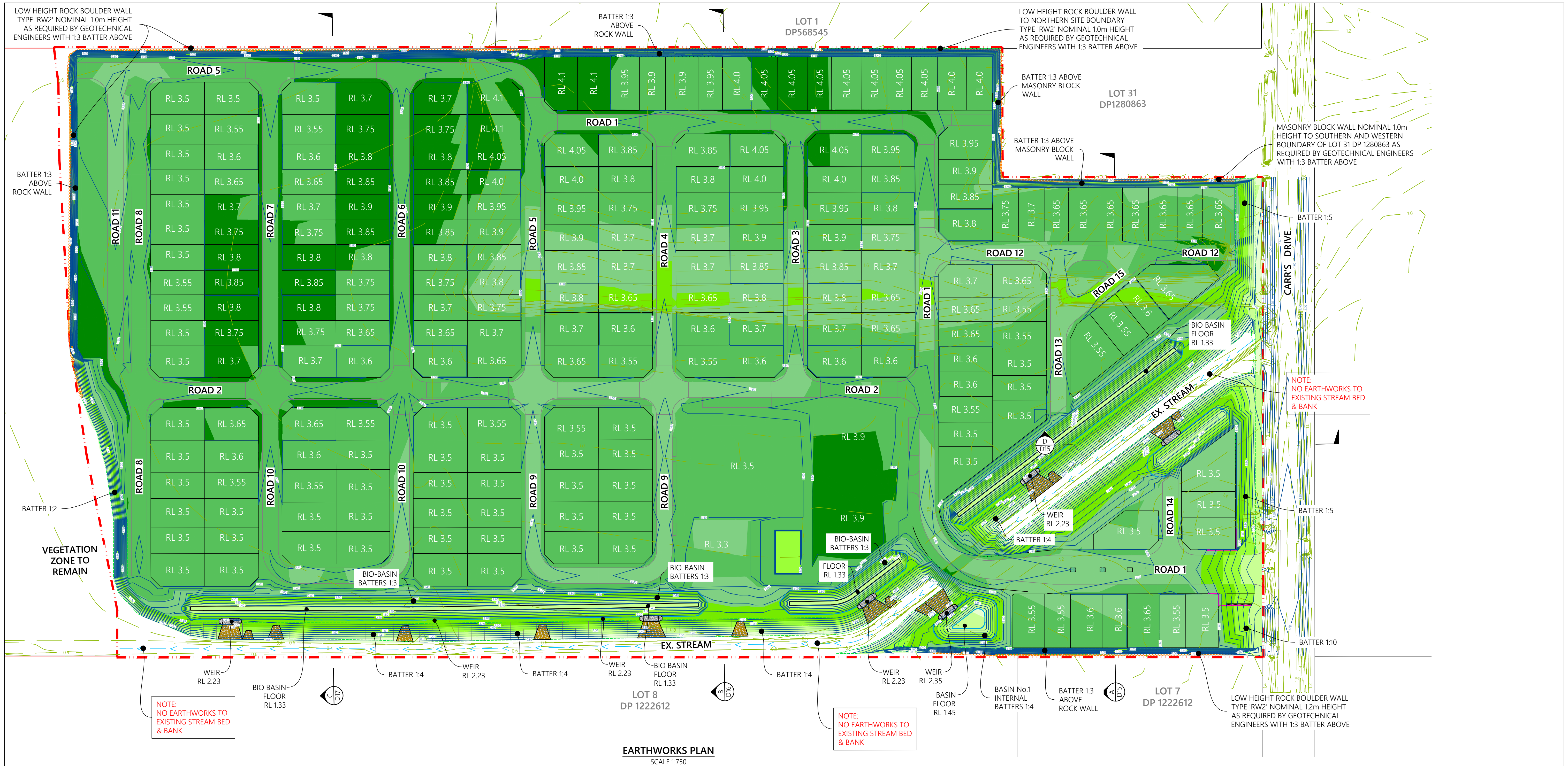
PROJECT NO:
21001

PLOTTED: 13/2/2024

DRAWING NO:
DA1001
REV: C



9 Appendix B – Proposed Site Grading Design



20 10 0 10 20 30 40
Horizontal Scale 1:750 (A1)
1:1500 (A3)

LEGEND

- FILL 0.0 - 0.5m DEPTH
- FILL 0.5 - 1.0m DEPTH
- FILL 1.0 - 1.5m DEPTH
- FILL 1.5 - 2.0m DEPTH
- FILL 2.0 - 2.5m DEPTH
- FILL 2.5 - 3.0m DEPTH
- FILL 3.0 - 3.2m DEPTH
- 6.6 EXISTING SITE CONTOURS 0.1m INTERVAL
- 2.6 PROPOSED RE-GRADING CONTOURS 0.2m INTERVAL

PRELIMINARY EARTHWORKS ESTIMATE

EARTHWORKS CUT TO FILL FROM NOMINAL 100mm DEEP STRIPPED SURFACE. TOPSOIL DEPTH TO BE CONFIRMED AT DETAILED DESIGN STAGE.

VOLUMES INCLUDING NOMINAL INTERNAL ROADWAY BOXING 320mm DEEP

AREA OF EARTHWORKS = 9.67Ha (EXCL. CARRS DRIVE RECONSTRUCTION)
TOPSOIL STRIPPED TO STOCKPILE = 9,670m³

GENERAL BULK EARTHWORKS
TOTAL CUT = 0m³
TOTAL FILL = 239,700m³ (IMPORTED FROM APPROVED SOURCE or QUARRY)

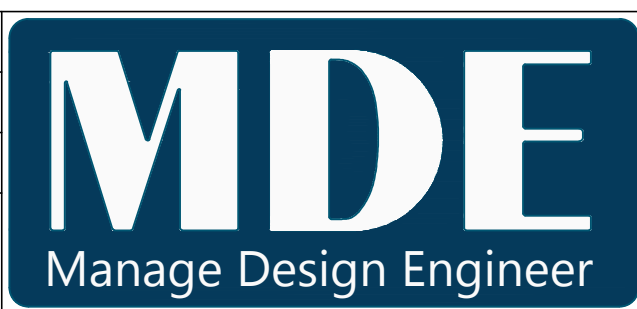
* NOTES:
AMENDED LOWER CLARENCE FLOOD MODEL 2022 WITH 1% AEP FLOOD LEVEL
RL=3.5m AHD

ALLOTMENT EARTHWORKS LEVELS TO BE NO LESS THAN THE 100 YEAR (1% AEP)
FLOOD LEVEL RL=3.5m AHD.

PLANS TO BE
PRINTED IN COLOUR

PRELIMINARY PLANS
FOR DA PURPOSES
ONLY NOT FOR
CONSTRUCTION

			DESIGNED: T.RYDEN	DATE: DEC 2023
			DRAWN: ASCHMID	SCALE: AS SHOWN
			SURVEYING:	SHEET SIZE: A1
1	ISSUED FOR DEVELOPMENT APPLICATION - AMENDED SITE FORMATION HEIGHTS	20.12.2023	ISSUED FOR DEVELOPMENT APPROVAL ONLY	
0	ISSUED FOR DEVELOPMENT APPLICATION	08.09.2022		
ISSUE	DESCRIPTION	DATE		



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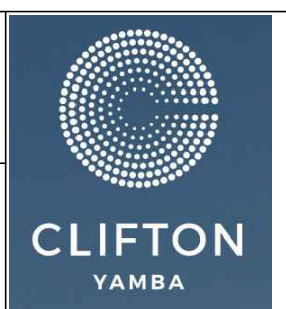
www.md-engineer.com.au

CLIENT

CLIFTON YAMBA LAND PTY LTD

TITLE

110 & 120 CARRS DRIVE, YAMBA
DEVELOPMENT APPLICATION CIVIL WORKS PLANS



PROJECT

PROPOSED MHE DEVELOPMENT
110 & 120 CARRS DRIVE
YAMBA, NSW 2464
LOT 2 DP733507 & LOT 32 DP128863

DA CIVIL DRAWING			
DRAWING TITLE:			
EARTHWORKS PLAN			
DWG No:	D14	SHEET:	14 OF 45
		REV:	1

10 Appendix C – Flood Actions Checklist

Prepared – Before A Flood			
Trigger	Action	Responsibility	Requirements
Always	Appoint a Chief Flood Warden and ensure that there is always someone in this role.	Site Management	FERP
	Install and maintain legible flood warning signs around the site to inform site occupants of flood risks and to evacuate to the flood community refuge building to SIP if notified to do so or if flood waters are observed approaching their location.	Site Management	Informative Signs.
	Install and maintain flood level indicators at low points around the site including the site entrance and within the site drainage channel with indicative levels at which site occupants should evacuate to the community refuge building.	Site Management	Flood Level Indicators.
	Ensure a public address (PA) and alarm system is installed at the CRB such that it is audible to all site occupants from inside their homes, is maintained in working condition, and is tested at a minimum every 12 months.	Site Management	PA and alarm system.
	Ensure a flood warning device including water level gauge and automatic alert system is installed and tested at a minimum every 12 months.	Site Management	Flood warning device, water level gauge, software including subscription service and digital app, site PA and alarm system.
	Subscribe Chief and Deputy Chief Flood Wardens to warning alert services and flood warning device so that they receive BoM severe weather warnings, flood watches, and flood warnings, and Early Warning Network warnings, SES warnings, and flood warning device alerts direct to their mobile phone.	Site Management	FERP, subscription to service and mobile device, access to BOM website via mobile device or computer.
	Ensure that the CRB is cleaned, maintained, and is appropriately stocked to accommodate site occupants for up to 10 days, including food supplies, beds and bedding, suitable amenities, medical supplies, backup power in case of power outage and water tank to be full.	Site Management	Long life food, water, and other basic supplies, regular cleaning service, beds and bedding, medical supplies.
	Supply and maintain all of the equipment necessary to implement the FERP.	Site Management	Flood response kits including first aid kits, portable radio and megaphone, sufficient torches and hi-vis vests for each Chief, Deputy and Flood Warden, spare batteries for all of the above.
	Ensure the Chief Flood Warden, the Deputy Chief Flood Wardens and Flood Wardens are trained in the implementation of the FERP and interpretation of the rainfall, flood information, flood warning system and warning information published by BoM and SES.	Site Management	FERP, training resources.
	Keep this FERP up to date and review it every five years or following a flood.	Site Management	FERP

Appoint sufficient Deputy Chief Flood Wardens such that there will be a Chief or Deputy Chief Flood Warden on duty (not necessarily on site) at all times.	Chief Flood Warden	FERP
Appoint sufficient Flood Wardens for the implementation of the FERP in any event.	Chief Flood Warden	FERP
Monitor BoM weather forecasts, flood warnings, recorded rainfall, media alerts, Council disaster dashboard, and Clarence River Maclean gauge water levels daily.	Chief or Deputy Chief Flood Warden	Mobile or computer with internet connection.
Organise contractor to conduct annual check of PA system, alarms and flood warning device performance, and to check flood related signage and flood level indicators.	Site Management	Maintenance contract.
Display A3 version of the nominated evacuation routes in the community refuge building and other relevant public places.	Site Management	FERP
A database of Site Management, Chief Flood Warden, Deputy Chief Flood Warden and Flood Wardens, the site occupant mobile phone numbers will be maintained and kept up to date.	Site Management	Phone Numbers.
Contact details of all residents and access to a bulk messaging service (e.g. bulk SMS). A list of emergency contacts will be maintained which will include emergency services, utility providers, and local businesses adjacent to the adopted evacuation route.	Chief Flood Warden	Emergency contact list.
This FERP and the list of contacts will be kept on site in electronic and hard copy and in a bulk SMS app used by flood wardens.	Chief Flood Warden	Electronic and hard copy of FERP.
Test the bulk SMS communication system at a minimum annually	Chief Flood Warden	Bulk SMS communication system, database of current residents' and workers' contact details.
Residents and site workers to be educated in flooding risks and procedures by distributing Flooding Information Pamphlets to new residents / workers and to all residents / workers once per year.	Site Management and Chief Flood Warden	This FERP, Flooding Information Pamphlet (Appendix D).
Residents to be prepared for isolation during a flood by maintaining critical supplies.	Residents	Battery operated radio, torch, spare batteries, first aid kit, non-perishable foods, drinking water, prescription medications.
Flood wardens to check flood preparedness of 40 - 50 residents each year.	Chief Flood Warden	Residents contact details, list of items residents to keep.

Alert – When a Flood is Possible

Trigger	Action	Responsibility	Requirements
Any of the following: - BoM forecasts or records heavy rainfall (200 mm or more within a 24-72 hour period). - BoM issues a severe weather warning with a chance of flooding in the Clarence River. - BoM issues a flood watch or flood warning for the Clarence River. - SES or other emergency service issues a flood or evacuation warning for the Clarence River or Yamba areas.	Check warning services (BoM, SES, Early Warning Network, Council Disaster Dashboard, internet, TV, radio, MHL) for severe weather warnings, flood warnings and information on road conditions in the Clarence River and Yamba areas every 2 hours.	Chief Flood Warden, or Warden in charge	Mobile or computer with internet connection, subscription service / app, radio, television.
	Monitor recorded levels for the Clarence River via the Maclean gauge and recorded levels for the Oyster Channel via the site gauge every 2 hours.	Chief Flood Warden, or Warden in charge	Mobile or computer with internet connection, flood warning device digital app, functioning site flood level gauge.
	Monitor recorded rainfall for the Clarence River catchment every day at 9am.	Chief Flood Warden, or Warden in charge	Mobile or computer with internet connection.
	Monitor BoM rainfall forecasts for the Clarence River area twice per day (at 9am and again in the evening).	Chief Flood Warden, or Warden in charge	Mobile or computer with internet connection, flood warning device subscription service / app.

Respond – During a Flood Event

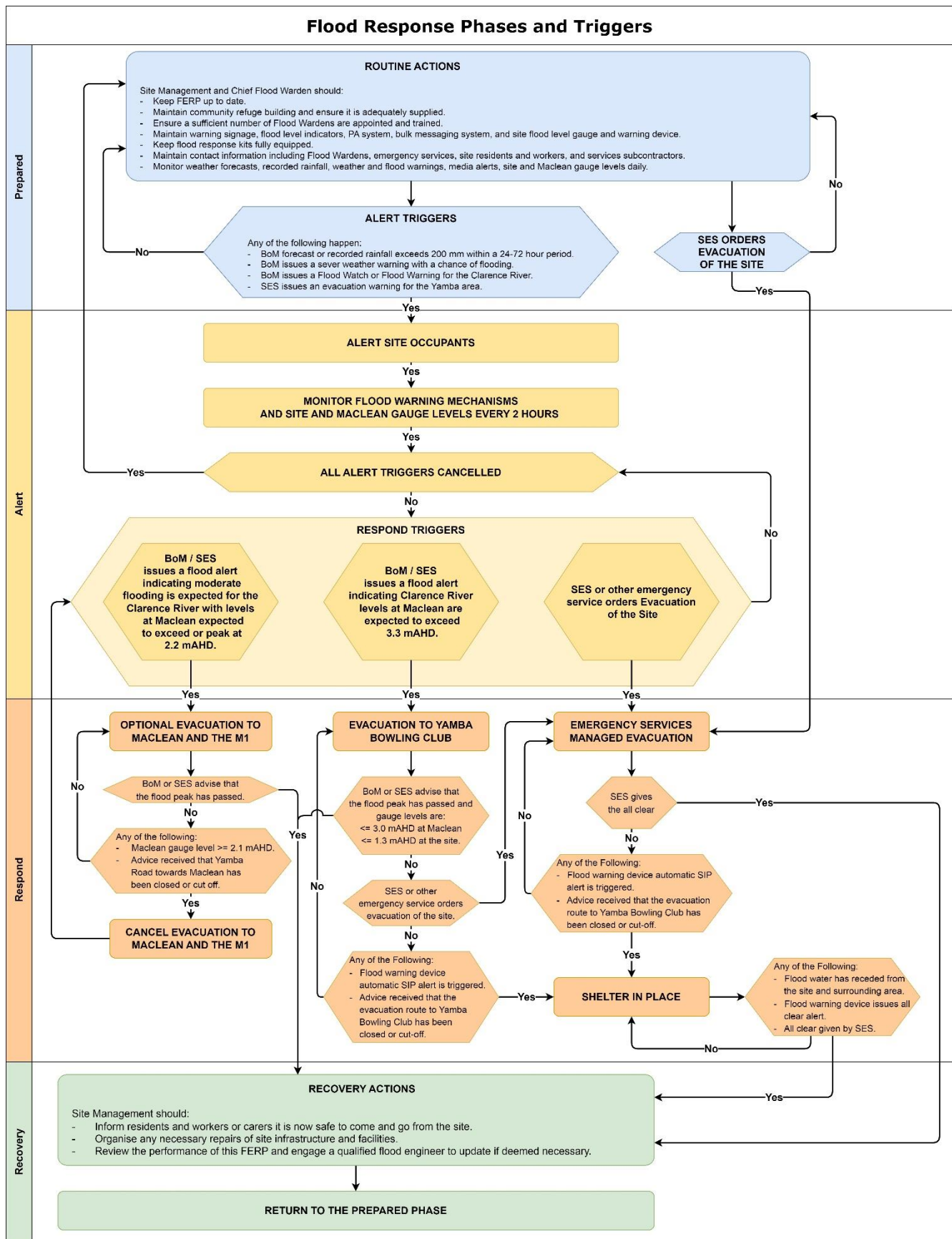
Trigger (Respond)	Action	Responsibility	Requirements
Refer to Triggers Below.	Monitor Maclean gauge and site gauge water levels every 30 minutes.	Chief Flood Warden, or Warden in charge	Mobile or computer with internet connection, flood warning device digital app, functioning site flood level gauge.
	Check warning services (BoM, SES, Early Warning Network, Council Disaster Dashboard, internet, TV, radio, MHL) for severe weather warnings, flood warnings and information on road conditions in the Clarence River and Yamba areas every 2 hours.	Chief Flood Warden, or Warden in charge	Mobile or computer with internet connection, subscription service / app, radio, television.
Trigger (Site Managed Evacuation to Maclean and M1).	Action	Responsibility	Requirements
Any of the following: - BoM or SES issue a flood alert indicating moderate flooding is expected for the Clarence River at Maclean and / or Clarence River levels at Maclean are expected to exceed or peak at 2.2 mAHD.	Issue warnings and advice via the site PA system, text message, and doorknocking to inform site occupants that Yamba may become isolated by flood waters and anyone requiring access to Maclean District Hospital or who wishes to leave Yamba should leave the site immediately.	Chief Flood Warden, or Warden in charge	PA system, mobile phones, Flood Wardens, torches, megaphone, informative signs, FERP.
	Monitor Council's disaster dashboard and liaise with emergency services and local businesses to monitor conditions along the Yamba to Maclean evacuation route.	Chief Flood Warden, or Warden in charge	Mobile or computer with internet connection.

<p>If any of the following happen:</p> <ul style="list-style-type: none"> - The Maclean gauge records a level of 2.1 mAHD or more - SES, emergency services, or Council advise that Yamba Road towards Maclean has been closed or cut off. 	<p>Notify site occupants that evacuation to Maclean and M1 is no longer possible.</p>	<p>Chief Flood Warden, or Warden in charge</p>	<p>PA system, mobile phones, Flood Wardens, torches, megaphone, informative signs, FERP.</p>
Trigger (Site Managed Evacuation to Yamba Bowling Club)	Action	Responsibility	Requirements
<p>Any of the following:</p> <ul style="list-style-type: none"> - BoM or SES issue a flood alert indicating Clarence River levels at Maclean are expected to exceed 3.3 mAHD. 	<p>Issue an evacuation warning to site occupants informing them that the site may become isolated by flood water for up to several days and to evacuate to the Yamba Bowling Club.</p>	<p>Chief Flood Warden, or Warden in charge</p>	<p>PA system, mobile phones, Flood Wardens, torches, megaphone, informative signs, FERP.</p>
	<p>Organise flood wardens to monitor conditions around the site and on Carrs Drive and provide updates every 30 minutes or when changes in flood and road conditions are observed.</p>	<p>Chief Flood Warden, or Warden in charge</p>	<p>Flood Wardens, walkie talkies and / or mobile phones with reception.</p>
	<p>Monitor Council's disaster dashboard and liaise with emergency services and local businesses to monitor conditions along the site to Yamba Bowling Club evacuation route.</p>	<p>Chief Flood Warden, or Warden in charge</p>	<p>Mobile or computer with internet connection.</p>
	<p>Prepare the community refuge building for SIP.</p>	<p>Chief Flood Warden, or Warden in charge</p>	<p>FERP, Flood response kits, bed and bedding, food and water, medical supplies, towels.</p>
Trigger (Emergency Services Managed Evacuation)	Action	Responsibility	Requirements
<p>Any of the following:</p> <ul style="list-style-type: none"> - SES or other emergency service issues an evacuation order covering the site. 	<p>Inform site occupants via the PA system, bulk messaging service and Door knocking that an evacuation order covering the site has been issued and to evacuate and follow directions of emergency services.</p>	<p>Chief Flood Warden, or Warden in charge</p>	<p>PA system, mobile phones, Flood Wardens, torches, megaphone, informative signs, FERP.</p>
	<p>Liaise with emergency services.</p>	<p>Chief Flood Warden, or Warden in charge</p>	<p>Telephone and emergency contact list.</p>
	<p>Organise flood wardens to monitor conditions around the site and on Carrs Drive and provide updates when changes in flood and road conditions are observed while the site is evacuated.</p>	<p>Chief Flood Warden, or Warden in charge</p>	<p>Flood Wardens, walkie talkies and / or mobile phones with reception.</p>

	Monitor Council's disaster dashboard and liaise with emergency services and local businesses to monitor conditions along the site to Yamba Bowling Club evacuation route.	Chief Flood Warden, or Warden in charge	Mobile or computer with internet connection.
Trigger (Shelter-in-place)	Action	Responsibility	Requirements
Any of the Following: - Flood waters are identified on site. - Carrs Drive becomes inundated by flood water. - Flood warning device automatic SIP alert is triggered. - Emergency services or Council advise that the Evacuation route has been closed or cut-off.	Issue shelter-in-place advice, inform site occupants that evacuation is no longer possible and to prepare to SIP in their homes or move to the CRB to SIP.	Chief Flood Warden, or Warden in charge	PA system, mobile phones, Flood Wardens, torches, megaphone, informative signs, FERP.
	Ensure site occupants are informed that evacuation is no longer possible and to move to the CRB if flood waters are observed approaching their location via the PA system, bulk messaging service, and doorknocking.	Flood Wardens	PA system, mobile phones, Flood Wardens, torches, megaphone, informative signs, FERP.
	Explain why SIP arrangements.	Flood Wardens	This FERP, PA system, megaphone, torches, informative signs, mobile phones.
	Contact the Site Management and advise that there are people sheltering on site.	Chief Flood Warden, or Warden in charge	Telephone and emergency contact list.
	Contact the Police and NSW SES (131 500) to advise that there are people sheltering on site.	Chief Flood Warden or Warden in charge	Telephone and emergency contact list.
	Prepare the CRB and shelter-in-place procedures.	Flood Wardens	FERP, Flood response kits, bed and bedding, food and water, medical supplies, towels.
Recover – After a Flood			
Trigger	Action	Responsibility	Requirements
All clear given by NSW SES, BoM, or Chief Flood Warden.	Notify site occupants that it is now safe to come and go from the site.	Chief Flood Warden or delegate	Computer with internet connection, database of residents' and workers' contact details, communication system with bulk SMS capability.
	Site access roads will need to be cleared of debris before the site is accessed. This should only be undertaken under the direction of the NSW SES or Clarence Valley Council, due to risks from electricity, gas, debris, and venomous animals.	Council and emergency agencies, the Site Management and Chief Flood Warden	Telephone and emergency contact list.
If floodwaters did not affect the site:			

	Normal site usage should be able to resume once the site has been checked to ensure that utilities are restored and no damage to infrastructure or facilities have occurred. These checks need to be undertaken by professionals qualified to do so. Although landscaping areas may need cleaning that would not prevent normal use of the premises if the site is in working order.	Site Management and Chief Flood Warden	Contact details for electricians and plumbers
	If floodwaters did affect the site:		
	There may be some repairs and cleaning needed before the premises become functional again.	Site Management	Contact details for structural engineer, electricians and plumbers.
	For every flood event:		
	Before any cleaning or repair work is undertaken on site, a hazard assessment will be undertaken, safe work methods statements (SWMS) prepared and personal protective equipment supplied consistent with the known hazards which can be associated with floods: - Slips, trips and falls - Sharp debris - Venomous animals - Contaminated water and sediments	Site Management and Chief Flood Warden	Correct SWMS and PPE.
	A debrief will be held and may involve emergency services. The flood event and response, including the use of this FERP and any emergency procedures will be reviewed.	Site Management, Flood Wardens	FERP, a log of actions taken during the event. This check list can be used for that purpose with times and notes recorded against each action
	Changes may be made to the FERP and the requirements for future emergency response should the review identify any improvements which may be made.	Site Management and Chief Flood Warden	FERP

11 Appendix D – Flood Response Phases and Triggers Diagram



12 Appendix E – Flood Warning Device Details

12.1 Purpose and Overview

In extreme flood events flood waters will preclude access via Carrs Drive and Yamba Road isolating the site for up to several days. The proposed flood warning device in conjunction with the flood warning mechanisms detailed in Section 6.2 have been designed to provide site occupants with effective warning time before the evacuation route to Yamba Bowling Club is undated by flood water and before site internal roads are inundated by floodwater to provide reliable flood-safe egress and prevent site occupants from becoming trapped in their homes in all events up to and including the PMF.

12.2 Flood Warning Device Design

In events larger than the 5% AEP flood the site becomes isolated due to inundation of the adopted Evacuation Route 2 at Carrs Drive near Harold Tory Drive or Yamba Road near the Yamba Marina. In events larger than the 0.2% AEP flood waters reach the level of internal site roads isolating site occupants in their homes. In very rare extreme events flood waters exceed site building FFLs.

A flood warning device will be provided that will automatically monitor Oyster Channel water levels. The device will issue alerts to Flood Wardens to prevent site occupants from encountering hazardous flood waters when evacuating the site and provide ample time to for site occupants to evacuate from their homes to the community refuge building before flood waters inundate internal site roads.

The flood warning device has been designed based on the following:

1. The adopted BMT 2022 flood study identifies the High High Water Solstices Spring tide level HHWS(SS) for the Clarence River tidal estuary as 1.13 mAHD. Therefore, the highest likely tide level without storm surge at the location of the flood warning device would be approximately 1.13 mAHD.
2. As discussed in Section 4.1.2.2, the travel time from the site to the Bowling Club is **7 minutes** under typical traffic conditions.
3. Oyster Channel reaches 1.3 mAHD, which is above the HHWS(SS) tide level to prevent false alarms due to high tides or storm surge, and occurs **3.9 hours** before evacuation route cut-off in the 2022 PMF event which is the minimum warning time across all modelled events.
4. The low point on Yamba Road near the Yamba Marina is cut-off by flood water of 300 mm when Oyster Channel levels reach 1.5 mAHD.
5. Flood waters are likely to start inundating site internal roads when the water level in Oyster Channel reaches approximately 3.1 mAHD.

6. As discussed in Section 5.2.1, the time required for site occupants to evacuate to the CRB is **1.25 hours**.
7. In the PMF event Oyster Channel levels are 2.71 mAHd **4 hours** prior to reaching 3.1 mAHd.

Flood warning device alert timings and associated levels based on the BMT (2024) time series data, and site operations for each alert, are summarised in Table 8 below:

Table 8: Flood Warning Alert Timings and Site Operations

Alert #	Timing and Level Trigger	Description	Site Operation
1	Oyster Channel level reaches 1.3 mAHd	Approx. 3.9 hours (minimum) until Evacuation Route 2 to Yamba Bowling Club is cut off	If site evacuation to the Yamba Bowling Club has been triggered based on SES warnings, immediately communicate the urgency of evacuation to site occupants, emphasizing the imminent cut-off of evacuation routes. Ensure all safety protocols for rapid evacuation are followed.
2	Oyster Channel level reaches 1.4 mAHd	Approx. 0.8 hours (minimum) until Evacuation Route 2 to Yamba Bowling Club is cut off	Coordinate immediate cessation of offsite evacuation and inform site occupants to SIP in their homes or at the CRB.
3	Oyster Channel level reaches 1.5 mAHd	Evacuation Route 2 to Yamba Bowling Club is cut off	Initiate site-wide SIP procedures as outlined in emergency response plans. Notify all site occupants to prepare for SIP, ensuring they move to safe locations either within their homes or the CRB. Oversee the distribution of emergency supplies and ensure communication lines are open for updates.
4	Oyster Channel level reaches 2.7 mAHd	Approx. 4 hours until site internal roads access to CRB is cut off.	Lead the evacuation to CRB, coordinating with emergency services as necessary. Ensure that all site occupants are aware of the evacuation order and the location of the CRB. Verify that the CRB is prepared to receive evacuees, with necessary supplies and accommodations in place.
6	Oyster Channel level drops below 3.1 mAHd	Site internal roads start to become inaccessible	Conduct a thorough inspection of the site for flood water presence and potential hazards. If conditions are safe, and flood waters did not reach dwelling levels, instruct site occupants they may return to their homes. For any occupants wishing to remain at the CRB, continue community refuge building SIP procedures, ensuring their safety and comfort. If the site is deemed hazardous or dwellings were affected, maintain CRB SIP procedures and coordinate with authorities for recovery efforts.
7	Oyster Channel level drops below 1.5 mAHd	Evacuation Route 2 to Yamba Bowling Club becomes accessible.	Liaise with council, SES, and other emergency services to gather information on local road conditions and the broader status of the flood. Assess whether flooding has receded to a level that no longer isolates the site. Inform site occupants of the cessation of SIP procedures and provide guidance on safety precautions for returning to normal site activities.
8	Oyster Channel level drops below 1.3 mAHd	Flood may have passed, and it may be safe to come and go from the site.	Confirm with council, SES, and other emergency services that flooding has passed and it is safe for site activities to resume normally. Communicate to site occupants that they are free to come and go from the site, ensuring they are aware of any remaining areas of concern or restrictions. Oversee the transition back to normal site operations, ensuring any flood impact assessments and recovery efforts are initiated.

12.3 Device Location and Setup

The flood warning device is to be located on site in a vandal proof pit adjacent to Oyster Channel. The pit will be connected to Oyster Channel by a pipe so that the flood level inside the pit and in the river are the same.

The device should be connected to an audible and visual alarm system linked by wiring or telemetry to the CRB, which will be triggered by a float switch. The device should be connected to a digital app that allows Flood Wardens to access recorded data, including Oyster Channel levels, estimated time remaining for evacuation, and a record of issued alerts and alarms.

We recommend that all flood warning device elements should be prevented from being removed by an appropriate control (e.g. restriction on title, site management plan).

12.4 Device Maintenance

Site management will be responsible for overseeing regular maintenance of the flood warning device in perpetuity. A qualified contractor should inspect and maintain the flood warning device every 12 months at a minimum, or after any actuation of the system. Maintenance checks should include:

1. Cleaning of stormwater pit and removal of any debris.
2. Signage maintenance.
3. Testing the device is operational and performs the required functions at the specified flood levels.
4. Checking wiring / telemetry.
5. Ensure PA and alarm system is operational for all parts of the site.
6. Ensure software including automatic alerts and digital app work as required.

12.5 Summary

The flood warning device in conjunction with Maclean gauge monitoring has been designed to cater for all BMT 2022 modelled design flood events including the worst case PMF ('extreme flood') event that will be widely anticipated beforehand. If a flood response is triggered, it is far more likely that a smaller flood event than the worst case PMF is occurring. Therefore, the minimum evacuation times are conservative, and it is very likely that there will be much more time available for persons to evacuate.

The flood warning device will provide a warning alert (alert 1) at a minimum of approximately 3.9 hours prior to evacuation route cut-off and will alert Flood Wardens to terminate off-site at a minimum of approximately 0.8 hours before evacuation route cut-off ensuring no one is on the evacuation route when it becomes inundated. This is considered acceptable for a journey time of 7 minutes.