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CONCRUSH EXPANSION

Flood Emergency Response Plan

FINAL

July 2020

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Flood Emergency Response Plan

FINAL

Prepared by
Umwelt (Australia) Pty Limited

On behalf of
Concrush

Project Director:	Glenn Mounser
Project Manager:	Chris Bonomini
Technical Director:	Glenn Mounser
Technical Manager:	Glenn Mounser
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Newcastle

75 York Street
Teralba NSW 2284

T| 1300 793 267
E| info@umwelt.com.au

www.umwelt.com.au

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1.0 Introduction

1.1 Background

Concrush Pty Ltd (Concrush) was established as a locally owned and operated resource recovery facility in 2002 after recognising the need for a construction and demolition recycling facility in the Lake Macquarie region. The facility provides cost-effective options for recycling of concrete, asphalt, bricks, pavers, roof tiles, wall and floor tiles, rock, sand, plasterboard, and green waste for domestic households and commercial industry. These materials are then recycled into products, such as road base, drainage aggregates, pipe bedding and haunch, packing fines, decorative aggregates, and mulches. These products are used within the civil and construction industries or for commercial, domestic, and household applications.

Concrush received development consent to increase the processing and storage capacity of the existing resource recovery facility as a State Significant Development (SSD 8753) on 27 March 2020. Consent was given by the Minister for Planning and Public Spaces under Part 4 of the *Environmental Planning and Assessment Act 1979*.

Development consent allows Concrush to increase production of recycled materials up to 250,000 tonnes per annum (tpa) and store up to 150,000 tonnes of material onsite. Development consent also enables the existing site to double in area, from 2.4 to 4.8 hectares (ha). Works to increase production under the development consent (the Project) include construction of infrastructure elements over two stages. The two stages allow for the Project components to come into operation as required, in line with increasing demand for products. The conceptual layouts for Stages 1 and 2 are shown in **Appendix A**.

1.2 Site Details

1.2.1 Locality

The Concrush site is situated in the suburb of Teralba, within the Lake Macquarie LGA (refer **Figure 1.1**). The site is located on part of Lot 2 DP 220347, bound to the west by the Main North Rail Line and to the east by Racecourse Road and Cockle Creek. The section of Cockle Creek adjacent the site flows into Lake Macquarie approximately 2.0 km downstream (to the south).

The Concrush site is situated in the Lower Cockle Creek floodplain and with lower portions of the site within the 1% Average Exceedance Probability (AEP) flood extent as determined by the *Winding Creek and Lower Cockle Creek Floodplain Risk Management Study and Plan* (WMA Water, 2017b). Potential flooding of the site is discussed in greater detail in **Section 2.0**.

Figure 1.1 Locality Plan

1.2.2 Site Layout

The layout of the site at Concrush will change with each Project stage, as described in the Environmental Impact Statement (EIS) (Umwelt, 2018) and shown in **Appendix A**. Key elements of the two Project stages are listed below:

Stage 1

The key elements of Stage 1 are:

- construction of all hardstand areas (processing areas and waste and product stockpiles)
- creation of the retail area
- widening of site access and installation of sliding gate
- re-configuration of existing exit only weighbridge to allow for vehicle exit and entry to facilitate entry to the site
- construction of production compound by relocating maintenance shed, lunchroom and toilet
- augmentation of the existing water management system (WMS) to incorporate the leachate dam, constructed wetland, additional sediment basins, drainage swales, flood mitigation bund, concrete agitator washout bay, vehicle wheel wash bay, water storage tanks and sprinkler systems
- establishment of landscaping mounds, fencing, power line extension and lighting
- sealing of internal access roads with a two-coat seal
- replacement of primary jaw crusher.

Stage 2

Stage 2 will be implemented when production reaches approximately 200,000 tpa up to the consent limit of 250,000 tpa. The key elements of Stage 2 are:

- relocation of the existing exit weighbridge, construction of a new entry weighbridge and establishment of the new weighbridge office
- conversion of (1) existing entry weighbridge to the retail area weighbridge and (2) existing weighbridge office to the retail area weighbridge office
- construction of a new exit onto Racecourse Road from retail area for light vehicles (less than 2 tonne) only
- establishment of a pug mill, ballast wash facility, trommel screening machine for green waste, and aeration system for green waste pasteurisation.

1.2.3 Access

Access onto the site is via a driveway on Racecourse Road. Trucks carrying raw materials/products to and from the site will travel from the site via Racecourse Road, then proceed to the main road network at Five Islands Road/Toronto Road via York Street and Toronto Road North. Smaller vehicles travel from the site via a northern route comprising Racecourse Road, The Weir Road, Northville Drive and then Wakefield Road to the west which leads to a connection with the M1 Motorway. Vehicle movements north of the site entrance are restricted by the low clearance bridge (4.2 m) under the Main North Rail Line.

1.2.4 Topography

The Project site is located on the alluvial flats of Cockle Creek with slope gradients of 0 to 2% (Soil Conservation Service of NSW, 1991). The landform in the area ranges from moderately broad (less than 500 m) alluvial flats to broad (up to 1,000 m) deltaic deposits on lower Cockle Creek, with some relict terrace and levee deposits and point bar deposits with local reliefs (elevation difference) up to 3 m, and widths of 5 to 10 m (Soil Conservation Service of NSW, 1991).

1.2.5 Operation

During the two Project stages, operations at the site will consist of the following activities:

- material processing, including the use of heavy plant machinery to sort, crush, screen, stockpile, vacuum foreign waste materials, and transport materials using mobile loaders
- construction to upgrade existing facilities as described in **Section 1.2.2**
- retail activities including the receipt and distribution of materials to customers in the retail area
- water management using the existing WMS (to be upgraded as part of the Project) to allow for substantial capture and re-use of stormwater on site.

The proposed times for construction and operations on the site are shown in **Table 1.1**.

Table 1.1 Hours of Operation

Activity	Day	Time
Stage 1 and Stage 2 construction	Monday – Friday	7.00 am to 6.00 pm
	Saturday	8.00 am to 1.00 pm
Stage 1 and Stage 2 operations[1]	Monday – Saturday	7.00 am to 10.00 pm
	Sunday and Public Holidays	8.00 am to 6.00 pm

[1] During the evening period operations are limited to screening and stockpiling or the loading and dispatch of trucks. No crushers can be used during the evening period.

1.2.6 Development Consent Requirements

Condition B26 of the development consent addresses preparation of the Flood Emergency Response Plan (FERP). **Table 1.2** lists the relevant requirements of Condition B26 and where each requirement is addressed in this FERP.

Table 1.2 Development Consent Requirements – Flood Emergency Response Plan (Condition B26)

Condition	Requirement	FERP Section
B26.	Prior to the commencement of Stage 1 operations, the Applicant must prepare a Flood Emergency Response Plan (FERP) to the satisfaction of the Planning Secretary. The FERP must form part of the OEMP required by condition C5 and be prepared in accordance with condition C1. The FERP must:	
	(a) be prepared by a suitably qualified and experienced person(s);	**Section 1.2.7**
	(b) be prepared in consultation with Council;	**Section 1.2.8**
	(c) address the provisions of the Floodplain Risk Management Guideline (OEH, 2007);	**Section 1.2.9**

Condition	Requirement	FERP Section
	(d) include details of:	
	(i) procedures for managing flood risks during operations including the protection of plant and equipment;	Sections 3.0, 4.0 and 5.0, and sub-sections
	(ii) the flood emergency responses for operation phases of the development;	Section 5.0 and sub-sections
	(iii) predicted flood levels;	Section 2.0 and sub-sections
	(iv) procedures for control of discharges from the site; and	Sections 5.4.5
	(v) awareness training for employees and contractors.	Section 5.4.1

1.2.7 Qualifications of Person Preparing this FERP

The principal author of this FERP was Glenn Mounser, Manager Water Group, Umwelt. Glenn holds a Bachelor of Engineering degree in Civil Engineering (Honours Class 1) from the University of NSW. He is a Chartered Professional Engineer (CPEng) and a Fellow of the Institution of Engineers, Australia. Glenn is a Principal Water Engineer with over 35 years of industry experience in both consulting engineering firms and government agencies. He provides expert advice and ensures technical rigour in a range of water engineering fields. A selection of these fields relevant to this FERP include: Surface Water Impact Assessments; Flood Impact Assessments; Floodplain Risk, Warning and Emergency Planning; Flood Mitigation; Dam Break Modelling & Dam Safety; Mine Water Management; Expert Witness (advice, reports, evidence); Peer Review and Audit of Consultant Studies.

Other degree qualified Civil and Environmental Engineers with experience in flood risk assessment and emergency management were involved in the preparation of the FERP under Glenn's direct supervision.

As well as being the principal author, Glenn was also responsible for the Umwelt internal review and approval to issue the FERP.

1.2.8 Consultation with Lake Macquarie City Council

Condition B26 requires that the FERP is prepared in consultation with Lake Macquarie City Council (Council). In accordance with this requirement, it is advised that:

- The *Lake Macquarie City Flood Emergency Sub Plan* (LMCC, 2013) was considered in the preparation of the FERP.
- Background to the FERP and the key recommendations were discussed by telephone with Council Flood Officer, Greg Jones, on 23 June 2020 and 6 July 2020. Key matters discussed included:
    - Two (2) types of emergency response considered– evacuation and shelter-in-place.
    - Early evacuation is the preferred response in time of flood emergency and this accords with the view of the NSW State Emergency Service (SES).
    - Site personnel are well aware of flood behaviour in Cockle Creek. Once water from Cockle Creek approaches the Racecourse Road level they close the operation and evacuate quickly.
    - If required, shelter-in-place is possible on the site, with safe refuge to be available above the level of the Probable Maximum Flood (PMF).

Upon submitting the FERP to the consent authority (Planning Secretary) for consideration and approval, a copy will be provided to Council for their information.

1.2.9 Floodplain Risk Management Guideline (OEH, 2007)

Condition B26 requires that the FERP addresses the provisions of the Floodplain Risk Management Guideline (OEH, 2007). There are in fact two (2) OEH guidelines that address emergency flood management, as follows:

- OEH 2007a. *Floodplain Risk Management Guideline - SES Requirements from the FRM Process*. Office of Environment and Heritage, NSW Government, October 2007, 10pp.
- OEH 2007b. *Floodplain Risk Management Guideline - Flood Emergency Response Planning of Communities.* Office of Environment and Heritage, NSW Government, October 2007, 4pp.

The first of these guidelines (OEH 2007a) outlines the preferred outputs from the floodplain risk management (FRM) process to assist the SES in effective emergency response planning (ERP). The guideline recommends information that should be provided in Flood Studies and Floodplain Risk Management Studies and Plans to assist ERP planning by the SES. The document provides guidance for regional scale ERP by the SES, and hence provides a useful backdrop to the local scale ERP developed for the Concrush site as part of this FERP.

More directly relevant to the Concrush site is the second guideline (OEH 2017b). It addresses continuing flood risk. It notes that as the risk varies across the floodplain, the type and scale of the emergency response problem also varies including the information necessary for effective ERP.

The ERP classifications in OEH (2017b) provide an indication of the relative vulnerability of the community in varying flood situations. At the regional scale, the classifications are used to inform the SES flood emergency response including the key operational issues of evacuation, resupply and rescue. Communities are classified as either Flood Islands (high and low), Rising Road Access, Overland Escape Route, Trapped Perimeter Areas (high and low) or Indirectly Affected Areas.

For a specific site (e.g. Concrush) the relevant site classification can provide guidance for ERP at the local level.

WMA (2017a and 2017b) provide a classification of 'Rising Road Access' in a PMF for the Cockle Creek floodplain downstream of the Main North Rail Line extending to Lake Macquarie. This area includes the Concrush site and the evacuation route to the south.

The Cockle Creek floodplain upstream of the Main North Rail Line extending to the Winding Creek confluence, and west to Barnsley, is classified in the two references as 'Overland Escape Route' in the PMF. This area includes the northern evacuation route from the Concrush site.

It is noteworthy that OEH (2017b) says that while the guideline provides a basis for the categorisation of floodplain communities into various flood ERP classifications, these may vary depending on local flood characteristics and flood behaviour. Aspects of the classification(s) given in WMA (2017a and 2017b) not specifically relevant to the Concrush site include:

- 'Rising Road Access' is based on continuous vehicle evacuation being available as water advances toward properties. This classification is not applicable for the Concrush site as the northern evacuation route passing through this area is cut in relatively frequent events (well below the 1% AEP flood level) and becomes impassable.

- ‘Overland Escape Route’ is based on vehicle evacuation being completed before that access route closes, and once the access is closed occupants can reach safety unassisted but may need transportation to evacuation centres. This classification is not applicable for the Concrush site as the northern evacuation route passing through this area is cut in relatively frequent events, and in large events the flood depths and velocities along the evacuation route will be too high to reach safety unassisted. In this case the only options for occupants will be to shelter-in-place or be evacuated by the SES.

Appropriate classifications for the Concrush site are therefore:

- Events up to the 1% AEP: ‘High Trapped Perimeter’ area. This classification is applicable as it requires evacuation to be completed prior to access route closure, and after closure resupply in-situ (by SES) will be required (unless appropriate provisions and facilities are made available pursuant to a site FERP).

- Much larger events including the PMF: ‘Low Trapped Perimeter’ area. This classification is applicable as it requires evacuation to be completed prior to access route closure, and after closure evacuation by the SES is required prior to site inundation (unless safe shelter-in-place can be made available pursuant to a site FERP).

The information on site classification described above has been used to develop a site specific FERP for the Concrush site, particularly in relation to evacuation planning.

2.0 Flood Behaviour

2.1 Flood Generating Weather

Coastal areas of eastern Australia mostly receive flooding rains from so-called "east coast lows" that develop from time to time over the adjacent Tasman Sea. These are intense depressions off the coast and can produce thunderstorm activity associated with troughs. Depressions can develop at any time of year, but are most likely when sea surface temperatures are high and the air is humid. Therefore, these events usually occur in the summer months and over the first half of the year. Flooding can also be a winter-spring phenomenon, associated with unusually frequent or active extra-tropical depressions and fronts. However, some major events have occurred in the summer half-year as systems of tropical origin extend or move south. Flooding over inland areas is usually associated with southward-moving tropical systems, but in the cooler months, may occur when well-developed cloud bands extend across the interior from the oceans north and northwest of Australia. Rainfall patterns are also dependant on longer term weather patterns. Flooding is more prevalent in a La Nina year when rainfall is significantly greater than the mean average rainfall. Thunderstorms, which generally occur during the summer, can also result in localised flooding which could impact specifically on the site.

2.2 Flood Probabilities

Flood probability can be expressed in more than one way. For example, a flood may be described as having a 1 in 100 year Average Recurrence Interval (ARI). This means that over a very long period (e.g. thousands of years), a flood of this magnitude or greater is expected to occur on average once per 100 years. This does not mean that a flood of this size only occurs once every 100 years. It is possible to have floods of this size in consecutive years or even two in the same year. This happened in several locations in Queensland and Victoria in 2010 and 2011. Another way of expressing flood probability is in terms of AEP. A 100 year ARI flood has a 1% AEP. That is, each and every year there is a 1% chance of a flood of this magnitude being equalled or exceeded.

The largest flood that can possibly occur is referred to as the PMF. Although it is extremely rare and has a very low probability of occurring in any one year (typically significantly less than a 1 in 1,000,000 chance in any year), events approaching a PMF have been recorded in Australia and many other parts of the world.

It is important to note also that flooding may occur at any time of year and at any time of day.

2.3 Flooding of the Site

Flooding of the site is primarily caused by Cockle Creek overtopping its banks, however minor flooding can also be caused by rainwater accumulating and flowing across the ground (local overland flooding).

The Lake Macquarie City Council ‘Flood Reporting Tool’ (on the Council website) provides site specific flood information. This tool was accessed to provide a ‘Property Flooding Information Summary’ for the Project site. This information shows that the site is flood affected in the 1% AEP flood event due to rainfall-runoff within the Cockle Creek catchment. Flooding of the site is also possible due to raised water levels in Lake Macquarie, however flooding (depth and extent) from Cockle Creek will be greater than the same AEP flooding from Lake Macquarie. The flood information obtained from the Council website is based on the flood model developed for Council as part of the *Winding Creek and Lower Cockle Creek Flood Study* (WBM, 2017a). Further information on flooding of the site is provided below.

2.3.1 Flood Extent, Levels and Hazard

The 'Property Flooding Information Summary' for the site includes approximate flood levels of 2.06, 2.38 and 4.28 m AHD for the 5% AEP, 1% AEP and PMF events respectively. The flood maps provided in the *Winding Creek and Lower Cockle Creek Flood Study* show that significant flooding of the site commences at the 5% AEP Level when floodwaters overtop the banks of Cockle Creek and flow over Racecourse Road and onto the site. In the 1% AEP event inundation is predicted in the eastern part of the site, as shown in **Figure 2.1.** The PMF would inundate the majority of the site as shown in **Figure 2.1**. It is noted that the PMF event is extremely rare (further information on the probability of the PMF event is given in **Section 2.2**).

In the area surrounding the site, peak 1% AEP flood levels and flood depths from the *Winding Creek and Lower Cockle Creek Flood Study* are provided at **Figure 2.2.** Similarly, **Figure 2.3** shows 1% AEP flood extent and flood hazard in the area surrounding the site.

The 'Property Flooding Information Summary' also shows that the Flood Planning Level for the site is 2.88 m AHD, which is based the 1% AEP flood level plus a 0.5 m freeboard.

In keeping with the development consent for the Concrush expansion, a levee is to be constructed on the eastern side of the southern site extension. This levee will provide protection for this area to the 1% AEP flood level with the levee crest incorporating a suitable freeboard.

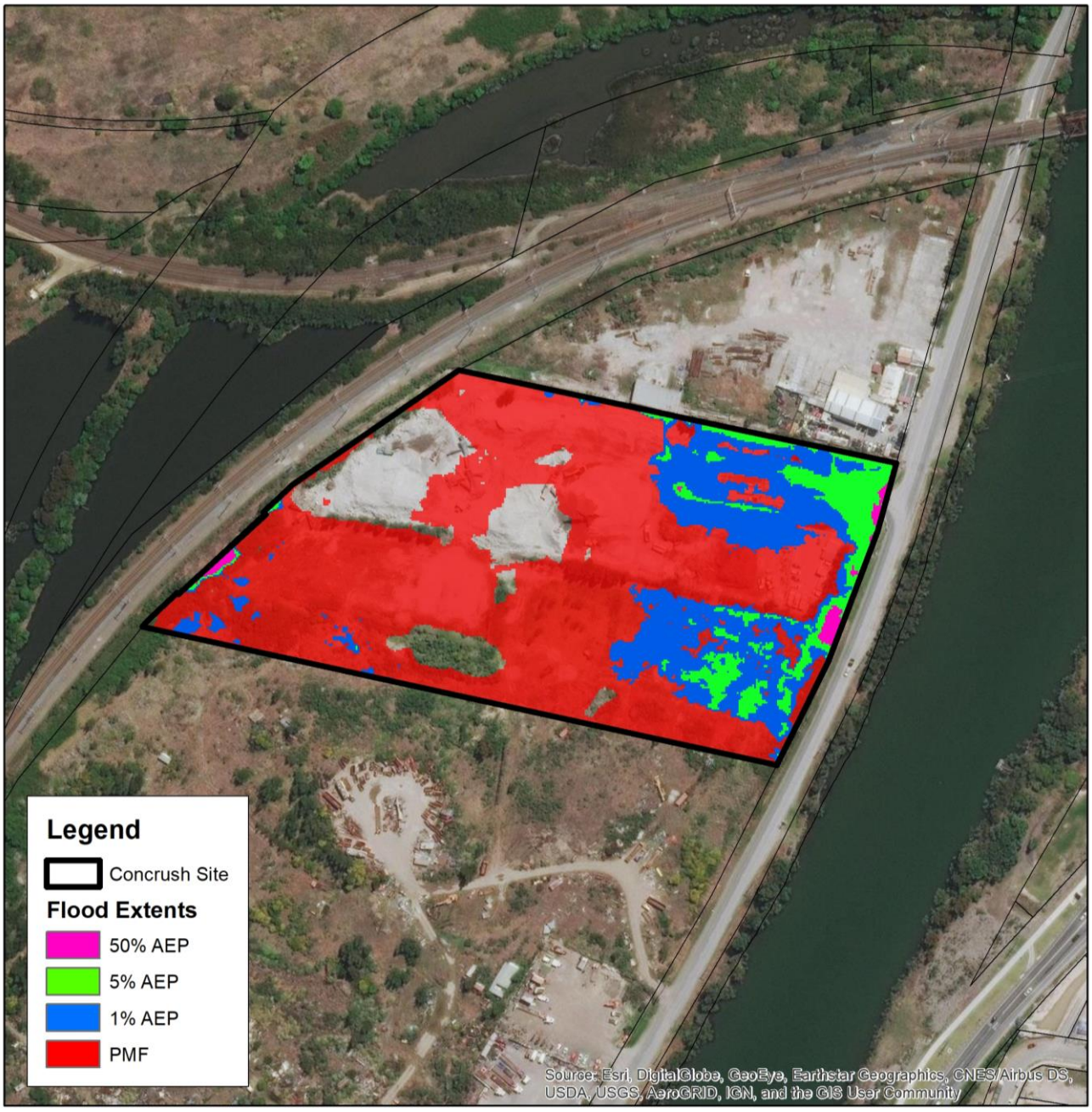


Figure 2.1 Design Flood Extents (based on flood levels in WBM 2017a and 2014 LiDAR data)

NOTE 1: The flood extents in **Figure 2.1** are based on the flood levels provided in WBM 2017a and the latest available LiDAR data (flown in 2014).

NOTE 2: For the PMF event, the majority of areas shown as not being inundated are stockpiled materials on the site.

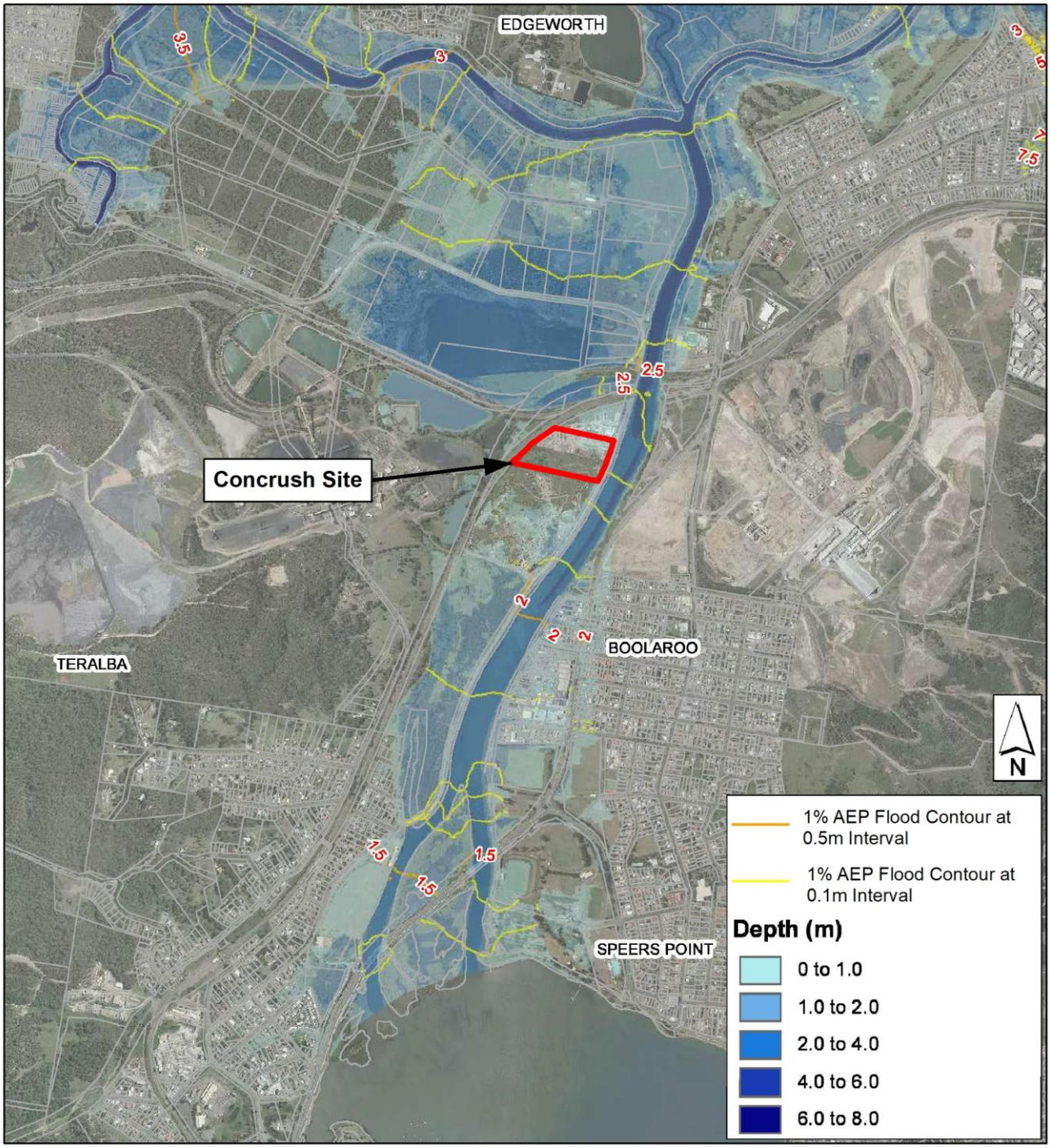


Figure 2.2 1% AEP Peak Flood Levels and Depths (Extract from Figure 23c of Winding Creek and Lower Cockle Creek Flood Study, WMB 2017a)

NOTE: The flood extents shown in **Figure 2.2** are approximately only. In relation to the Concrush site, more accurate flood extents are shown on **Figure 2.1**.

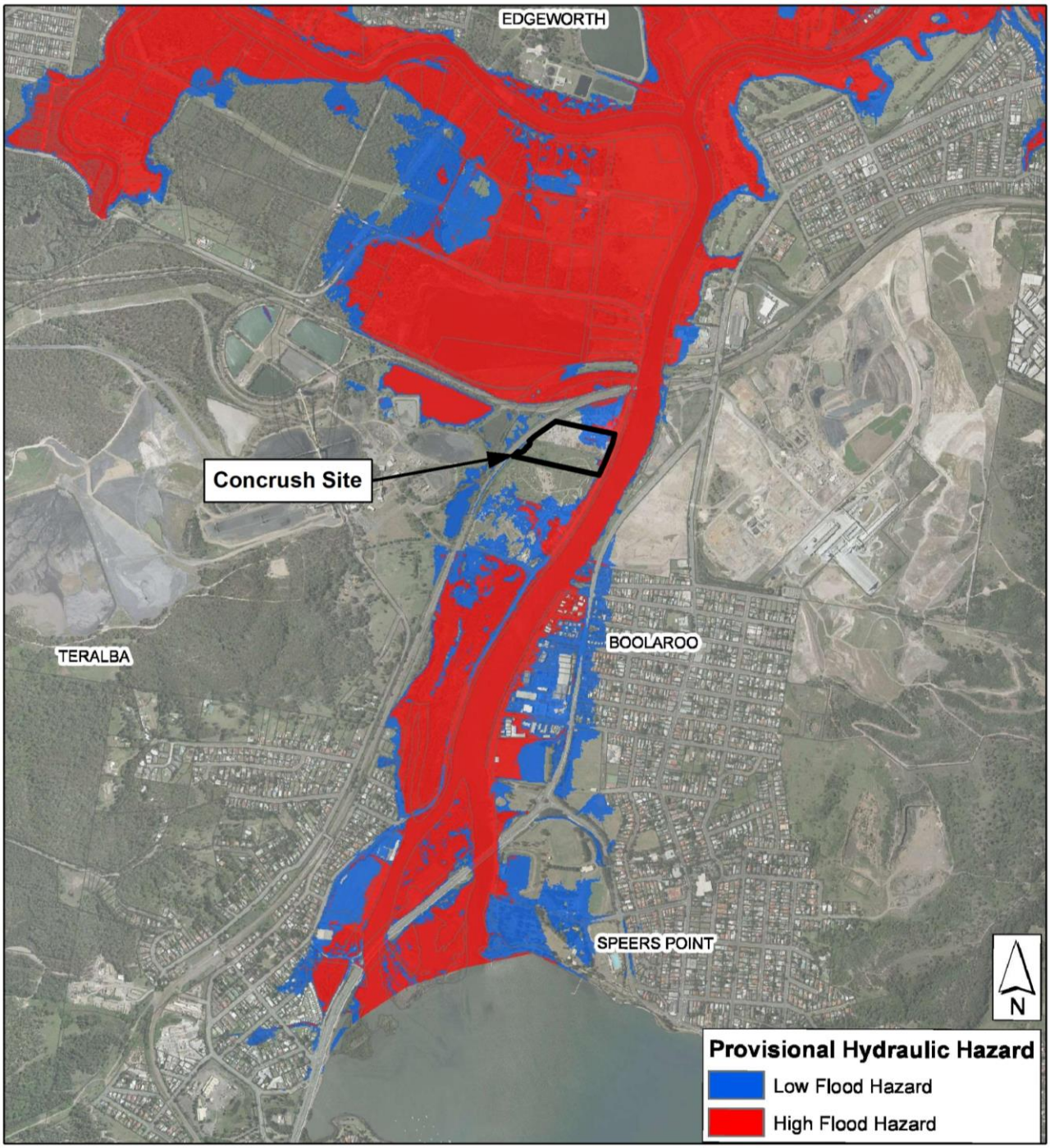


Figure 2.3 1% AEP Provisional Hydraulic Hazard (Extract from Figure 36c of Winding Creek and Lower Cockle Creek Flood Study, WBM 2017a)

NOTE: The flood extents shown in **Figure 2.3** are approximate only. In relation to the Concrush site, more accurate flood extents are shown on **Figure 2.1**.

2.3.2 Flood Rate of Rise and Duration

Figure 2.4 shows modelled hydrographs for Cockle Creek taken from the *Winding Creek and Lower Cockle Creek Flood Study* (2017a) at the model location 'Cockle Ck Railway Bridge'. This model location corresponds with the stream gauge 'Cockle Railway Station (211455)' located on the eastern bank of Cockle Creek immediately upstream of the railway bridge (Main North Rail Line). The Project site is located approximately 200 m downstream of the railway bridge.

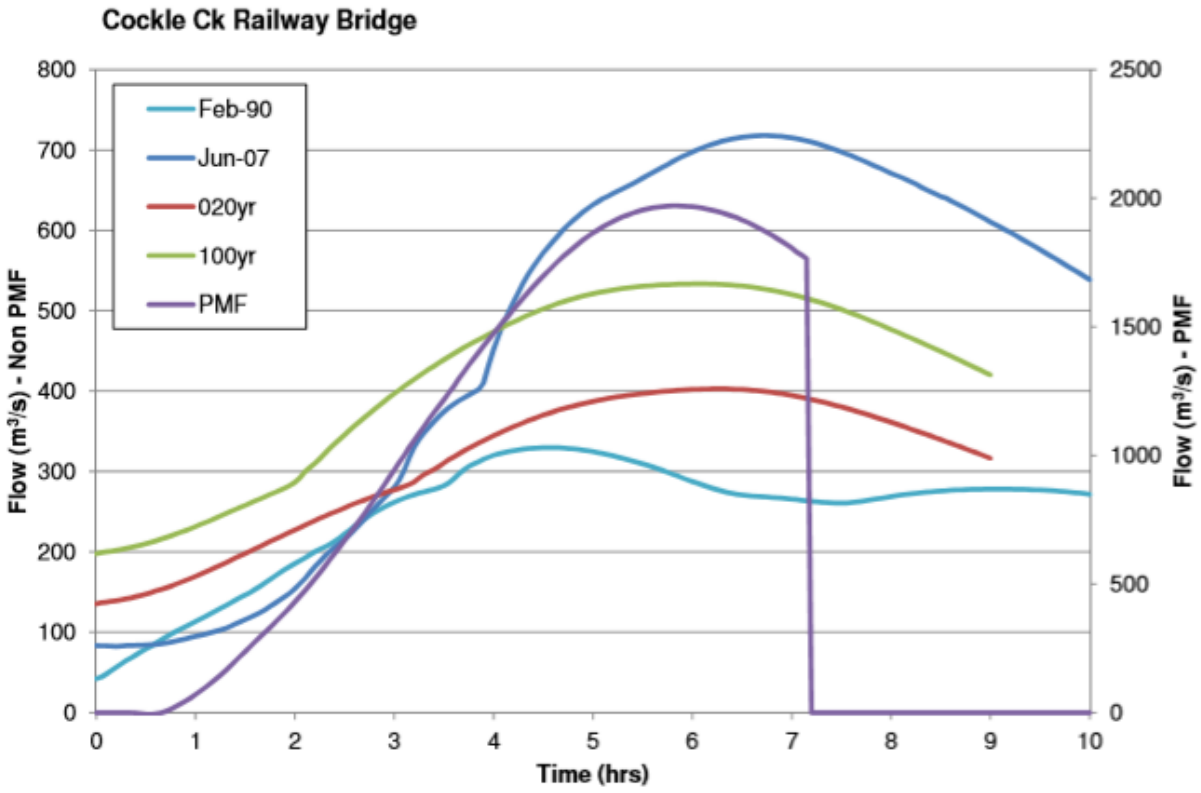


Figure 2.4 Flow Hydrographs at Cockle Creek (Extract from Figure D2C Winding Creek and Lower Cockle Creek Flood Study, WBM 2017a)

NOTE: The PMF has a different vertical axis in the above figure.

For the purpose of addressing evacuation of the site during a flood, an examination was made of flood duration and rate of rise. From WBM (2017a) the peak flow at the Cockle Creek Railway Bridge in the 50% AEP event is 200 m^3/s, and in this event the low point on the access route to/from the Project site would be inundated by at least 400 mm and therefore impassable (further information is provided in **Section 4.0**).

By extrapolating the 1% AEP hydrograph provided in **Figure 2.4**, the floodwaters would rise to the level of the 50% AEP peak (200 m^3/s) in approximately 6 hours, and the peak of the 1% AEP event would occur approximately 12 hours after the initial water level rise.

In the PMF event, the floodwaters would reach the level of the 50% AEP peak (200 m^3/s) in approximately 1.5 hours, and the peak of the PMF event would occur in approximately 5-6 hours after the initial water level rise.

3.0 Flood Forecasts and Warnings

To manage flood risk at the site, it is critical that site personnel monitor weather forecasts and warnings. Reliable forecasts and warnings are issued by the Bureau of Meteorology (BoM) and the SES.

The type of warnings provided by BoM and SES are presented in **Section 3.1**. To prepare for short-notice warnings sent by telephone, it is recommended that the site register for the Early Warning Network (EWN) as described in **Section 3.2** and/or have access to radio as described in **Section 3.3**. For longer-range forecasting and to access site-specific flood related data in near real time, the site should use the Lake Macquarie FloodWatch online tool, as described with links in **Section 3.4**. Physical observation of the water level in Cockle Creek can give a strong indication of flood risk, however, this can be dangerous and should only be done from a safe distance.

3.1 BoM and SES Warning Products

The following official forecasts and warnings related to flooding in NSW are issued by BoM and the SES. These warnings can be communicated through a range of media, including internet (links included below), telephone, radio, television and print:

Table 3.1 BoM and SES Warning Products

Organisation	Warning/Forecast	Link
BoM	**Flood Watch** - provides a 'heads up' that flooding is likely.	http://www.bom.gov.au/nsw/warnings/index.shtml
	Flood Warning - warns a community of flooding at a predicted height, time and location.	
SES	**Flood Bulletin** – warns of flooding at a predicted height, time and location and the expected risks, impacts, consequences and the safest actions to take.	https://www.ses.nsw.gov.au/majorwarning/floodbulletin?major=1&active=FloodBulletin
	Evacuation Warning – warns of the potential to evacuate properties, risks to life and property and the safest actions to take.	
	Evacuation Order – orders immediate evacuation of 'at risk' sections of the community from a flood threatened area and advises the safest actions to take.	
	All Clear – advises the evacuated community that it is safe for people to return to the area and any residual risks.	

3.2 Early Warning Network (EWN)

In operation since 2007, the EWN) is a location-based warning system for severe weather (including flood warnings) and incident alerts issued by government agencies and other sources using **mobile phones.** The EWN monitors and tracks potentially dangerous weather systems and alerts people directly in the path of an event. Council has partnered with EWN so that local residents and businesses are able to receive the alert service free of charge. Warnings are yellow, amber, red or black according to the threat level. A registration link for this service is provided in **Table 3.2**. The yellow, red and black warnings levels generally correlate to the flood alert modes described in **Section 5.1.2.**

Table 3.2 Lake Macquarie EWN Registration Instructions

Registration	Link/Instruction
Online registration	https://www.lakemac.com.au/For-residents/Emergencies/Register-with-the-Early-Warning-Network
Smartphone	Register for smartphone alerts using the online factsheet at the link above.
Non-smartphone	Call 02 4921 0333 or visit http://www1.ewn.com.au/lake_macquarie/register.aspx

3.3 ABC Radio Newcastle

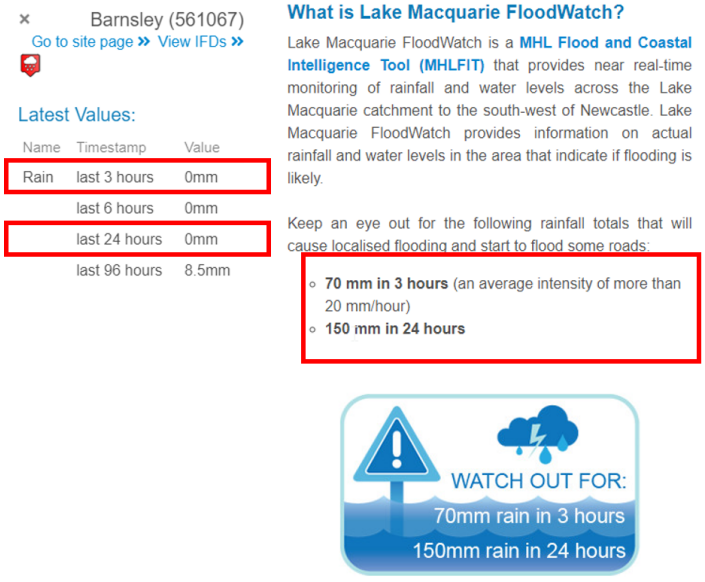
Listen to local radio broadcasts on ABC Radio Newcastle for weather and flood warnings.

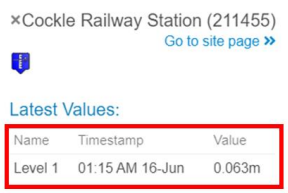
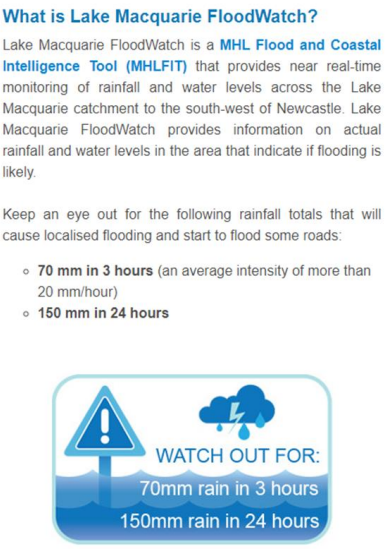
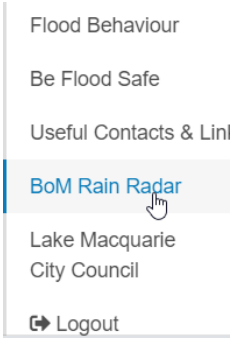
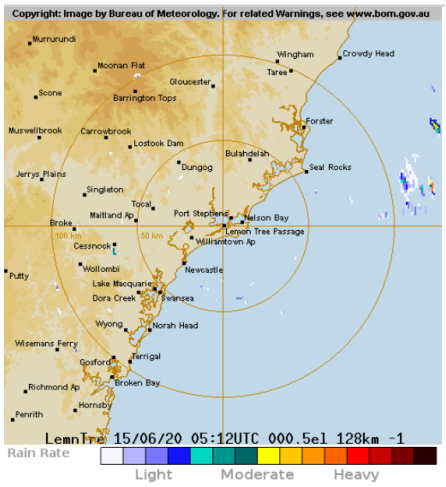
ABC Radio Newcastle 1233 AM

3.4 Lake Macquarie FloodWatch

Lake Macquarie FloodWatch is an online/internet flood warning tool that provides near real-time monitoring of rainfall and water levels across the Lake Macquarie catchment. The tool includes an interactive map showing rainfall and river gauges in the catchment. Barnsley (561067) is the closest and most relevant rainfall station, 3.5 km North-West of the Concrush site, and Cockle Railway Station (211455) is the closest stream gauge station, 240 m upstream of the Concrush site. The four steps for monitoring rainfall and water levels near the Concrush site are shown in **Table 3.3** below.

Table 3.3 Steps for Flood Monitoring using Lake Macquarie FloodWatch

Step	Instruction	Link/Screenshot
1	Navigate to Lake Macquarie FloodWatch by clicking on the link.	Link: https://www.mhlfit.net/users/LakeMac/
2	Click on **Barnsely (561067)** to see latest values for rainfall. Latest values for rainfall can be compared against recommended rainfall intensity totals likely to cause localised flooding, which are: • 70 mm in 3 hours • 150 mm in 24 hours	

Step	Instruction	Link/Screenshot
3	Click on **Cockle Railway Station (211455)** to see latest values for Cockle Creek water levels[1]. It can be helpful to monitor flood levels throughout a flood event. However, this data may not be accessible during a flood due to storm or flooding damage to gauges and telecommunications infrastructure. If possible, observe and monitor flood levels in Cockle Creek from a safe distance. • At a gauge reading of 0.7 m AHD, water will commence to break creek bank at location of low point on access route • At a gauge reading of 1.4 m AHD, water will reach 300 mm depth at location of low point on access route. • At a gauge reading of 1.9 m AHD, water will commence to inundate the site at its lowest point.	 
4	The **side panel** in the tool shows other useful information, including useful contacts and links (also in **Appendix B**). The side panel includes a link to the BoM Rain Radar (128 km Newcastle Radar Loop), a tool which detects nearby rainfall. The radar can be useful in estimating likely rainfall in the area of the Concrush site and the Cockle Creek catchment (refer to instruction on how to interpret images).	  Link: http://www.bom.gov.au/products/IDR043.loop.shtml Instructions: http://www.bom.gov.au/australia/radar/about/radar_images_intro.shtml

Note [1] Water levels reported for the Cockle Railway Station (211455) gauge relate to Australian Height Datum (AHD). As the gauge zero is at 0.0 m AHD, a reading on the gauge provides a water level in m AHD.

4.0 Emergency Preparedness and Response Considerations

The two main types of responses to a flood emergency are to either:

- Evacuate to an area above the reach of floodwaters. This is the SES preferred response, provided that the risks of evacuating are deemed acceptable; or
- Take Shelter in Place (SIP) (i.e. within the Site) and wait until floodwaters have receded and the emergency has passed. SIP is to be considered an alternative to evacuation only when the risks of evacuating are higher than the risks of SIP.

Both evacuation and SIP are considered as possible flood emergency response strategies in this FERP. This Section provides a summary of the flood emergency response analysis (for evacuation and SIP) that was undertaken as part of this FERP to inform the identification of the most suitable response strategy and required management actions. The analysis was undertaken considering both the 1% AEP flood that is used for flood planning purposes, and where appropriate the PMF event that is the theoretically largest possible flood that can occur. As the PMF is an extremely rare event (typically significantly less than a 1 in 1,000,000 chance in any year) it has not been considered in isolation but in conjunction with the 1% AEP event which is a large flood in its own right. Most flood emergencies will be much smaller events than the PMF, but by having a FERP that addresses the largest possible flood event, all floods can be appropriately responded to within a suitable timeframe.

4.1 Evacuation Considerations

4.1.1 Context

Although it is intended that a levee will be constructed on the eastern side of the southern site extension to protect this area in floods up to the 1% AEP event, other parts of the site will be inundated in a 1% AEP event, and persons on site when a flood is imminent will need to make a decision on whether they intend to evacuate the site prior to the access routes being cut by flood waters. At the peak of a 1% AEP event the access routes would be inundated by 1.3 m in the northern direction and 1.0 m in the southern direction and both would be impassable. The evacuation routes and lowest points along these routes are shown in **Figure 4.1**.

4.1.2 Protection of Plant and Equipment

Whether a decision is taken to evacuate the site or to instigate SIP, plant and equipment should be moved/parked so they are afforded reasonable protection from flooding. However, this action should only be implemented where it will leave sufficient time to safely evacuate the site or instigate SIP. An area is to be designated on site above the 1% AEP flood level (2.38 m AHD) where plant and equipment can be located for the duration of the flood.

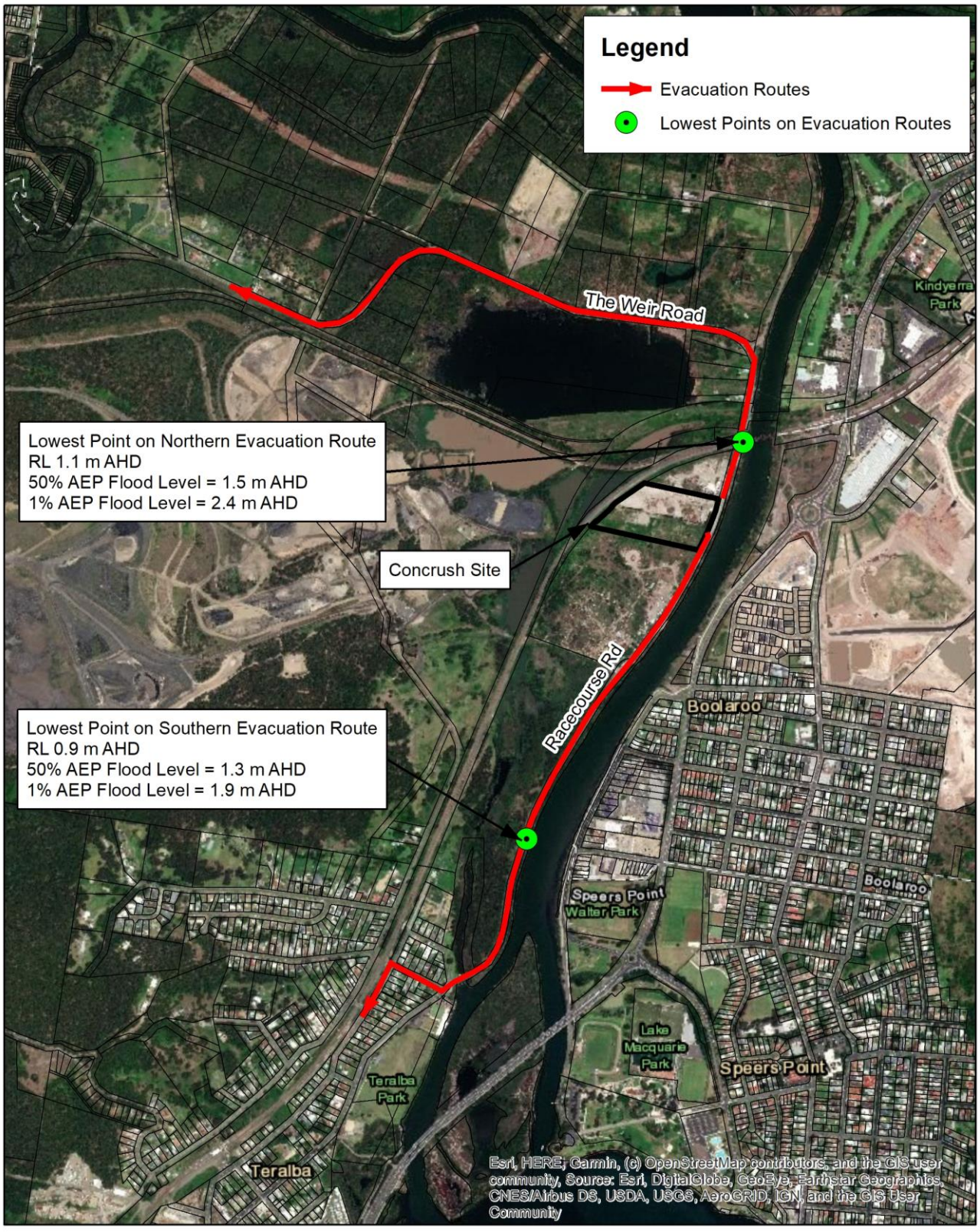


Figure 4.1 Evacuation Routes for Concrush Site

4.1.3 Evacuation Timeline

Taking into account the evacuation routes an assessment of evacuation time in the 1% AEP event was undertaken to understand:

- Whether evacuation would be possible prior to evacuation routes being cut by floodwaters in a 1% AEP event
- At what point in time an evacuation order would need to be issued to provide enough notice for all personnel (staff, contractors, customers) to leave the site before evacuation routes are cut.

Evacuation in a 1% AEP event is addressed below. The potential evacuation time for the PMF is also discussed.

An evacuation timeline has been defined by:

- Identifying the discharge hydrograph for the 1% AEP flood event for Cockle Creek. This is shown in Figure D2C in WBM (2017a) – **Figure 2.4** in this FERP
- Identifying the level of the lowest point(s) along the evacuation route(s)
- Identifying the time to evacuate from the site beyond the lowest point(s) to high ground
- Using the 1% AEP hydrograph, identifying the time from the commencement of hydrograph rise when the lowest point on the evacuation routes are cut by floodwaters and no longer passable by motor vehicle
- Subtracting the total evacuation time from the time at which the evacuation route is cut to identify the latest time that evacuation should begin (relative to the start of water level rise in Cockle Creek)
- Identifying the level of floodwaters at the time evacuation should begin to set the evacuation trigger (i.e. flood level trigger).

The lowest point along the evacuation route of Racecourse Road to the south that is first affected by floodwater water breaking out of Cockle Creek is at a level of approximately 0.9 m AHD (location shown on **Figure 4.1**). At the peak of a 1% AEP event, the flood level at this point is 1.0 m deep. At the peak of a 50% AEP event, the flood level at this point is 400 mm deep.

The lowest point along the evacuation route to the north to The Weir Road is approximately 1.1 m AHD (location shown on **Figure 4.1**). At the peak of a 1% AEP event, the flood level at this point is 1.3 m deep. At the peak of a 50% AEP event, the flood level is also 400 mm deep.

Driving a motor vehicle in even 300 mm of flood water is not considered safe, particularly if there is a significant flow velocity. Hence the access routes can be considered impassable at the level of a 50% AEP event (400 mm depth), which is a relatively small and frequent event.

It has been determined that in a 1% AEP event, evacuation should commence within 3-4 hours after the start of water level rise in Cockle Creek. This is based on the access routes being passable at a flow in Cockle Creek up to 100 m^3/s (50% of the peak flow in a 50% AEP event). An assessment of **Figure 2.4** indicates a flow of 100 m^3/s would be reached in the 1% AEP event approximately 3-4 hours after the initial water level rise.

Using a similar assessment of **Figure 2.4** for a PMF event, evacuation should commence within 0.5 hours of the initial water level rise in Cockle Creek.

In practice, site personnel are very aware of the frequency and behaviour of flooding from Cockle Creek. As soon as water from Cockle Creek approaches the level of Racecourse Road, they close the operation and evacuate quickly. Early evacuation is aided by The Weir Road flashing alarm that advises of closure of The Weir Road at the low-level causeway due to flooding in Cockle Creek. When the flashing alarm is activated customers are quick to advise Concrush that access to/from Barnsley via The Weir Road is no longer possible, and this provides Concrush with informal advance warning (several hours) there is a risk of the evacuation route from the Concrush site being cut should Cockle Creek flood waters continue to rise. This is simply an added level of early warning that will aid the process outlined in this FERP for timely evacuation of the site (when required).

4.2 Shelter in Place

4.2.1 SIP Challenges

If staff and customers make the decision to take shelter within the Concrush site until the emergency has passed, they would be isolated by floodwaters for around 16-18 hours in a 1% AEP event. The maximum water depth along the evacuation route would be around 1.3 m to the north and 1 m to the south. While it is widely acknowledged that there are risks associated with taking SIP, these are generally greater for longer isolation times. Nevertheless, the risks of SIP have been identified and addressed as part of this FERP. These include:

- **Staff and Customers Walking through Floodwaters**
  Staff might become impatient while the site is isolated and walk though floodwaters. This is a known risk for any SIP based response strategy and can be exacerbated by circumstances in which there is a lack of power, sustenance, access to medical care, or overall comfort or inability to access information on the expected duration of isolation. These risks will be reduced by:
  - Providing shelter from the rain and floodwaters, and access to food, water, telephone and toilets. Further information is provided at **Section 4.2.2**.
  - Providing updates on the expected flood duration based on communications with the SES.
- **Persons Requiring Medical Attention**
  A staff member or customer may be injured or become ill during a flood event. There will be first aid supplies on site to assist in this scenario. Further, given the duration of confinement during a flood will typically be around 16-18 hours (1% AEP event), for minor injury or illness it will be reasonable to wait for the evacuation route to be passable before medical attention is sought. Where urgent and immediate medical attention is required this can be addressed by the Emergency Management Plan (EMP).
- **Risk of Fires**
  A secondary risk generally associated with SIP is the risk of fire. This risk is exacerbated when the isolation time is long and there is lack of power for cooking and heating, particularly relevant for residential dwellings but also relevant for commercial/business sites. The risk is that people may improvise for cooking, heating and lighting by using naked flames. With an isolation time of around 16-18 hours, and in a non-residential setting, it is very unlikely that the risk of fire at the site would be increased during a flood. Nonetheless, the risk of fire will be managed according to the site EMP.

4.2.2 Designated Safe Area

As stated earlier, it is intended that a levee will be constructed on the eastern side of the southern site extension to protect this area in the 1% AEP event. While there will be other areas of the site inundated in a 1% AEP event, there will be a significant proportion of the site that is not inundated in the 1% AEP event. On this basis. safe refuge in a 1% AEP event would be satisfied by a designated weatherproof area(s) that is adequately provisioned and located at a height above the 1% AEP flood (2.38 m AHD).

However, floods greater than the 1% AEP event can inundate a much larger proportion of the site and to significantly greater depths. As such, a designated weatherproof area(s) is required above flood level, sufficient to safely accommodate the maximum number of personnel (staff, contractors, customers) likely to be on the site while the evacuation routes are cut – duration on site around 16-18 hours for both the 1% AEP and PMF events. The minimum level of this area(s) should be at the level of the PMF level (4.28 m AHD). As well as this area being sheltered from rain and floodwaters, it should have access to food, water, toilets, telephone and first aid facilities.

5.0 Flood Emergency Response Plan

This section outlines the basic principles underlying flood emergency response (**Section 5.1**), responsibilities and emergency contacts (**Section 5.2**), flood alert communication methods (**Section 5.3**) and the list of response actions and triggers (**Section 5.4**).

5.1 Emergency Response Philosophy

5.1.1 Priorities

This FERP recognises that the protection of life is of critical and primary importance. This FERP is principally concerned with the safety and comfort of personnel on the site in relation to a flood situation. The flood emergency responses recommended in this FERP recognise the primacy of life and wellbeing over property. Nonetheless, it is recommended that Concrush management and staff take all necessary measures (either identified in this FERP or otherwise) to manage the risks which flooding poses to the site. The FERP sets emergency management prevention, preparedness and response measures that are relevant to a flood emergency and structure for a range of Alert Modes.

5.1.2 Alert Modes

To assist in managing flood risks and communicating response actions, five flood alert modes have been developed for use in this FERP. They have been colour coded to further assist in communication. They are:

- *White:* normal operations
- *Yellow:* flooding of the site and/or evacuation routes in the next 24 hours may be possible
- *Red:* flooding that will cut evacuation routes in the next two hours is possible (based on a 1% AEP event).

  NOTE: In a 1% AEP event, the evacuation routes would become impassable at a level of 1.4 m AHD on the Cockle Railway Station (211455) gauge. Two hours prior to the access being cut would correspond to a level of 1.2 m AHD on the Cockle Railway Station (211455) gauge.

- *Black:* flooding of the site is possible within the next two hours (based on a 1% AEP event).

  NOTE: In a 1% AEP event, inundation of the site would commence at a level of 1.9 m AHD on the Cockle Railway Station (211455) gauge. Two hours prior to site inundation commending would correspond to a level of 1.6 m AHD on the Cockle Railway Station (211455) gauge.

- *Green:* all clear, floodwaters have receded and there is flood-fee access to/from the site

The initiation times for these alert modes may be revised up or down depending on the changing forecasts and actual conditions. An Alert Mode table nominating thresholds that trigger escalation of Alert Modes is shown in **Table 5.1**. The Alert Mode **MUST** be escalated if **any one of these thresholds** alone is reached or exceeded because there is a high degree of certainty that the corresponding management actions will be necessary.

It is recommended that the Alert Mode table plays a key role in the planning and training processes before a flood occurs, as well as when flooding is possible and when it does happen. It will be important to maintain the Alert Mode table and update this if new information is made available and review it after events which trigger any level of flood response.

5.2 Responsibilities and Emergency Contacts

The responsibility for successful implementation of this FERP lies with Concrush site management. However, the SES, as the State combat agency for flood events, and the NSW Police Force have the right to intervene and may intervene before, after or during a flood to provide guidance or prescriptive directions to Concrush personnel. Any decision to evacuate the site is to be made in consultation with the SES and the NSW Police Force. Concrush are to provide the following staff resources to coordinate the management of flood emergencies:

- *Wardens:* Members of the Concrush team who are trained to deal with a range of emergencies.

A list of emergency contacts is provided in **Appendix B**.

5.3 Flood Alert Communication Methods

Different communication methods and channels will be available to the Wardens, staff, contractors and customers before, during and after a flood event. The selected communication methods are specific to the type of user and are summarised in **Table 5.1** and the sections following.

Table 5.1 Alert Mode Table

Activity or Advice	Thresholds that Trigger Escalation of an Alert Mode				
	White	Yellow	Red	Black	Green
	Normal Operation	Flooding of the site and/or evacuation routes possible within the next 24 hours	Flooding of evacuation routes is possible within the next 2 hours	Flooding of the site is possible within the next 2 hours	All clear after flood event
BoM Severe Weather Warning	Not Applicable	A Severe Weather Warning is issued OR ↴	Not Applicable	Not Applicable	Not Applicable
BoM Flood Watch issued	Not Applicable	A Flood Watch is issued OR ↴	Not Applicable	Not Applicable	Not Applicable
Early warning network (EWN) system	Not Applicable	A MINOR Flood warning or "Yellow Threat Level" is issued	A MAJOR Flood warning or "Red Threat Level" is issued OR ↴	A 'Black Threat Level" is issued OR ↴	A 'NO FURTHER IMPACT' alert or "Green Threat Level" is issued
Visual Observation	Not Applicable	Not Applicable	Floodwaters are sighted reaching bank of Cockle Creek, OR Level reaches 0.8 m AHD on Cockle Railway Station (211455) gauge OR ↴	Floodwaters are sighted approaching Racecourse Road OR ↴	Not Applicable
Direct communication from NSW SES	Not Applicable	Not Applicable	Received notification that a MAJOR flood is expected	Level reaches 1.6 m AHD on Cockle Railway Station (211455) gauge	The SES gives the all clear

5.4 Response Actions and Triggers

The actions to be undertaken in response to a flood will change based on when the emergency occurs, and the Alert Mode that is active at that point in time. The management actions listed below are organised by Alert Mode are summarised in **Table 5.1**.

5.4.1 White Alert Mode – Normal Operations (includes Flood Awareness Training)

The site will be operated in White Alert Mode if none of the triggers listed in the Alert Mode table (**Table 5.1**) is detected. In other words, the site will remain in White Alert mode until there is evidence that a flood might occur within the next 24 hours. The management actions for the White Alert Mode (i.e. normal operations) are listed below.

The Warden (or delegate) will:

- Execute *flood awareness training* for employees and contractors likely to be on site during a flood. This should include:
    - All staff and contractors that may work on the site are to undergo induction and training to a level appropriate to their responsibilities under the FERP.
    - While on site all staff and contractors are to be aware of the flood risks and the flood management procedures detailed in the FERP.
    - Staff and contractors are to participate in a drill of the flood emergency response procedures annually.
- Ensure that there is a Warden or delegate available to coordinate the FERP should the need arise.
- Maintain a register of the staff and contractors on site at all times, including contact details and emergency contacts.
- Monitor daily the sources of information that provide triggers to the alert modes as per
- Ensure that this FERP is reviewed annually or after any flood event or site evacuation to reflect any lessons learnt or changes in the site layout, features or operations or to incorporate new data on flood behaviour as this becomes available.

5.4.2 Yellow Alert Mode

The Yellow Alert Mode is called by the Warden if any of the relevant triggers (**Table 5.1**) are detected. Under the Yellow Alert Mode, a flood affecting the site is possible in the next 24 hours. The management actions for the Yellow Alert Mode are listed below.

The Warden (or delegate) will:

- Communicate to personnel on site (staff, contractors, customers) that the site Alert Mode has escalated to yellow and tell them that a flood affecting the site is possible in the next 24 hours.
- Every four hours monitor the sources of information that can trigger higher alert modes as per **Table 5.1**.

5.4.3 Red Alert Mode

The Red Alert Mode is called by the Warden if any of the relevant triggers of **Table 5.1** are detected. The management actions to be undertaken for the Red Alert Mode are listed below.

The Warden (or delegate) will:

- Communicate to personnel on site (staff, contractors, customers) that the site Alert Mode has escalated to red and tell them that a flood affecting closure of evacuation routes is possible in the next 2 hours.
- Close vehicular and pedestrian access to the site until further notice.
- Within 1 hour of the Red alert mode being triggered, decide whether the site will be evacuated. Consultation with the NSW Police Force and/or SES is recommended if time allows.
- If flood level is below the bank of Cockle Creek and below a level of 0.8 m AHD on the Cockle Railway Station (211455) gauge, an evacuation order can be issued.
- If flood levels are above the bank of Cockle Creek and approaching Racecourse Road or exceed a level of 1.1 m AHD on the Cockle Railway Station (211455) gauge, issue a Stay in Place order (this instigates SIP for duration of the flood).
- Make preparation for remaining personnel remaining on site to have access to an appropriate safe refuge on the site.
- Advise the NSW Police Force and SES that evacuation from the site is no longer possible and personnel will instigate SIP until the evacuation routes become passable.
- Using this FERP, rehearse the management actions to be undertaken should the Alert Mode escalate to Black or change to Green.

5.4.4 Black Alert Mode

The Black Alert Mode is called by the Warden if any of the relevant triggers of **Table 5.1** are detected. The management actions to be undertaken for the Black Alert Mode are listed below.

The Warden (or delegate) will:

- Communicate to personnel on site (staff, contractors, customers) that the site Alert Mode has escalated to black and tell them that a flood affecting the site is possible in the next 2 hours.
- Communicate to personnel on site that evacuation routes are cut until advised otherwise.
- Ensure that all personnel have access to an appropriate safe refuge on the site.
- Communicate with the NSW Police Force and SES as appropriate during the SIP period.
- Using this FERP, rehearse the management actions to be undertaken should the Alert Mode change to Green.

5.4.5 Green Alert Mode (includes Control of Discharge from Site)

The Green Alert Mode is called by the Warden once any of the relevant ('All Clear') triggers of **Table 5.1** are detected. The management actions to be undertaken for the Green Alert Mode are listed below.

The Warden (or delegate) will:

- Communicate to all personnel on the site (staff, contractors, customers) that the flood emergency has now passed and the Alert Mode has changed to Green.
- Continue to monitor hourly the sources of information for triggers to the Alert Modes as per **Table 5.1**.
- Listen to the local ABC radio station for updates on the weather and flood situation.
- When safe to do so, assess any flood waters present on the site and execute procedures for the *control of discharges from the site*, including:
    - Identify areas where flood waters will drain freely off the site, once Cockle Creek water levels recede sufficiently.
    - Dewater the area behind the flood levee on the eastern side of the southern site extension. A suitable pump facility is to be available on site to execute this procedure.
    - Dewater other bunded areas (e.g. fuel, chemical and/or Dangerous Goods storage areas). Confirm there is no contamination of stored water prior to discharge off site. A suitable pump facility is to be available on site to execute this procedure. If any stored water is contaminated this is to be addressed by the EMP and the Pollution Incidence Response Management Plan.
- If car parks have experienced any flooding, coordinate a hazard assessment, prepare safe work method statements and supply staff with personal protective equipment consistent with the known hazards associated with floods, including:
    - Slips, trips and falls
    - Sharp debris
    - Venomous animals
    - Contaminated water and sediments.
- When appropriate, communicate to all personnel on site that it is safe to evacuate the site. Provide the following guidance and assistance as required:
    - Open exit gates and advise personnel about to leave the site to please move to the closest exit in an orderly fashion as directed by the Warden (or delegate).
    - Where known, provide any relevant information to personnel on site about current flooding of the Lake Macquarie/Newcastle area and the availability of public transport.
    - Provide support while personnel leave the site.
    - Help address any concerns of personnel arising from the request to leave the site.
    - Identify any medical emergencies and report these to the medical team.
- Review this FERP to reflect any lessons learnt or changes in the site layout, features or operations or to incorporate new data on flood behaviour as this becomes available.

6.0 References

LMCC 2013. *Lake Macquarie City Flood Emergency Sub Plan.* LMCC, June 2013.

LMCC 2019. *Lake Macquarie City Council Flood Report Tool* [online], LMCC, accessed 9/04/2020, https://propertyinfo.lakemac.com.au/floodtool/

Manly Hydraulics Lab 2020. *Lake Macquarie FloodWatch* [online], Manly Hydraulics Lab, accessed 9/04/2020, https://www.mhlfit.net/users/LakeMac

NSW Government 2005. *Emergency Response Planning for Floods*, Appendix N in *Floodplain Development Manual: the management of flood liable land*. Department of Infrastructure, Planning and Natural Resources, April 2005.

OEH 2007a. *Floodplain Risk Management Guideline - SES Requirements from the FRM Process*. Office of Environment and Heritage, NSW Government, October 2007.

OEH 2007b. *Floodplain Risk Management Guideline - Flood Emergency Response Planning of Communities.* Office of Environment and Heritage, NSW Government, October 2007.

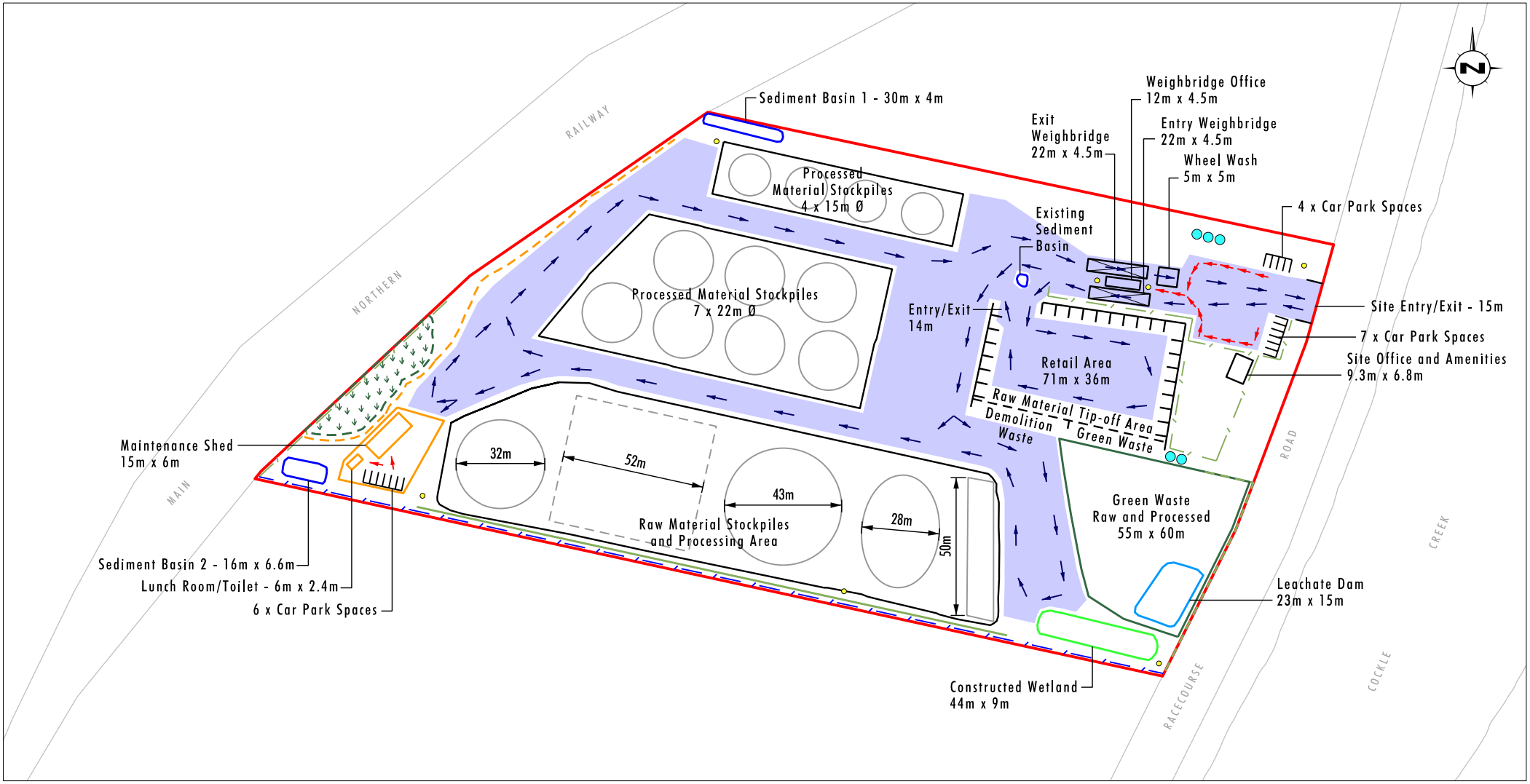
Umwelt 2018. *Concrush Increase to Capacity Project Teralba, NSW - Environmental Impact Statement*, November 2018. Prepared by Umwelt (Australia) Pty Limited for Concrush Pty Ltd.

WMA 2017a. *Winding Creek and Lower Cockle Creek Flood Study*. Prepared by WMAwater for LMCC, November 2017.

WMA 2017b. *Winding Creek and Lower Cockle Creek Floodplain Risk Management Study and Plan*. Prepared by WMAwater for LMCC, June 2017.

APPENDIX A

Stage 1 and 2 Conceptual Layouts



Data Source: Concrush (2018)

0 25 50 100m
1:2 000

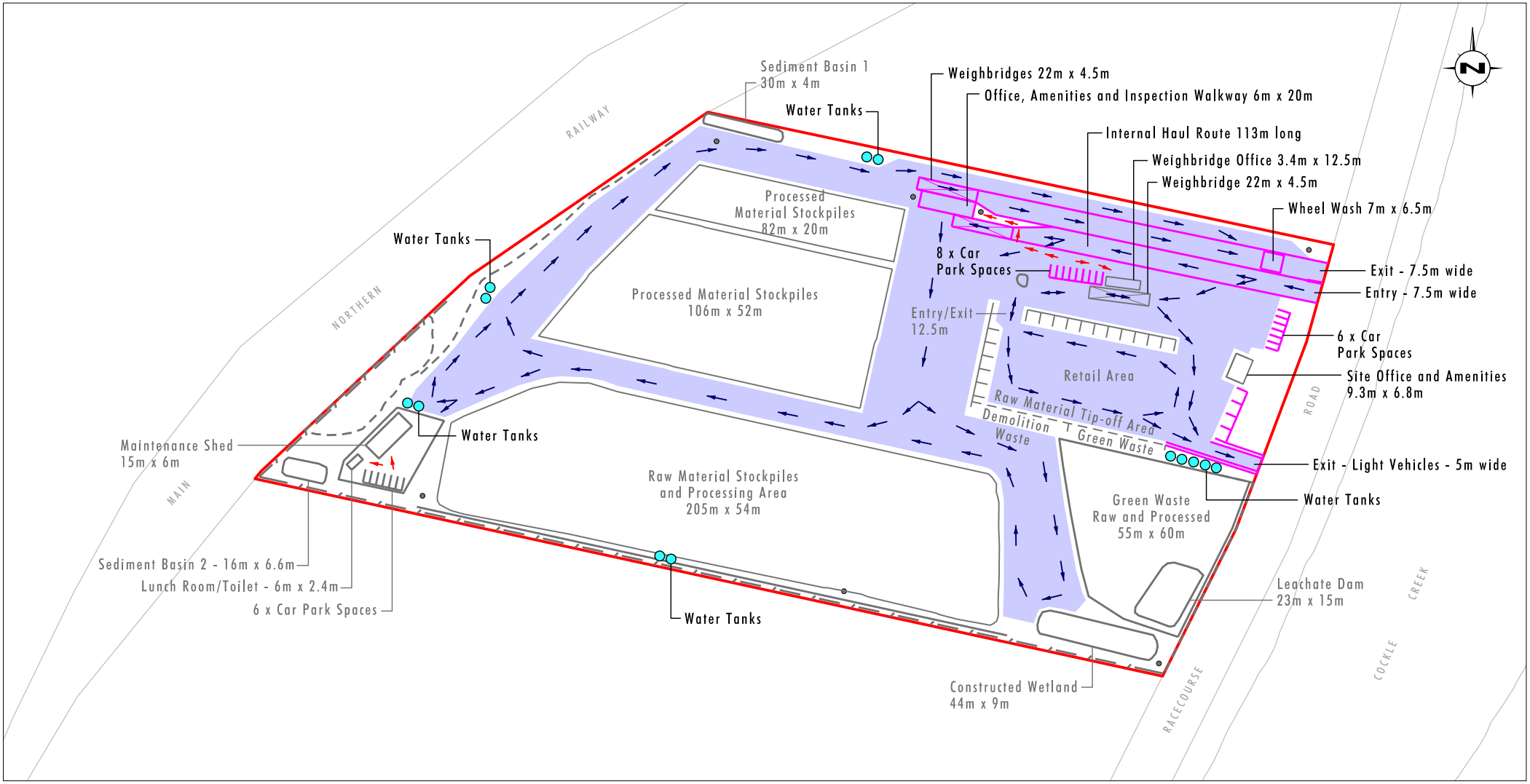
Legend

- Project Site
- Production Compound
- Processing and Stockpile Areas
- Sediment Basin
- Green Waste Area
- Existing Wetland Area with Buffer
- Landscaped Earth Bund (1 in 100 Year Flood Mitigation)
- Existing Earth Bund
- Existing 2m High Fence
- Proposed 2m High Fence
- Proposed 2m High Concrete Block Wall
- Existing Water Tanks
- Proposed Security Lighting
- Pedestrian Movement
- General Vehicle Movement
- Internal Roads/Hardstand Area
- Proposed Stockpile
- Proposed Processing Area

FIGURE 3.1

Stage 1 - Conceptual Layout
Up to 200 000 Tonnes per Annum

File Name (A4): R03/3972_077.dgn
20181019 10.48



Data Source: Concrush (2018)

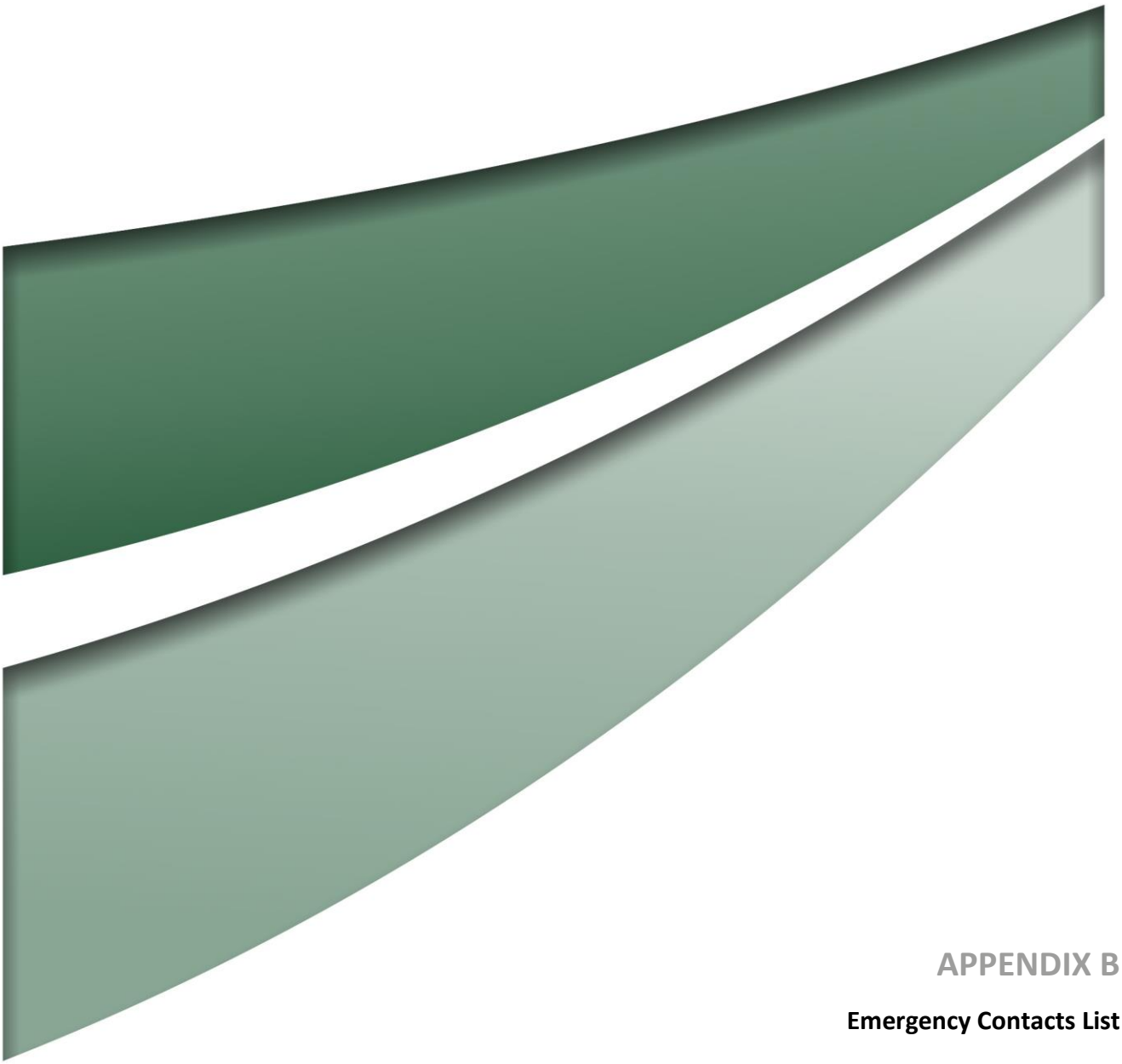
0 25 50 100m
1:2 000

Legend

- Project Site
- Stage 2
- Water Tanks
- Security Lighting
- Pedestrian Movement
- General Vehicle Movement
- Internal Roads/Hardstand Area

FIGURE 3.2

Stage 2 Conceptual Layout
Up to 250 000 Tonnes per Annum

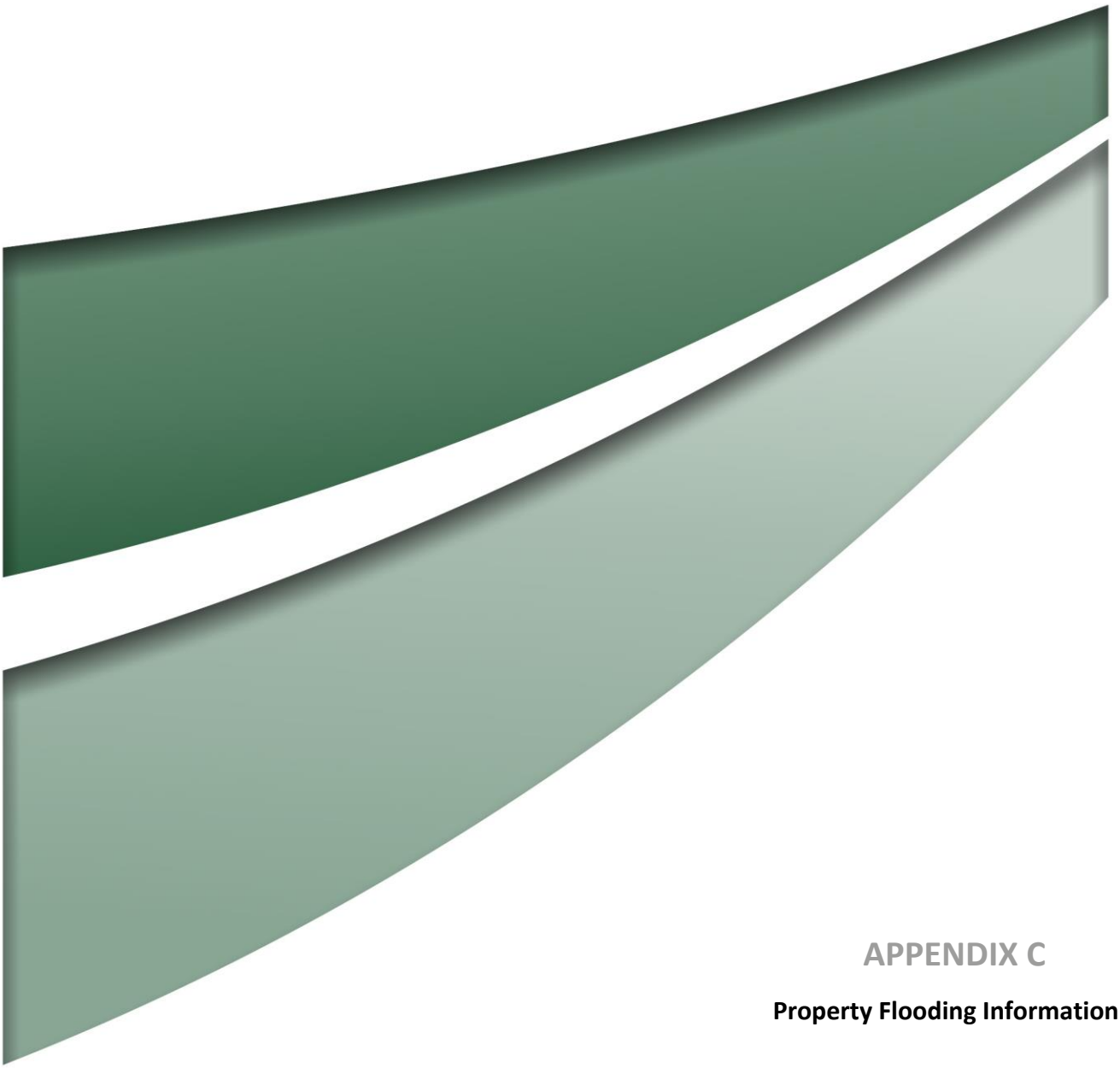


APPENDIX B

Emergency Contacts List

Table B1 Emergency Contact List in Preparation for and During Floods

Name	Organisation	Role	Contact
Kevin Thompson	Concrush	General Manager/ Warden/ Emergency Contact	0408 687 093 Concrush: (02) 4958 3777 OR 0401 804 556
-	Fire/Ambulance/Police	Life threatening emergencies	000
-	NSW State Emergency Service SES	Emergency help	132 500
-	Bureau of Meteorology (BoM)	Weather and flood warnings	1300 659 218
-	John Hunter Hospital (Public) 16.5 km away	Medical	4921 3000
-	Warners Bay Private Hospital 7.6 km away	Medical	4958 4288
-	Lake Macquarie City Council	Incl. after hours emergencies	4921 0333
-	Ausgrid	Electricity supply	13 13 88 (hazard or emergency) 13 13 65 (general enquiries)
-	Hunter Water	Water and sewerage	1300 657 000 (hazard or emergency) 1300 657 657 (general enquiries)
-	Telstra	Telecommunications	13 22 03



APPENDIX C

Property Flooding Information

Property Flooding Information Summary for Lot 2 DP 220347, 21 Racecourse Road, Teralba

Summary generated: 12:15PM on 9/04/2020

The following information is provided from the records of the Council pursuant to the *Local Government Act 1993*, in response to your request for details of the possible effects on the specified property (Lot) from flooding, tidal inundation, and predicted sea level rises. For detailed, survey-verified flood information you can apply for a Flood Certificate or Flood / Tidal Inundation certificate (charges apply).

Where the lot is affected by flooding from both the Lake Macquarie Waterway, and flooding from watercourses within the catchment, information is provided on flooding from both sources.

The **Winding Creek and Lower Cockle Creek Flood Study 2017** indicates the following flood information for Lot 2 DP 220347.

Source of flooding
Catchment

Flood Level (5%)
Max level: 2.06m AHD (metres Australian Height Datum)

Flood Level (1%)
Max level: 2.38m AHD (metres Australian Height Datum)

Probable Maximum Flood (PMF)
Max level: 4.28m AHD (metres Australian Height Datum)

Flood Planning Level
2.88m AHD (metres Australian Height Datum)

The **Lake Macquarie waterway (The Lake) Flood Study - 2012** indicates the following flood information for Lot 2 DP 220347.

Source of flooding
Lake Waterway

Current Lake Level (Baseline 1990)

Lake still water level
0.1m AHD (metres Australian Height Datum)

5% probable flood level
1.23m AHD (metres Australian Height Datum)

1% probable flood level
1.5m AHD (metres Australian Height Datum)

Probable Maximum Flood (PMF)
2.45m AHD (metres Australian Height Datum)

Flood Planning Level
2.36m AHD (metres Australian Height Datum)

Current Lake Level + 0.4 metres SLR (Sea Level Rise)

Predicted Lake still water level
0.5m AHD (metres Australian Height Datum)

5% probable flood level
1.61m AHD (metres Australian Height Datum)

1% probable flood level
1.86m AHD (metres Australian Height Datum)

Probable Maximum Flood (PMF)
2.81m AHD (metres Australian Height Datum)

Flood Planning Level
2.36m AHD (metres Australian Height Datum)

Current Lake Level + 0.9 metres SLR (Sea Level Rise)

Predicted Lake still water level
1.0m AHD (metres Australian Height Datum)

5% probable flood level
2.1m AHD (metres Australian Height Datum)

1% probable flood level
2.32m AHD (metres Australian Height Datum)

Probable Maximum Flood (PMF)
3.27m AHD (metres Australian Height Datum)

Please note

All levels are shown in metres on the Australian Height Datum (m AHD).

All ground levels are measured by LIDAR. Council recommends that you confirm ground levels with a registered surveyor.

Floor levels are based on physical survey levels held in Council records. Council recommends that you confirm existing floor levels with a registered surveyor.

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Lot information

Lot details
Lot 2 DP 220347

Minimum Ground Level
0.59m AHD (metres Australian Height Datum)

Maximum Ground Level
15.30m AHD (metres Australian Height Datum)

Flood Hazard Classification
High

If you believe the information shown is incorrect, please contact us.

Map

Not Found

HTTP Error 404. The requested resource is not found.

Legend

 Red lines: contours

 Cyan line: subject parcel boundary

 Dark purple: 1% AEP (1 in 100 year) flood extent

 Light purple: 5% AEP (1 in 20 year) flood extent

Definitions

Australian Height Datum (AHD)

Australian Height Datum refers to the elevation relative to a reference point. In Australia this reference point approximates mean sea level, which is taken as 0.00 metres AHD (Australian Height Datum). Flood levels, ground levels, floor levels, and flood planning levels are shown in metres on AHD (Australian Height Datum).

Commercial Floor

A building used as a business office or for other commercial or business purposes. (Source: 2004 Standards Australia Glossary of Building Terms).

Flood Certificate or Flood / Tidal Inundation Certificate

A Flood Certificate (catchment flooding) or Flood/Tidal Inundation Certificate (Lake Macquarie waterway flooding) provides flood and tidal risk/sea level rise information for a parcel of land. It is provided by Council at a fee and includes Council's Flood Planning Level and other development restriction requirements, as well as detailed field survey results showing relative levels of the existing land and floor levels of any buildings on the land.

Flood Control Lot (Flood Prone Land)

Land identified by Council as being subject to flood related development controls (Codes SEPP 2008).

Flood Hazard Classification

Flood Hazard Classification is related to Flood Control lots defined in the NSW Codes SEPP (State Environmental Planning Policy) 2008. A "High" hazard refers to Flood Control lots that are within a high hazard area as identified in the Council's flood study or floodplain risk management study carried out in accordance with the Floodplain Development Manual. The hazard extent layers determine the extent of the hazard area within the Flood Control lot.

You will need to lodge a Development Application to develop this site. Development on this Lot is not eligible for consideration under the State Environmental Planning Policy (Exempt and Complying Development) 2008 http://www.onegov.nsw.gov.au/new/agencies/ehc.

The Lot, or part of the Lot, is expected to be affected by the current 1% AEP lake or catchment flood. The Lot, or part of the Lot, is expected to be affected by more frequent lake flooding in the future due to rising sea and lake levels.

If land on the Lot is below 1.0 metres AHD it may be affected by tidal inundation in future due to rising sea and lake levels.

To help manage current and future flood risks (and tidal inundation), flood-related development controls apply, such as floor height requirements for new buildings. See the Lake Macquarie Development Control Plan (DCP) https://www.lakemac.com.au/Development/Planning-controls/Local-Planning-Controls#section-4 for a full explanation of conditions for development on Lots affected by lake and catchment flooding. Where floor height requirements in the DCP for a particular type of development vary between the catchment flood and the lake flood, the highest level will apply.

Council's flood information estimates the extent and depth of flooding over the land and is not necessarily an indication of the risk to buildings, which depends on other factors such as floor height, construction methods, and construction materials.

Special Note for Strata Plans and Strata Lots/Units:

- The "Flood Hazard Classification" for a strata lot is the same as the classification for the real property lot (parent property base lot – BL) that the strata is on. This is a direction from the NSW Department of Planning as the CODES SEPP applies to land and strata lots are not technically land but merely spaces defined by structures.
- Flood Planning Areas are allocated for strata lots the same way as Flood Control Lots. If any part of the real property lot is affected by the Flood Planning Area, then all the strata lots will be affected. Council recommends that you engage a registered surveyor to ascertain floor levels for individual strata lots and units.

Flood Level 1%

The 1% flood level is one that has a 1% chance of occurring in any year, or has the long term average chance of occurring once every 100 years. The term "100-year flood" is really a statistical probability designation stating there is a 1-in-100 chance that a flood this size will happen during any year. Another interpretation could be the "1-in-100 chance flood".

The 1 in 100 year flood does not mean that if a location floods one year, it will definitely not flood for the next 99 years. Nor, if it has not flooded for 99 years, will it necessarily flood this year. Some parts of Australia have received more than one 1% flood in one decade. Lake Macquarie waterway (the Lake) has not experienced a 1% flood since written records began 150 years ago.

The 1% flood is a serious but infrequent event, and is used widely as the risk threshold for flood planning.

Flood Level 5%

The 5% flood level is one that has a 5% chance of occurring in any year, or has the long term average chance of occurring once every 20 years. This is a statistical probability, and does not mean that if a location floods one year, it will definitely not flood for the next 19 years.

The 5% flood is less serious but more frequent than the 1 in 100 year flood.

Flood Planning Level (FPL)

The Flood Planning Level (FPL) is the risk threshold set for new buildings in flood-affected areas, and is usually applied as a minimum floor level. There are different Flood Planning Levels for various types of development, e.g. habitable floors, commercial floors, non-habitable floors, industrial floors, unit floors, medium density floors, sensitive use floors.

If there is more than one source of flooding that affects the lot (e.g. Lake or Catchment flooding) Council makes an assessment on a case-by-case basis to determine which Flood Planning Level applies. In general, the highest level applies.

The Flood Planning Level shown in this particular Information Summary is relative to single residential (habitable) buildings or commercial buildings.

Floor levels

Floors of buildings as levelled by a surveyor on the date as shown. Floors are levelled and recorded as metres on the Australian Height Datum (m AHD).

Freeboard

Freeboard is included in the Flood Planning Level to allow a safety margin for unpredictable factors such as waves, localised hydraulic effects, blockages, flood debris, and uncertainties in the computer flood modelling. A freeboard of 500mm (millimetres) is typically applied to the 1% flood level for residential / commercial developments.

Ground levels

All ground levels are measured by LiDAR and are recorded as metres on the Australian Height Datum (m AHD)

Habitable Floor

A room used for normal domestic activities including a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room, home theatre and sunroom. (Source: 2015 Building Code of Australia Vol 2).

Industrial Floor

A building in which a handicraft or process for the production, assembly, alteration, repair, packing, finishing, or cleaning of goods or produce is carried on for trade, sale, or gain. (Source: Building Code of Australia Class 8 and 2004 Standards Australia Glossary of Building Terms).

LIDAR

Light detection and ranging (LIDAR) is a remote sensing technology that uses laser pulses to generate data about the physical layout of terrain and landscape features including the elevation of buildings, trees, and other objects on the ground.

LIDAR data is typically accurate to an elevation of plus or minus 0.15m (metres).

Minimum and Maximum Levels

Flood levels on a sloping lot may vary due to the difference between the highest and lowest parts of the land. If your lot has a slope, two predicted flood levels may be shown corresponding to the high and low parts of that lot. Where the lot is flat, only one flood level is shown.

Minimum Ground Level

Ground level at the lowest point on the lot.

Maximum Ground Level

Ground level at the highest point on the lot.

Non-habitable Floor

A domestic building or area of a building such as garage, workshop, storeroom, laundry, water closet, bathroom, corridor, hallway, clothes drying room, lobby, pantry, and other spaces of a specialised nature occupied neither frequently nor for extended periods. (Source: 2015 Building Code of Australia Vol 2).

Probable Maximum Flood (PMF)

The Probable Maximum Flood is the largest flood that could feasibly occur. However, it is an extremely rare event. Despite this, some floods in Australia have approached the PMF (Probable Maximum Flood). Council provides the PMF level on this Property Flooding Information Summary, if it is available, to indicate the full extent of risk, even if the chance is very small.

Some essential services (such as hospitals) and retirement housing, are required to locate above the PMF (Probable Maximum Flood) to avoid any risk from flooding.

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T| 1300 793 267 E| info@umwelt.com.au www.umwelt.com.au