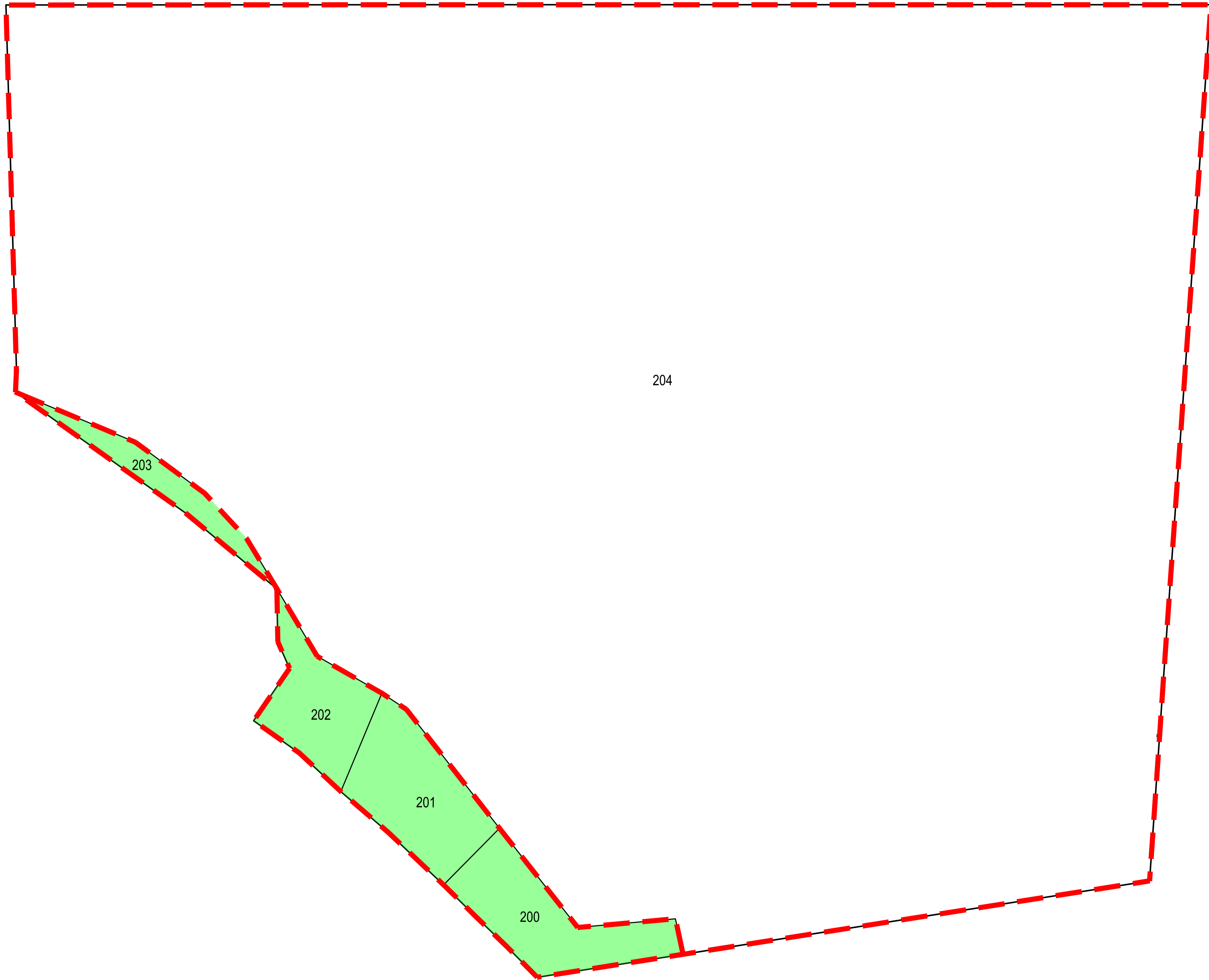


OLD

CASTLEREAGH

ROAD



204

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REV.	DATE	DESCRIPTION	DRN.	DES.	VERIF.	APPD.
2	02/03/2022	ISSUED FOR INFORMATION	MDH	AD	MKH	
1	01/03/2022	ISSUED FOR INFORMATION	MDH	AD	MKH	

Client



**NEPEAN
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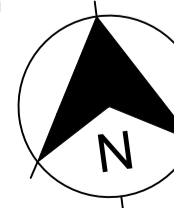
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North




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Project
NEPEAN BUSINESS PARK

Title
TORRENS TITLE SUBDIVISION PLAN

Scale
1:1500

Date
01/03/2022

Size
A1

Datum

Status
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Project Number/Drawing Number
200044-DA-C01.91




Revision
2

OLD

CASTLEREAGH

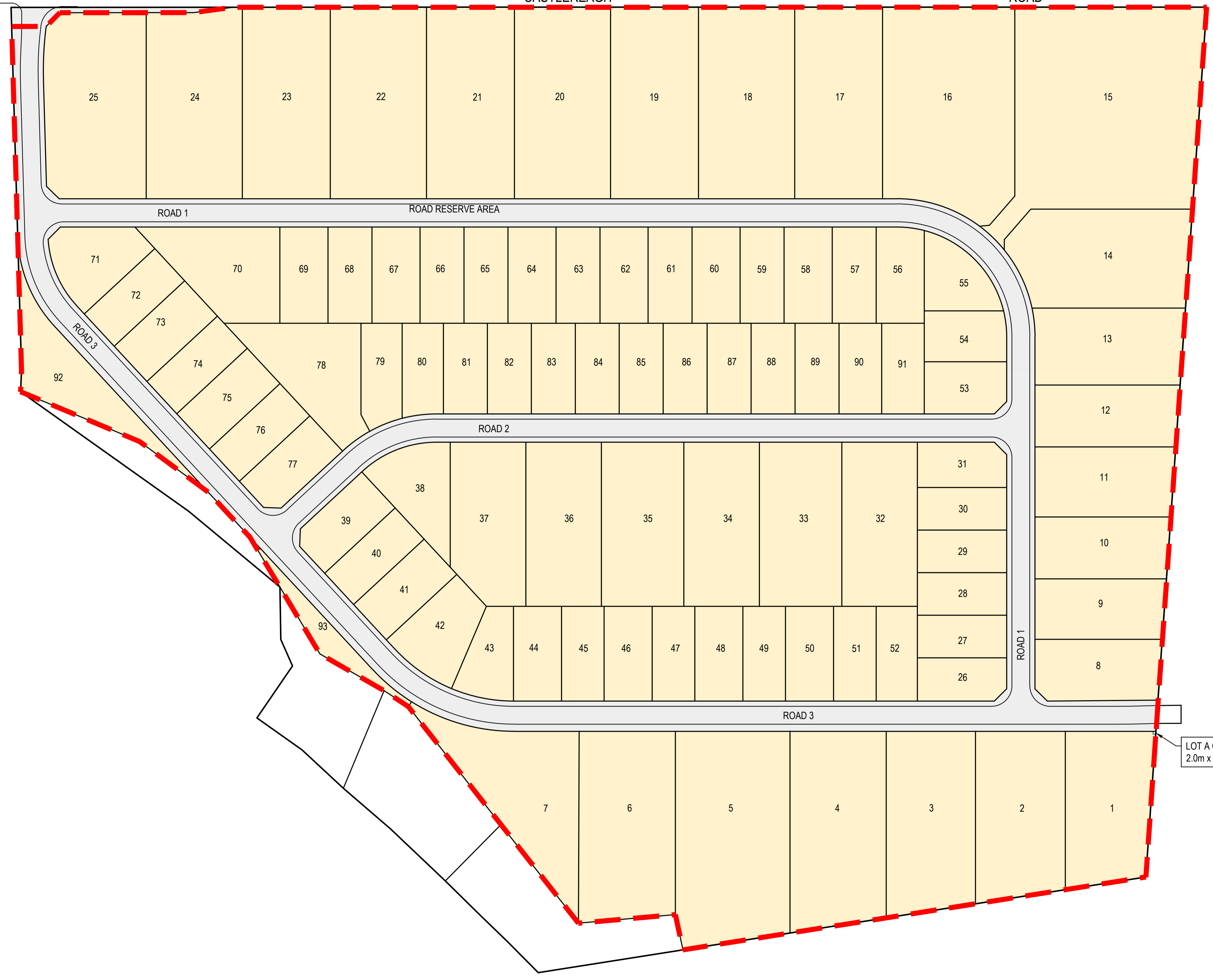
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LEGEND

-  COMMUNITY TITLE EXTENT
-  COMMUNITY TITLE
-  ROADS (DEDICATED TO COUNCIL)

NOTES

- ALL ROADS AND ASSOCIATED TRUNK STORMWATER DRAINAGE IS TO BE DEDICATED TO PENRITH CITY COUNCIL AS PUBLIC ROADS.



LOT A COMMUNITY ASSOCIATION PROPERTY
2.0m x 2.0m


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1	02/03/2022	ISSUED FOR INFORMATION							

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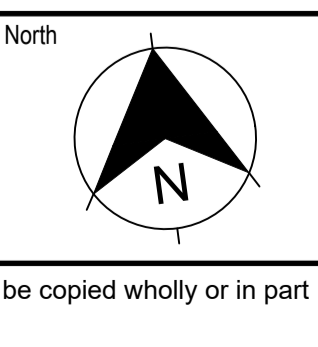



NEPEAN BUSINESS PARK

Scale



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Project	NEPEAN BUSINESS PARK
Title	COMMUNITY TITLE PLAN

Scale	1:1500	Status	FOR INFORMATION ONLY NOT TO BE USED FOR CONSTRUCTION
Date	28/02/2022	Project Number/Drawing Number	200044-DA-C01.90
Size	A1	Revision	1
Datum			



ADDENDUM TO STATEMENT OF ENVIRONMENTAL EFFECTS 14-98 OLD CASTLEREAGH ROAD, PENRITH

DATE: 2 March 2022

This document constitutes an addendum to the *Statement of Environmental Effects (Amended and Consolidated)*, prepared by Planning Ingenuity, dated 5 November 2021 for 14-98 Old Castlereagh Road, Penrith (Development Application DA9876).

As part of the proceedings for *Great River NSW Pty Ltd v Minister for Planning and Public Spaces* (Case No. 2021/204069), the previously proposed Torrens title subdivision of 3 lots into 93 (with 4 residual lots) is amended to the following:

- a Torrens title subdivision to create four “environment” lots (lots 200-203) and one residual lot (Lot [204]); and
- a subdivision of the residue lots into 93 community title lots (lots 1-93) and one community association Lot (Lot A), with all roads to be dedicated to Council.

The amended proposal is detailed in the following plans:

Drawing No.	Description	Date
200044-DA-C01.90	Community Title Subdivision Plan Rev 2	2 March 2022
200044-DA-C01.91	Torrens Title Subdivision Plan Rev 2	2 March 2022

The amendment results in the following changes over those described in the *Statement of Environmental Effects (Amended and Consolidated)* dated 5 November 2021:

- Description
 - Description of the subdivision as per the above;
 - Updated subdivision plans as referenced above; and
 - Proposed management of the site once subdivided will be subject to with the community association (rather than individual landowners as described in Section 5.5 of the SEE).
- DCP controls
 - Annexure B of the SEE provided an assessment of compliance against the controls of the *Penrith Lakes Draft Development Control Plan – Stage 1*, which has subsequently been made; and,
 - The amendment results in compliance with Control 2 of Section 5.4.3 which requires strata or community title subdivision. The proposed community title now complies with this control.

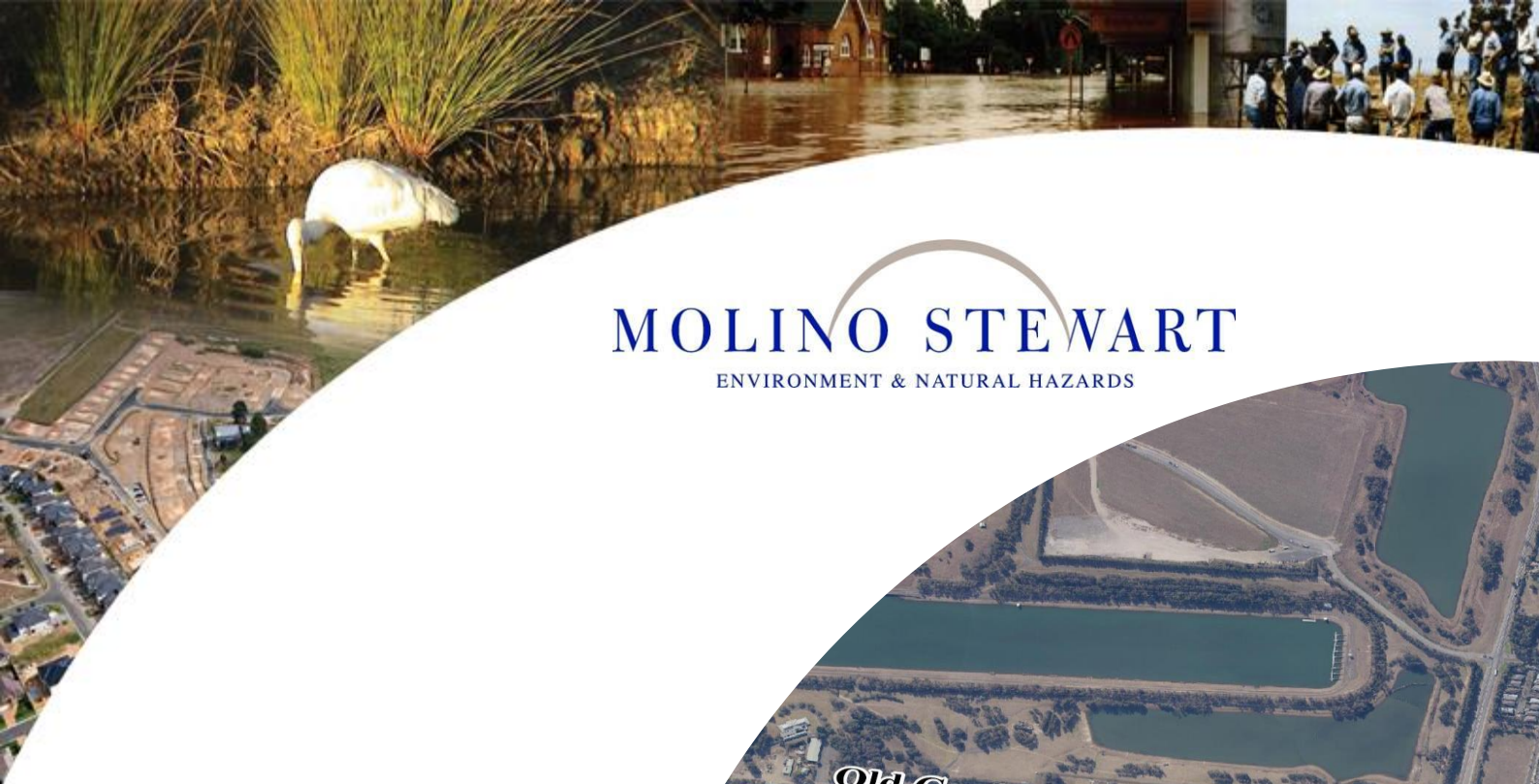
The amendments do not result in any other material change to the assessment of the impacts of the proposal as per the *Statement of Environmental Effects (Amended and Consolidated)* dated 5 November 2021.

Yours faithfully,
Planning Ingenuity Pty Ltd

Jeff Mead

MANAGING DIRECTOR





MOLINO STEWART

ENVIRONMENT & NATURAL HAZARDS

Great River NSW Pty Ltd



Nepean Business Park

Flood Emergency Response Plan



Nepean Business Park

FLOOD EMERGENCY RESPONSE PLAN

for

Great River NSW Pty Ltd

by

Molino Stewart Pty Ltd

ACN 067 774 332

MARCH 2022

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DOCUMENT CONTROL

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Author	Steven Molino

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Date	Version	Name	Comments
28/11/2018	1.0	Steven Molino	Draft for client comment
14/12/2018	1.1	Steven Molino	Final
02/12/2020	2.1	Steven Molino	Minor changes to reflect revised layout
11/12/2020	2.2	Steven Molino	Incorporating client comments
14/12/2020	3.0	Steven Molino	Final
12/9/2020	4.0	Steven Molino	Additional information on evacuation modelling
4/11/2021	5.0	Steven Molino	Removal of evacuation modelling & update of flood levels
5/11/2021	5.1	Steven Molino	Final
6/12/2021	5.2	Steven Molino	Insertion of additional actions
1/3/2022	6.1	Steven Molino	Revised Draft
2/3/2022	6.2	Steven Molino	Revised Draft

DOCUMENT APPROVAL

<i>For Molino Stewart</i>	
Name	Steven Molino
Position	Principal
<i>For Great River NSW Pty Ltd</i>	
Name	The Directors
Position	

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1 INTRODUCTION

1.1 BACKGROUND

In January 2017, the NSW Government published the State Environmental Planning Policy (Penrith Lakes Scheme) Amendment 2017. Amongst other things, this zoned an area in the south of Penrith Lakes as Employment.

A development application was submitted for a proposed subdivision of this land into light industrial lots within a Community Title scheme.

Clause 33 of the SEPP states that:

(3) Development consent must not be granted for development on land zoned Employment, Residential or Tourism unless the consent authority is satisfied that the development will not adversely affect the safe and effective evacuation of the land and the surrounding area.

This Flood Emergency Response Plan (FERP) has been prepared by Molino Stewart Pty Ltd on behalf of Great River NSW Pty Ltd. The FERP, of which evacuation is only one aspect, sets out how the development will be prepared for flooding and what actions will be taken before, during and after a flood to manage the safety of those on site and to ensure this is done in a way which is compatible with the safe evacuation of the surrounding areas.

This FERP is an overarching plan for the whole precinct and provides a level of detail appropriate to planning and response at a precinct level. Each individual business and body corporate within the precinct will need to develop its own detailed FERP which is consistent with this precinct FERP.

1.2 SITE DETAILS

1.2.1 Locality

The site is located in Penrith and is situated between Castlereagh Road to the east and

Nepean River to the west. The location is referred to as the Nepean Business Park and is shown in Figure 1.

The site covers approximately 49 hectares and is located within the NSW SES Penrith North (A) flood evacuation subsector within the Penrith North flood evacuation sector.

1.2.2 Site Layout

Figure 2 shows the indicative layout plan for the proposed subdivision. It consists of a total of 93 lots ranging in size from 2,006m² to 20,236m² and a community title lot of 4 m². It will have road access from Lugard Street in the east and Old Castlereagh Road in the north. It will have an internal ring road network.

1.2.3 Topography and Drainage

The precinct is situated in one of a series of floodplains formed by the topography within the Hawkesbury-Nepean valley. After exiting the Fairlight Gorge, the Nepean River expands into a wider channel with a broad floodplain at Regentville and then flows past Penrith on the east bank of the River and Emu Plains on the west bank. A sharp bend in the river and a narrowing of the channel downstream of Emu Plains creates a constriction which is responsible for the flooding of the Penrith and Emu Plains floodplain.

The precinct is on the outside of this bend at a level of around 26m AHD compared to the normal river level which is at about 12m AHD. Development approval has already been granted to fill the site and that will increase the levels across the site to between 27m AHD and 30.5m AHD.

Boundary Creek enters the River from the east about 650m south of the precinct.



Figure 1: Location of Nepean Business Park

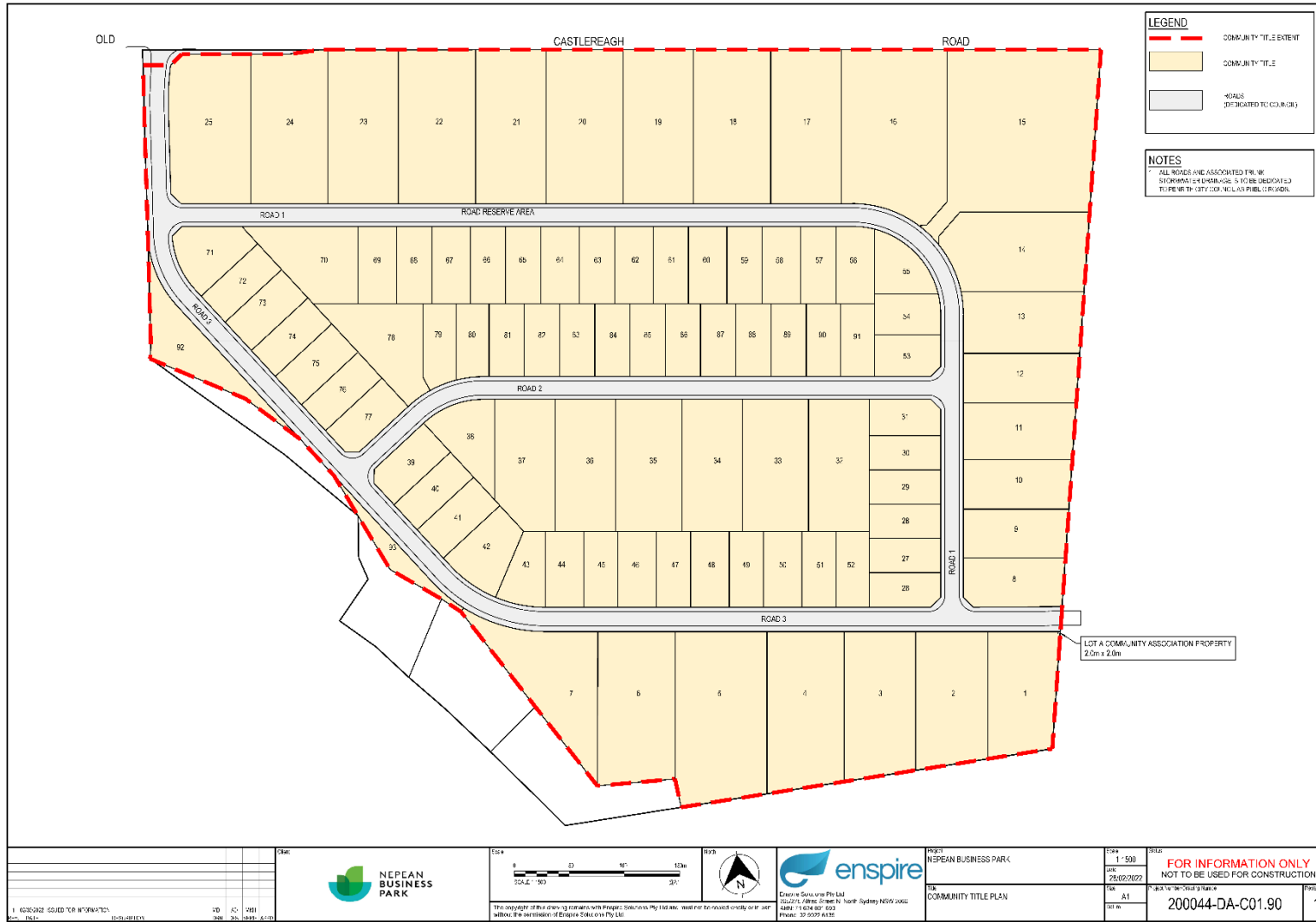


Figure 2: Indicative Layout Plan for Nepean Business Park

2 FLOOD RISKS

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.

All of the above weather can result in extended rainfall events which can cause flooding in the Nepean River or in Boundary Creek or both.

Flooding is more prevalent in a La Nina year when rainfall is significantly greater than the average rainfall.

Rainfall patterns are also dependant on weather patterns that occur throughout the year. Thunderstorms, which generally occur during the summer, can result in localised flooding, which could impact on the site.

Sydney has experienced severe thunderstorms in the past and because large expanses of the urban area are paved, much of the rainfall becomes flood run-off. This could result in localised flooding of Boundary Creek but is unlikely to be the cause of flooding in the Nepean River.

The Hawkesbury-Nepean Valley has been flooded in numerous large rainfall events,

although the March 2021 flood at Penrith was the first major flood in 30 years. In summary, there are many different weather events which could cause flooding at the site and this could happen at any time of year.

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 many thousands of years, a flood of this magnitude would occur on average once in 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 average exceedance probability (AEP). A 1 in 100 year ARI flood has roughly a 1 in 100 AEP. That is, each year and every year it has a 1 in 100 or 1% chance of being reached or exceeded. This is perhaps a more helpful way of thinking about flood probabilities.

This document will refer to flood probabilities in terms of chance per year. Each and every year a 1 in 100 chance per year flood has a 1 in 100 chance of being equalled or exceeded in that year.

A flood with a 1 in 100 chance per year has about a 1 in 2 chance of being reached or exceeded in the average person's lifetime, the same probability of tossing a coin and getting a head.

Bigger floods can and do occur. There were several floods with greater than a 1 in 100 chance per year experienced in Eastern Australia in early 2011. Some reached levels which have a 1 in 1,000 (0.1%) chance per year.

A flood with a 1 in 500 chance per year has about a 1 in 6 chance of being reached or exceeded in the average person's lifetime, the same as tossing a die and getting a 6.

The largest flood that can occur is referred to as the Probable Maximum Flood (PMF). Although it has a very low probability of occurring in any one year (about a 1 in 100,000 chance per year

at Penrith), events approaching a PMF have been recorded.

Flooding may occur at any time of year and at any time of day. There is no seasonality associated with flooding in Sydney and an event could occur during hours of operation for commercial premises on the site.

2.3 FLOODING ON THE SITE

2.3.1 Nepean River

The largest flood on record in the Hawkesbury-Nepean valley occurred in 1867 when the river level reached 26.9 metres Australian Height Datum (AHD) at Victoria Bridge at Penrith. This flood is estimated to have between a 1 in 200 and a 1 in 500 chance of occurrence in any year. A PMF event would reach a level of approximately 32.8 metres AHD at Victoria Bridge. Table 1 outlines the history of recorded floods in the valley.

Sediment within the Fairlight Gorge in the Nepean River upstream of Penrith shows that prior to European settlement at least one flood reached or exceeded the level of a flood with about a 1 in 1,000 chance per year level of 27.6 metres AHD at Penrith. The most recent floods in the Hawkesbury-Nepean Valley have ranged been 1 in 5 and 1 in 50 chance of occurrence per year flood levels. The March 2021 flood peaked at 24.2m AHD.

To place these probabilities in context, some of the rivers in Victoria which flooded in 2011 experienced floods with a 1 in 200 chance per year level, while flooding in Lismore NSW in 2022 exceeded a 1 in 500 flood level. Some catchments in Queensland experienced floods in 2011 that have been reported to have had about a 1 in 1,000 chance of occurrence per year.

Flood waters from the Nepean River would initially back up Boundary Creek, eventually flooding Castlereagh Road and cutting the evacuation route south of the site. As the water

level continues to rise it would break the river banks and enter the existing industrial estate immediately south of the site.

Further flood rises would result in the water to the south eventually flowing around the east of the precinct and cutting off its access via Lugard Street. At the same time the water backing up in Boundary Creek would have crossed Andrews Road, cutting off that evacuation route. Once water overtops Lugard Street it would flow through the industrial estate to the north and cut Old Castlereagh Road which is at a lower level.

Eventually the river overtops the banks adjacent to the site and begins flooding the site.

2.3.2 Flood Levels

The Penrith gauge is just upstream of Victoria Bridge which itself is upstream of Penrith Weir. The precinct is 700m downstream of the weir. This means that the water level at the gauge is higher than the water level at the site.

Table 1 shows the full range of flood levels which could affect the site. The table shows three levels. The first is the peak gauge level at Victoria Bridge for the corresponding flood probability (note that historically the gauge was set arbitrarily with a zero reading at 14.139m AHD). The second level is the corresponding peak height above sea level (m AHD) for that gauge reading. The third level is the peak level at the precinct which would be reached for a flood of that probability.

The 1 in 100 chance per year flood would reach a peak of 25.8m AHD at the gauge and about 25.0m AHD adjacent to the precinct. The entire Precinct is at or above 27.0m AHD and so would not be directly affected by the flood. However, as shown in Figure 3 its evacuation route along Castlereagh Road would be cut by floodwaters backing up Boundary Creek. The road has a low point of 24.2m AHD at the creek crossing and would be covered by 0.6m of water at this location.

Table 1: Flood history in the Hawkesbury-Nepean valley

<i>Chance per year</i>	Peak gauge level at Victoria Bridge (m)	Peak flood level at Victoria Bridge, Penrith (m AHD)¹	Peak flood level in river at the Precinct (m AHD)²	Year equalled or exceeded¹
<i>1 in 5</i>	5.5	19.6	18.1	1986, 1962, 1955, 1950, 1943, 1934, 1922, 1895, 1894,
<i>1 in 10</i>	7.2	21.3	20.0	1988, 1975, 1949, 1916, 1898
<i>1 in 20</i>	9.2	23.3	22.2	2021, 1990, 1978, 1964, 1961, 1956, 1952, 1904
<i>1 in 50</i>	10.7	24.8	23.9	No record
<i>1 in 100</i>	11.7	25.8	25.0	No record
<i>1 in 200</i>	12.4	26.5	25.7	1867
<i>1 in 500</i>	13.0	27.1	26.5	No record
<i>1 in 1,000</i>	13.4	27.5	26.9	At least once before 1788
<i>1 in 2,000</i>	14.3	28.4	27.8	No record
<i>1 in 5,000</i>	15.3	29.4	29.0	No record
<i>PMF</i>	18.7	32.8	32.6	No record

1. Source – Hawkesbury Nepean Valley Regional Flood Study Final Report (WMAwater, 2019)
2. Source – flood model outputs provided by WMAWater.

A flood would have to exceed the 1 in 1,000 chance per year level of 26.9m AHD at the site and reach 27.0m AHD before the lowest parts of the site began to flood through water backing up into the internal drainage system and onto the lowest parts of roads.

All of the building floor levels will be at least 0.8m above the 1 in 2,000 chance per year level of 27.8m AHD and most would be above the 1

in 5,000 chance per year flood level of 29.0m AHD. The PMF peak level at the gauge is 32.8m AHD and estimated to be 32.6m AHD at the precinct. The whole precinct would therefore be flooded with the lowest parts of the site flooded to a depth of 5.6m but no ground floor levels being flooded to a depth of more than 5m.



Figure 3: 1 in 100 chance per year flood levels

Note that the above figure is sourced from the Nepean River Flood Study which has slightly higher 1 in 100 chance flood levels than the Hawkesbury Nepean Valley Regional Flood Study which has been relied upon in this FERP. The flood planning level for the site has been based on the Nepean River flood study levels as these are what have been adopted by Penrith City Council.

2.3.3 Rate of Flood Rise

The rate at which this water rises will vary depending on how big the flood is and how quickly the rain is falling. A simulation of 20,000 different rainfall distributions and intensities show that 99.7% of floods take more than 10 hours to rise from 17.0m AHD to 24.0m AHD at the Penrith gauge, most take more than 24 hours (Figure 4). The NSW SES plans its vehicular evacuation of the Hawkesbury Nepean Valley around a minimum of about 10 hours at Penrith.

It should also be noted that the peak at the site will occur a little while after the flood has peaked at Victoria Bridge because of the time it takes the flood peak to travel downstream from the bridge.

2.3.4 Critical Levels

There are several levels associated with the Nepean Business Park which are critical to the safety of people and the protection of property. They are:

- 24.2m AHD – the lowest point along Castlereagh Road which is the lowest evacuation route for the site. All vehicles should leave the precinct before flooding reaches this level at Castlereagh Road. This has between a 1 in 20 and 1 in 50 chance of occurring per year.
- 25.4m AHD – the lowest point on Lugard Street. When flooding exceeds this level adjacent to the precinct, exiting the precinct by car or on foot in this direction becomes dangerous. Water would flow north from this point and cut Old Castlereagh Road which is at a lower level. Andrews Road would also be cut by water backing up Boundary Creek. Once this level is reached safe evacuation routes from the site are effectively cut. This has less than a 1 in 100 chance of occurring per year.
- 27.0m AHD – the lowest point within the precinct. At this level floodwaters enter the precinct directly from the river via the internal drainage system. This has about a 1 in 1,000 chance of occurring per year and would cut the internal roads

- 28.5m AHD – water might start to enter the lowest lying buildings on site. This is has between a 1 in 2,000 and 1 in 5,000 chance of occurrence per year.
- 30.5m AHD – the highest ground level within the precinct would flood. This has between a 1 in 5,000 and 1 in 100,000 chance of occurring per year

Floor levels in each of the buildings within the precinct vary and details of those should be provided in each respective flood response plan. All will have mezzanine floors or first floors which are above the reach of the PMF. An extreme flood could isolate the precinct for up to three days.

2.3.5 Emergency Response Classification

The NSW SES has developed a classification system for areas within floodplains which determines whether those who fail to evacuate by car:

- have safe walking access to a flood free area
- would be isolated and/or overwhelmed by rising floodwaters

The Floodplain Risk Management Guideline: Flood Emergency Response Planning Classification of Communities (DECC, 2007) provides details of the classification system.

According to this classification system the precinct is a Low Flood Island (LFI). This is an area whose evacuation routes get cut before the area begins to flood but as floodwaters rise the whole area can be inundated.

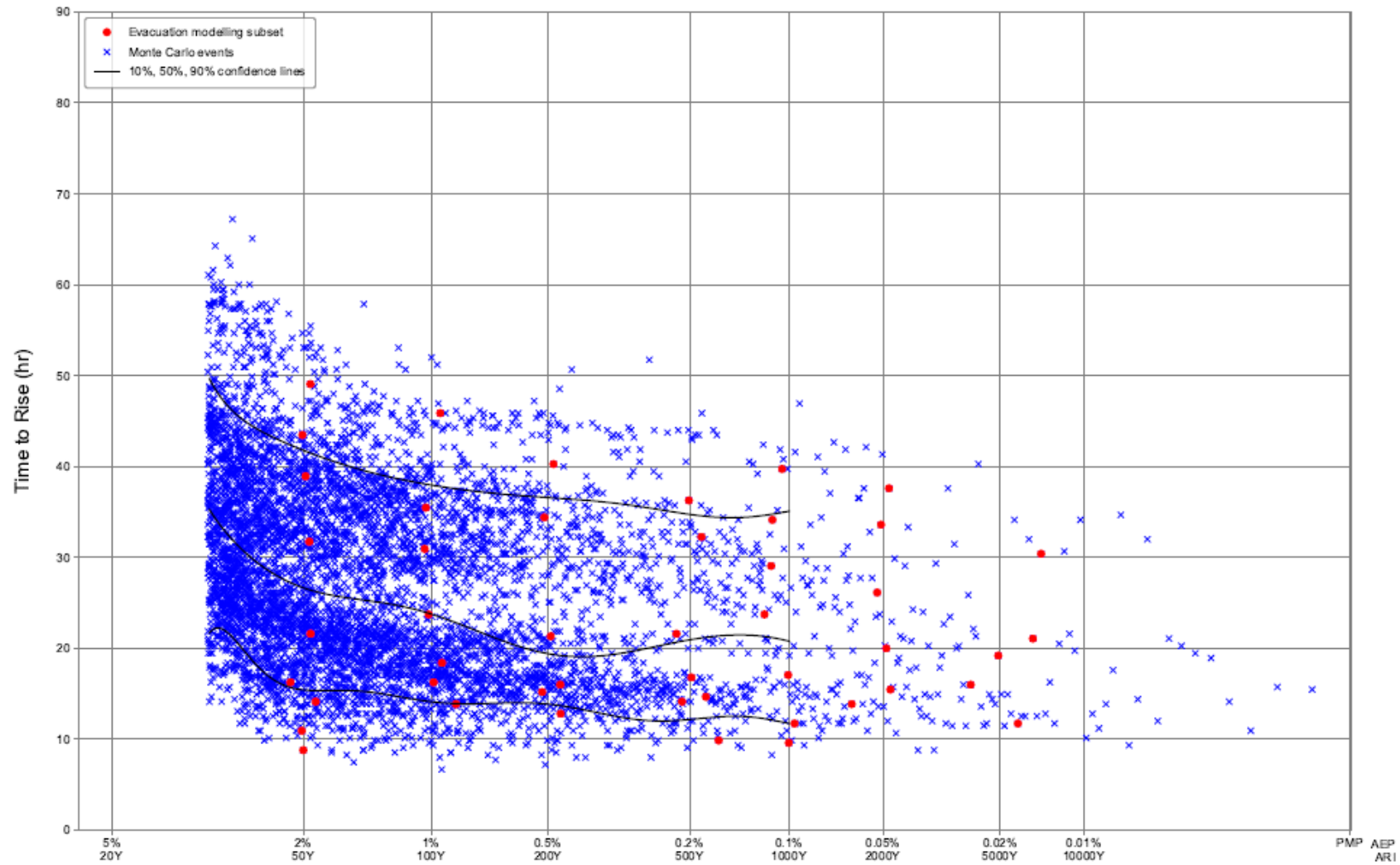


Figure 4: Time to rise between 17.0m and 24.0m AHD at the Penrith Gauge
(source, WMA Water, 2019)

3 PRECINCT FERP

3.1 EMERGENCY RESPONSE PHILOSOPHY

This FERP recognises that protection of life is of critical and primary importance.

The protection of all lives is the first priority, the comfort of workers and customers is second, the protection of property is third and the continuity of business operations, while of lesser priority, should not be overlooked.

While this FERP recognises the need for developers, owners and operations managers at premises within the precinct to consider financial implications, this will not be consciously done to the detriment of protecting life. It is incumbent on the developers, owners and operations managers to take all necessary measures outside of this FERP to manage the financial risks which flooding poses to their property and assets.

It should also be recognised that for this site there is an extremely low probability (less than 1 in 2,000 chance per year) of floodwaters entering buildings but a moderate probability (about 1 in 50 chance per year) of evacuation routes being cut and the site being isolated for days.

Therefore, the proposed response to a flood is the evacuation of the entire precinct without spending time protecting building contents from flood damage. This FERP for the Nepean Business Park must be consistent with the NSW SES Flood Emergency Plan for the Hawkesbury Nepean Valley and the proposed Penrith Lakes Early Warning System when it becomes available.

3.2 NSW SES FLOOD EMERGENCY PLAN

The NSW SES flood response strategy for the Hawkesbury Nepean Valley is set out in its Hawkesbury Nepean Flood Emergency Sub Plan (2020). It involves evacuating all residential, business and other premises that are at risk of flooding and directing evacuees towards Sydney Olympic Park. It is expected

that most evacuees will find their own temporary accommodation with friends and relatives or at commercial accommodation outside of the floodplain. Those who cannot, will be assisted at Sydney Olympic Park.

To achieve orderly and timely evacuation, the NSW SES has divided the floodplain into sectors and subsectors with designated evacuation routes.

The Precinct is located within the Penrith North A subsector within the Penrith North Sector. This subsector includes the existing industrial estates to the east and south. This subsector would evacuate either south along Castlereagh Road before heading east along Coreen Avenue and other streets to The Northern Road or north on Castlereagh to Andrews Road and east The Northern Road. All evacuation traffic on The Northern Road heads south.

The subsector and evacuation routes are shown in Figure 5.

3.3 FLOOD RESILIENCE FEATURES

The development will include the following flood resilience features:

- all internal roads will be above the 1 in 1,000 chance per year flood level
- all building floors will be above the 1 in 2,000 chance per year flood level
- all buildings will be provided with a refuge above the PMF
- all buildings will be designed and constructed to remain structurally stable in PMF
- the Community Association will implement a vehicle monitoring system which is triggered during a flood alert which ensures vehicle numbers on site do not exceed 1,000 for the duration of that flood alert period
- early evacuation of site is based on a forecast flood level lower than that which would cut evacuation routes and would give at least an additional three hours for early evacuation. Earlier evacuation can be undertaken if

directed by NSW SES, or following the adoption of the Penrith Lakes Scheme Flood Response Guideline when it becomes available

- a Community Association is co-ordinating flood risk management

3.4 EVACUATION

Because the precinct is a low flood island it is imperative that it is evacuated before its evacuation routes are cut by flooding. The NSW SES nominated evacuation routes for the site is south on Castlereagh Road then east on Coreen Avenue or east on Old Castlereagh Road and east on Andrews Road. Andrews Road may remain open for a few hours longer than Castlereagh Road heading south. Andrews Road provides the shortest vehicular route to flood free land.

Andrews Road is recommended as the pedestrian evacuation route as it provides the shortest route from the precinct to flood free land and will remain open the longest. It is about a 2.5km from most locations in the precinct to the section of Andrews Road which is above the reach of the PMF. This would take about 30 minutes to walk at a brisk walking pace or about one hour at a strolling pace. Pedestrian evacuation is only recommended should vehicular evacuation not be possible.

The evacuation routes are shown in Figure 6.

3.5 ROLES AND RESPONSIBILITIES

This FERP is an overarching FERP for the precinct which provides important information on flood levels, flood warnings, evacuation triggers, evacuation routes and actions to take before during and after a flood. The following sets out roles and responsibilities in relation to the maintenance and implementation of the FERP.

3.5.1 Agencies

Within the flood emergency response context, the Bureau of Meteorology has responsibility for

forecasting rainfall and river levels and issuing flood warnings and forecasts.

The NSW SES is the lead agency for flood emergency response and will issue evacuation warnings and evacuation orders for the Hawkesbury Nepean Valley including the Penrith North A subsector of which Nepean Business Park is part. The NSW SES also carries out rescue and resupply for those who are stranded by floodwaters.

This FERP and the premises specific FERPs include actions to ensure that people within Nepean Business Park do not need to be rescued or resupplied and therefore are not reliant upon the NSW SES other than for it to issue evacuation warnings and orders for Penrith North A subsector.

3.5.2 Community Association

The maintenance and implementation of this FERP is the responsibility of the Community Association.

The Community Association will appoint a Chief Flood Warden and sufficient Deputy Flood Wardens such that there is at least one Flood Warden on duty at all times.

The Community Association will provide sufficient financial resources to implement the FERP including by way of appointing contractors, or employing staff, appointing and train flood wardens, subscribing to flood and weather warning services and installing and maintaining equipment for the proper implementation of the FERP.

The responsibilities of the Community Association may change following the adoption of the Penrith Lakes Scheme Flood Response Guideline when it becomes available.

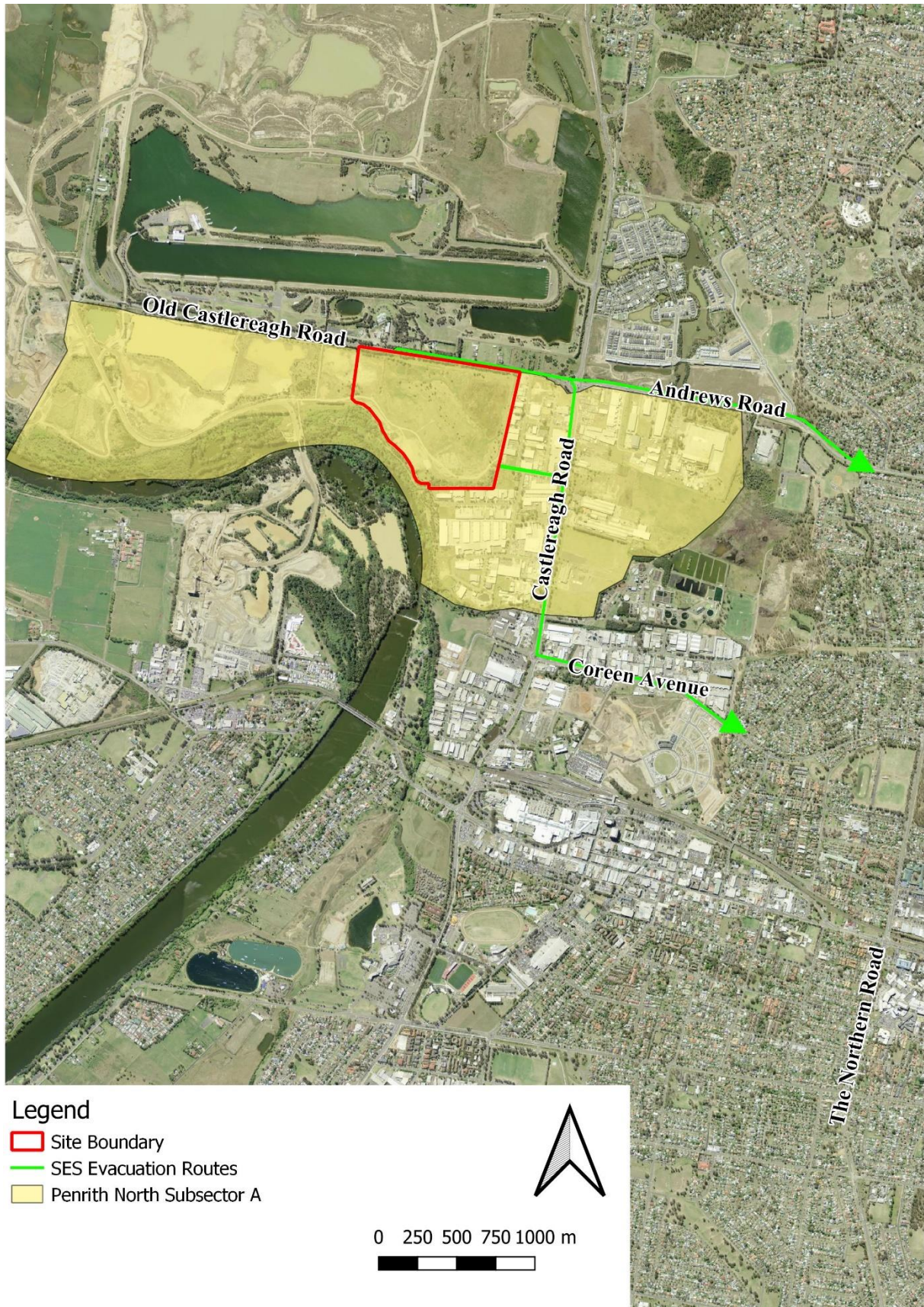


Figure 5: Vehicle evacuation routes for the Penrith North Subsector

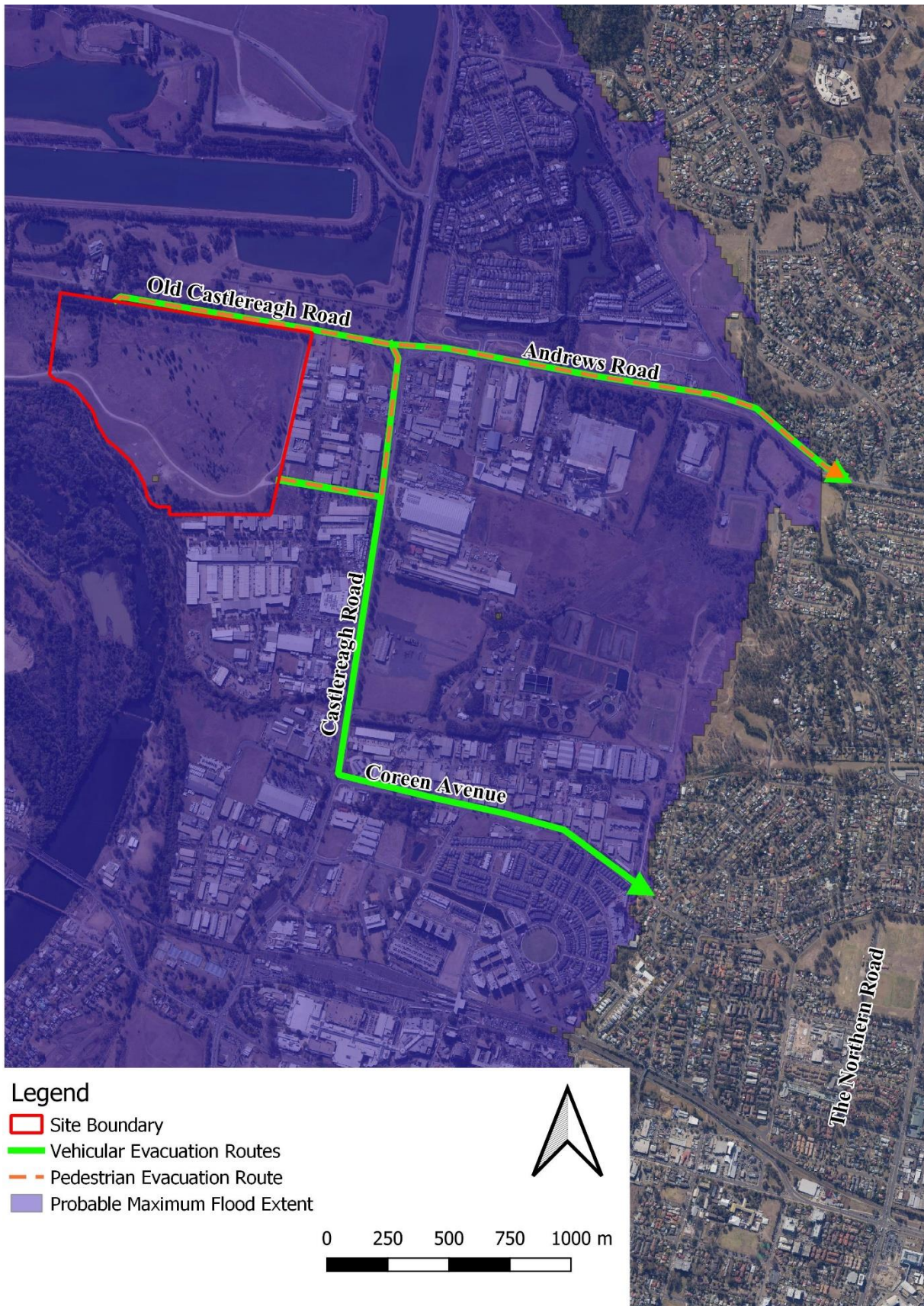


Figure 6: Evacuation Routes

3.5.3 Chief Flood Warden

The Chief Flood Warden will be either contracted to or employed by the Community Association but may have duties other than those of the Chief Flood Warden.

Chief Flood Warden will:

- Become familiar with the flood emergency response procedures set out in the FERP.
- Appoint sufficient Deputy Flood Wardens such that there will be a Chief or Deputy Flood Warden on duty (not necessarily on site) at all times
- Organise training for themselves and Deputy Flood Wardens in the maintenance of the flood warning system and the implementation of the flood emergency response procedures set out in this FERP
- Monitor weather forecasts and flood warnings daily
- Monitor Nepean River flood levels daily through the Bureau of Meteorology website
- Ensure any alerts from a flood and weather warning service are sent directly to the Chief Flood Warden and Deputy Flood Wardens
- Ensure the Chief Flood Warden, the Deputy Flood Wardens and the Flood Wardens know how to monitor and interpret weather warnings, rainfall forecasts and river levels
- Ensure the supply and maintenance all of the equipment necessary to implement the FERP
- Maintain the Emergency Contact List in Appendix B of this report
- Maintain the Business Contact List in Appendix C of this report
- Keep a soft and hard copy of the FERP readily accessible to the Flood Wardens and Deputy Flood Wardens at all times
- Implement this FERP in the event of a flood
- Direct Deputy Flood Wardens to implement various aspects of this FERP, as required

- Liaise with emergency service organisations and other external stakeholders as required
- Review the FERP every 5 years or following a flood which triggers evacuation
- Report annually, and as requested, to the Community Association on implementation and maintenance of the FERP
- Provide new business with a copy of this FERP and brief them on the flood evacuation procedures

The responsibilities of the Chief Flood Warden may change following the adoption of the Penrith Lakes Scheme Flood Response Guideline when it becomes available.

3.5.4 Deputy Flood Wardens

The Deputy Flood Wardens will:

- Become familiar with the flood emergency response procedures set out in the FERP
- Follow the procedures set out in this FERP in the event of a flood
- Fulfil the role of the Chief Flood Warden in the absence of the Chief Flood Warden

3.5.5 Businesses

Each of the businesses within the precinct will need to develop its own FERP which is consistent with the overarching FERP but which deals with the specifics of that business.

Each of the premises in the Precinct will have a management structure, either individual business management or strata management. The specific roles and responsibilities within each business with regard to flood emergency response will need to be determined by each of those organisations.

Each of these premises will need to have someone who is responsible for maintaining and implementing their FERP such as monitoring river heights, ensuring basic measures are in place, training staff in flood response procedures, and issuing the necessary warnings when the river reaches the relevant trigger levels (see Section 3.6.3b).

For each individual building FERP this management structure must be identified,

documented and flood responsibilities allocated to personnel with appropriate seniority.

No reliance will be placed upon the New South Wales State Emergency Service or Penrith City Council's emergency resources in the development or implementation of individual FERPs other than relying on the SES to issue evacuation warnings and orders for Penrith North A subsector or any other responsibilities identified following the adoption of the Penrith Lakes Scheme Flood Response Guideline when it becomes available.

3.5.6 Visitors

Visitors will follow the directions of Flood Wardens during a flood response operation.

3.6 FORECASTS AND WARNINGS

3.6.1 Bureau of Meteorology

Monitoring the weather forecasts and warnings will be an integral step in managing the flood risk of the Nepean Business Park. This will be critical to being able to evacuate the site before flooding cuts evacuation routes.

The Bureau of Meteorology (BoM) has forecast rainfall maps which can be used to estimate the amount of rain expected to fall over the next eight and four days, as well as the next 24 hours. This information is available at: www.bom.gov.au/jsp/watl/rainfall/pme.jsp.

NSW Weather Warnings are issued by the Bureau of Meteorology and can be found at the following link: www.bom.gov.au/nsw/warnings/.

The Bureau will also provide specific warnings for flooding in the Nepean River.

There are five potential warnings of relevance to the precinct which operators and managers will need to be alert to. They are:

- Severe Weather Warnings for the Sydney Metropolitan Area or Western Sydney – these are an alert to possible flooding in Boundary Creek
- Flash Flood Warnings for the Sydney Metropolitan Area or Western Sydney –

these are an alert to possible flooding in Boundary Creek.

- A Flood Watch for the Nepean River – this is a heads up that flood producing rainfall is forecast within the catchment and flooding may eventuate
- A General Flood Warning for the Nepean River – this is a warning that minor, moderate or major flooding is expected on the Nepean River but it is too early to forecast specific levels
- A Quantified Flood Warning for the Nepean River at Penrith. This will include a forecast flood height and the time at which that height is expected to be reached. It may also include information on whether further flood rises are expected, whether that forecast is expected to peak or whether the river level is falling.

The Bureau of Meteorology also has rainfall gauges which show the amount of rainfall that has fallen in the previous 24 hour period and stream gauges which indicate water heights. These can be monitored at: www.bom.gov.au/australia/flood/.

There are several gauges in the region that are relevant to flood prediction and warning. The most relevant for the precinct is the Penrith gauge at Victoria Bridge and flood response actions for the Precinct should principally be determined by forecasts related to this gauge.

Gauge readings at Warragamba Dam, Camden Weir and Wallacia Weir will be indicative of flood behaviour upstream of Penrith and would be indicative of expected flood behaviour at Penrith some hours later. The data on the website is updated every hour or so.

The radar service on the BoM website also shows current rainfall location and intensities. The radar station to be used for the site would be the Sydney radar at:

<http://www.bom.gov.au/products/IDR713.loop.shtml>.

It also needs to be remembered that it is the forecast level at the Penrith gauge, not the observed level at the gauge, which needs to be used to trigger evacuation of the Precinct because it is the time it takes to reach the forecast level which is needed to effect evacuation.

3.6.2 Nepean River Flood Categories

The BoM has set minor, moderate and major flood levels for the Nepean River at Penrith based on the impacts that flooding would have. These are set out in Table 2 as both the gauge levels (which is what BoM will report and forecast to) and the corresponding elevations at both the gauge and the site. The site flood levels are lower than the gauge flood levels because the site is downstream of Penrith Weir where the river level drops. It should also be remembered that the flood will peak at the site a little after it does at the gauge because the water takes time to travel from the gauge to the site.

Table 2: Penrith Flood Classes

Class	Penrith Gauge (m)	Penrith (m AHD)	Site* (m AHD)
Minor	3.9	18.0	16.5
Moderate	7.9	22.0	20.8
Major	10.4	24.5	23.6

* estimate only

Provisions and Requirements for Flood Warning in New South Wales (NSW SES, 2019) states that for floods forecast to exceed 8.9m at the Penrith gauge, 6 hours warning will be provided by BoM and for those exceeding 11.3m AHD at Penrith, 8 hours warning will be provided. These warning times are based on the flood travel times from upstream rainfall and stream gauges to the Penrith gauge and are independent of the rate of rise of the flood.

3.6.3 Alerts and Responses

Taking all of the preceding information into account, the following flood alerts, triggers and responses have been adopted for Nepean Business Park.

These may be superseded by those detailed in the Penrith Lakes Scheme Flood Response Guideline when it becomes available.

Level 1 Alert: Basic preparedness – Bureau of Meteorology issues either a:

- Severe Weather Warning for the Sydney Metropolitan Area or Western Sydney; or
- Flash Flood Warning for the Sydney Metropolitan Area or Western Sydney

Level 2 Alert: Prepare for potential closure of Precinct – Bureau of Meteorology issues either a:

- Flood Watch for the Nepean River; or
- Generalised Minor Flood Warning for the Nepean River:

Level 3 Alert: Prepare for closure of premises

Bureau of Meteorology issues either a:

- Generalised Moderate Flood Warning for the Nepean River; or
- Forecast that the river level at Penrith will exceed 8m (22.1m AHD).

Level 4 Alert: Close premises and evacuate

Bureau of Meteorology issues either a:

- Generalised Major Flood Warning for the Nepean River
- Forecast that the river level at Penrith will exceed 8.9m (23.0m AHD).

OR

The NSW SES issues an evacuation order

Level 5 Alert: Shelter on Site

- The River is flooding Lugard St

3.6.4 Closure and Evacuation Procedures

Flooding can occur at any time of any day and it is unlikely that many, if any, of the premises within the precinct will be open 24hrs per day, seven days per week. In fact, most business premises are closed for 60-70% of the time.

It will therefore be important that FERPs for individual businesses acknowledge their operating hours and have different responses for when they are open compared to when they are closed.

It is also noted that premises may close between a Level 2 alert being issued and a Level 3 alert being issued. It may be prudent to

close the premises at the end of the day when a Level 2 alert is issued and not reopen until it is clear that major flooding is not likely to occur.

While this FERP documents that there is likely to be several hours between when an evacuation order is given and when the evacuation route is cut, delaying evacuation should be avoided. The evacuation planning is done on the assumption that everyone will start leaving when the evacuation order is given. If everyone delays their evacuation until the business would otherwise be closing for the day there may be insufficient time for everyone in the subsector to safely evacuate.

If individual business FERPs include procedures for protecting property from flood damage (e.g. moving plant, equipment and stock off site or into higher parts of the building) these should be triggered at a Level 2 alert and not at the Level 3 alert.

If people fail to evacuate from buildings by vehicle or on foot before the precinct is isolated, they should contact NSW SES then stay within the highest part of the building until the “all-clear” has been given. Sheltering on site should only be a last resort if evacuation has failed because the precinct could be isolated for up to three days, there is unlikely to be power, telecommunications or safe water supply and flood depths and velocities could cause buildings to fail.

4 MANAGEMENT ACTIONS

The management actions listed below are also provided in a Flood Actions Checklist in Appendix A. This is a generic list for the precinct and should be edited and supplemented to reflect the specific needs of each premises.

Each premises will be obliged to establish, implement and maintain a FERP consistent with this overarching FERP through a legally enforceable mechanism such as a DA condition or covenant on title.

The following actions may be superseded by those detailed in the Penrith Lakes Scheme Flood Response Guideline, when it becomes available.

4.1 BEFORE A FLOOD

Trigger for action: Always

- Each building will be provided with a refuge area within the building above the PMF level which is capable of safely accommodating site personnel for the duration that the building might be isolated by PMF floodwaters. This is to be a refuge of last resort in the event of evacuation failure.
- The Community Association will appoint a Chief Flood Warden and sufficient Deputy Flood Wardens such that there is at least one Flood Warden on duty at all times
- The Community Association will provide sufficient financial resources to employ staff, appoint and train flood wardens, subscribe to flood and weather warning services and install and maintain equipment for the proper implementation of the FERP.
- The Chief Flood Warden will be familiar with the flood emergency response procedures set out in the FERP.
- The Chief Flood Warden will appoint sufficient Deputy Flood Wardens such that there will be a Chief or Deputy Flood Warden on duty (not necessarily on site) at all times
- The Chief Flood Warden will organise training for themselves and Deputy Flood Wardens in the maintenance of the flood warning system and the implementation of the flood emergency response procedures set out in this FERP
- The Chief Flood Warden or delegate will monitor weather forecasts and flood warnings daily
- The Chief Flood Warden or delegate will monitor Nepean River flood levels daily through the Bureau of Meteorology website
- The Chief Flood Warden will ensure any alerts from a flood and weather warning service are sent directly to the Chief Flood Warden and Deputy Flood Wardens
- The Chief Flood Warden will ensure the Chief Flood Warden, the Deputy Flood Wardens and the Flood Wardens know how to monitor and interpret weather warnings, rainfall forecasts and river levels
- The Chief Flood Warden will ensure the supply and maintenance all of the equipment necessary to implement the FERP
- The Chief Flood Warden will maintain the Emergency Contact List in Appendix B of this report
- The Chief Flood Warden will maintain the Business Contact List in Appendix C of this report
- The Chief Flood Warden will keep a soft and hard copy of the FERP readily accessible to the Flood Wardens and Deputy Flood Wardens at all times
- Each business will develop and maintain detailed emergency procedures consistent with this precinct FERP and that takes into account any additional risks associated with the particular development.
- Each business owner will ensure all management, staff, and temporary employees likely to be in the Precinct at any time will be made aware of the possibility of flooding and the emergency procedures to be followed if a flood were to occur. This will be done by including flood procedures during staff inductions.
- The business procedures will also include clear responsibilities for management and staff in the event of a flood, and back up resources should key personnel not be present.

- The business management will maintain an emergency contacts list to advise the various emergency services and essential staff of the actions in train on the site. A suggested format for these details and other necessary contact details is provided in Appendix B – this will need to be completed by each business.
- A staff contact list will be created for each business and kept up-to-date in electronic AND hard copy format in the business offices on site.
- Management will appoint a staff member and alternates as flood wardens to monitor weather forecasts, current and predicted rainfall, flood warnings and the local gauge readings to ensure that any design features or equipment required to implement the FERP are in working order. They may delegate some duties to other staff and must have provision for suitable back-ups.
- Each business will subscribe to a flood alert service such as EWN or the equivalent to receive flood warnings direct to management and flood wardens.
- The Chief Flood Warden will review this FERP for currency and appropriateness every five years or when there are changes to the NSW SES Hawkesbury Nepean Flood Sub Plan or the Penrith Lakes Early Warning System
- Each business will review its FERP when this FERP is updated.

4.2 WHEN A FLOOD IS LIKELY

4.2.1 Alert Level 1 – Basic Preparedness

Trigger for action: Bureau of Meteorology issues severe weather warnings or flash flooding warnings for the Sydney Metropolitan area or Western Sydney

The Chief Flood Warden will:

- Ensure all emergency contact details within the FERP are up to date
- Ensure there are Deputy Flood Wardens rostered for duty for the foreseeable duration of the potential flood event
- Remind Deputy Flood Wardens of the procedures in this FERP

- Monitor weather and flood warnings every 8 hours

The manager or delegate responsible at each business will ensure that:

- there is a hard copy of the FERP on site
- all emergency contact details within the FERP are up to date
- all staff have been trained in the flood emergency procedures
- contact details are available for:
 - all staff who will be rostered on for the next week; and
 - all clients or customers that have appointments for the next week.
 - All deliveries which are expected in the next week
- forecasts, warnings and rainfall/stream gauges and local conditions on the site are monitored at least every four hours and advise management accordingly.

4.2.2 Alert Level 2 – Prepare for potential precinct closure

Trigger for action: Bureau of Meteorology issues either a Flood Watch for the Nepean River

OR

a Minor flood warning for the Nepean River at Penrith

The Duty Flood Warden will:

- Implement the vehicle monitoring system
- Ensure that vehicle numbers on site are reduced to less than 1,000 vehicles over the next four hours, with no further vehicle entry unless they are collecting people from site or leaving immediately.
- Remind business managers that they should have implemented their business specific FERP
- Monitor forecasts, warnings and rainfall/stream gauges and local conditions on the site at least every two hours and advise management accordingly.

Each business manager or delegate responsible will ensure that:

- there is a hard copy of the FERP on site
- all emergency contact details within the FERP are up to date
- all staff have been trained in the flood emergency procedures
- contact details are available for:
 - all staff who will be rostered on for the next week; and
 - all clients or customers that have appointments for the next week.
 - All deliveries which are expected in the next week
- forecasts, warnings and rainfall/stream gauges and local conditions on the site are monitored at least every two hours and advise management accordingly.

4.2.3 Alert Level 3 – Prepared for closure of premises

Trigger for action: Bureau of Meteorology issues either a Moderate Flood Warning for the Nepean River

OR

forecasts that the river level at Penrith will exceed 8m (22.1m AHD)

Each business manager or delegate responsible will ensure that:

- staff that are rostered on for that week are notified of the possibility of flooding and reminded of actions and procedures to follow should evacuation be required.
- all organisations/patrons booked to use any facility within the Precinct are notified of the possibility of its closure should floodwaters continue to rise.
- consideration is given to cancelling appointments and deliveries and closing the business until flood threat has passed
- any movable objects owned by each development which are external to the building are either secured to prevent them from floating away or are brought inside the building. This includes objects such as

garbage bins, storage containers or external furniture.

- forecasts, warnings and rainfall/stream gauges and local conditions on the site are monitored at least every two hours and advise management accordingly.

4.3 DURING A FLOOD

4.3.1 Alert Level 4 – Close and Evacuate to The Northern Road

Trigger for action: When the Bureau of Meteorology issues either a Major Flood Warning for the Nepean River

OR

forecasts that the river level at Penrith will exceed 8.9m (23.0m AHD)

OR

The NSW SES issues an evacuation order

Each business manager or delegate responsible will:

- Advise staff that are not on the premises that the business is expected to be isolated by flooding and is closing and for them not to come to work until further notice.
- cancel all appointments and deliveries until the flood threat has passed
- direct staff on site to leave and proceed to their homes via The Northern Road.
- direct staff on site who are not able to travel to their homes to travel to the Sydney Olympic Precinct at Homebush.
- direct anyone present who does not have private transport to travel with those who do have private transport.
- sweep the premises following evacuation to ensure that all have left the site, all floatable infrastructure is safely and securely stored and power, water and other utilities are turned off as necessary.

4.3.2 Alert Level 5 – Shelter on Site

Trigger for action: When floodwaters are over Lugard Street

- shelter in the building until flooding has passed
- contact NSW SES on 132 500 (if possible) and advise of your situation

4.4 AFTER A FLOOD

Trigger for action: When emergency services give the all clear to return

- No owners, tenants or staff will be allowed to return to the site while flooding is still occurring or has recently occurred.
- Owners, tenants and staff can return to the site only after the all clear has been given by emergency services or Council when the flood emergency has passed.
- Where necessary, the Community Association will organise for the site to be appropriately cleaned and utilities checked by professionals before any re-use of the site if floodwaters have entered the site.
- Before site clean up and repair, a hazard assessment will be undertaken, safe work methods statements 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; and
 - Contaminated water and sediments.
- When evacuation has been triggered, the Community Association will organise a debrief with business owners and operators in the precinct and may invite emergency services and/or Council staff to participate. The flood event and response procedures, including the use of the FERP and individual FERPs, will be reviewed to identify changes required or considered beneficial to the operation of the plan.
- Changes may be made to the FERPs and the requirements for future emergency evacuation should the review identify any improvements which may be made.

5 REFERENCES

Advisian, 2018 *Nepean River Flood Study – Final* Prepared for Penrith City Council

DECC, 2007 *Guideline Flood Emergency Response Classification of Communities* Version 1.01 25-10-2007

NSWSES, 2019, *Provisions and Requirements for Flood Warning in New South Wales Supplementary Document to the State Flood Plan v2.0* November, 2019

NSWSES, 2020 *Hawkesbury Nepean Flood Plan*

WMAWater, 2019 *Hawkesbury-Nepean Valley Regional Flood Study – Final Report* Prepared for Infrastructure NSW

APPENDIX A – FLOOD ACTIONS CHECKLIST

Stage	Trigger for action	Action	Who responsible	is	What is needed
Before A Flood					
	Always	Each building will be provided with a refuge area within the building above the PMF level which is capable of safely accommodating site personnel for the duration that the building might be isolated by PMF floodwaters. This is to be a refuge of last resort in the event of evacuation failure.	Building owner		
		The Community Association will appoint a Chief Flood Warden and sufficient Deputy Flood Wardens such that there is at least one Flood Warden on duty at all times.	Community Association		
		The Community Association will provide sufficient financial resources to employ staff, appoint and train flood wardens, subscribe to flood and weather warning services and install and maintain equipment for the proper implementation of the FERP.	Community Association		FERP, financial resources
		The Chief Flood Warden will be familiar with the flood emergency response procedures set out in the FERP.	Chief Flood Warden		FERP
		The Chief Flood Warden will appoint sufficient Deputy Flood Wardens such that there will be a Chief or Deputy Flood Warden on duty (not necessarily on site) at all times.	Chief Flood Warden		
		The Chief Flood Warden will organise training for themselves and Deputy Flood Wardens in the maintenance of the flood warning system and the implementation of the flood emergency response procedures set out in this FERP.	Chief Flood Warden		FERP
		The Chief Flood Warden or delegate will monitor weather forecasts and flood warnings daily.	Chief Flood Warden		Smartphone/tablet/computer with internet access, subscription to a weather warning service
		The Chief Flood Warden or delegate will monitor Nepean River flood levels daily through the Bureau of Meteorology website.	Chief Flood Warden		Smartphone/tablet/computer with internet access

Stage	Trigger for action	Action	Who is responsible	What is needed
		The Chief Flood Warden will ensure any alerts from a flood and weather warning service are sent directly to the Chief Flood Warden and Deputy Flood Wardens.	Chief Flood Warden	Subscription to a weather warning service
		The Chief Flood Warden will ensure the Chief Flood Warden, the Deputy Flood Wardens and the Flood Wardens know how to monitor and interpret weather warnings, rainfall forecasts and river levels.	Chief Flood Warden	Smartphone/tablet/computer with internet access, subscription to a weather warning service
		The Chief Flood Warden will ensure the supply and maintenance all the equipment necessary to implement the FERP.	Chief Flood Warden	FERP
		The Chief Flood Warden will maintain the Emergency Contact List in Appendix B of this report.	Chief Flood Warden	Emergency Contact List (Appendix B of FERP)
		The Chief Flood Warden will maintain the Business Contact List in Appendix C of this report.	Chief Flood Warden	Business Contact List (Appendix C of FERP)
		The Chief Flood Warden will keep a soft and hard copy of the FERP readily accessible to the Flood Wardens and Deputy Flood Wardens at all times.	Chief Flood Warden	FERP
		Each business will develop and maintain detailed emergency procedures consistent with this precinct FERP and that takes into account any additional risks associated with the particular development.	Business Manager	FERP
		Each business owner will ensure all management, staff, and temporary employees likely to be in the Precinct at any time will be made aware of the possibility of flooding and the emergency procedures to be followed if a flood were to occur. This will be done by including flood procedures during staff inductions.	Business Owner	Up-to-date induction procedures with flooding information
		The business procedures will also include clear responsibilities for management and staff in the event of a flood, and back up resources should key personnel not be present.	Business Manager	FERP

Stage	Trigger for action	Action	Who is responsible	What is needed
		The business management will maintain an emergency contacts list to advise the various emergency services and essential staff of the actions in train on the site. A suggested format for these details and other necessary contact details is provided in Appendix B – this will need to be completed by each business.	Business Manager	Hard and soft copies of contact details
		A staff contact list will be created for each business and kept up-to-date in electronic AND hard copy format in the business offices on site.	Business Manager	Hard and soft copies of staff contact details
		Management will appoint a staff member and alternates as flood wardens to monitor weather forecasts, current and predicted rainfall, flood warnings and the local gauge readings to ensure that any design features or equipment required to implement the FERP are in working order. They may delegate some duties to other staff and must have provision for suitable back-ups.	Business Manager & appointed Flood Wardens	Staff members designated as Flood Wardens
		Each business will subscribe to a flood alert service such as EWN or the equivalent to receive flood warnings direct to management and flood wardens.	Business Manager	Warning service subscription
		The Chief Flood Warden will review this FERP for currency and appropriateness every five years or when there are changes to the NSW SES Hawkesbury Nepean Flood Sub Plan or the Penrith Lakes Early Warning System.	Chief Flood Warden	FERP, NSW SES Hawkesbury Nepean Flood Sub Plan, Penrith Lakes Scheme Flood Response Guideline
		Each business will review its FERP when this FERP is updated.	Business Manager	FERP

Stage	Trigger for action	Action	Who is responsible	What is needed
When a Flood is Likely				
	Level 1 Alert: BOM issues severe weather warnings or flash flood warnings for Sydney Metropolitan Area or Western Sydney	Ensure all emergency contact details within the FERP are up to date	Chief Flood Warden	FERP (Appendix B)
		Ensure there are Deputy Flood Wardens rostered for duty for the foreseeable duration of the potential flood event	Chief Flood Warden	
		Remind Deputy Flood Wardens of the procedures in this FERP	Chief Flood Warden	FERP
		Monitor weather and flood warnings every eight hours	Chief Flood Warden	Smartphone/tablet/computer with internet access, subscription to a weather warning service
		Ensure there is a hard copy of the FERP on site	Business Manager	FERP
		Ensure all emergency contact details within the FERP are up to date	Business Manager	FERP (Appendix B)
		Ensure all staff have been trained in the flood emergency procedures	Business Manager	A list of staff and their responsibilities and training for those staff members
		Check that contact details are available for: <ul style="list-style-type: none"> - all staff who will be rostered on for the next week; and - all clients or customers that have appointments for the next week. - All deliveries which are expected in the next week 	Business Manager	Contact details
		Ensure that forecasts, warnings and rainfall/stream gauges and local conditions on the site are monitored at least every four hours and advise management accordingly.	Business Manager	Smartphone/tablet/computer with internet access,

				subscription to a weather warning service
	<p>Level 2 Alert: BOM issues a Flood Watch for the Nepean River</p> <p>OR</p> <p>BOM issues a minor flood warning for Nepean River at Penrith</p>	Implement the vehicle monitoring system	Duty Flood Warden	Vehicle monitoring system
		Ensure that vehicle numbers on site are reduced to less than 1,000 vehicles over the next two hours, with no further vehicle entry unless they are collecting people from site or leaving immediately.	Duty Flood Warden	Vehicle monitoring system
		Remind business managers that they should have implemented their business specific FERP	Duty Flood Warden	FERP
		Monitor forecasts, warnings and rainfall/stream gauges and local conditions on the site at least every two hours and advise management accordingly.	Duty Flood Warden	Smartphone/tablet/computer with internet access, subscription to a weather warning service
		Ensure there is a hard copy of the FERP on site	Business Manager	FERP
		Ensure all emergency contact details within the FERP are up to date	Business Manager	FERP (Appendix B)
		Ensure all staff have been trained in the flood emergency procedures	Business Manager	A list of staff and their responsibilities and training for those staff members
		Check that contact details are available for: <ul style="list-style-type: none"> - all staff who will be rostered on for the next week; and - all clients or customers that have appointments for the next week. - All deliveries which are expected in the next week 	Business Manager	Contact details
		Ensure that forecasts, warnings and rainfall/stream gauges and local conditions on the site are monitored at least every two hours and advise management accordingly.	Business Manager	Smartphone/tablet/computer with internet access, subscription to a weather warning service

	<p>Level 3 Alert: BoM issues a moderate flood warning for Nepean River</p> <p>OR</p> <p>BoM forecasts the river gauge level at Penrith to exceed 8m (22.1m AHD)</p>	<p>Ensure that staff that are rostered on for that week are notified of the possibility of flooding and reminded of actions and procedures to follow should evacuation be required.</p>	<p>Business Manager or appointed Flood Wardens</p>	<p>Contact details</p>
		<p>Ensure all organisations/patrons booked to use any facility within the Precinct are notified of the possibility of its closure should floodwaters continue to rise.</p>	<p>Business Manager or appointed Flood Wardens</p>	<p>Contact details</p>
		<p>Ensure consideration is given to cancelling appointments and deliveries and closing the business until flood threat has passed</p>	<p>Business Manager or appointed Flood Wardens</p>	<p>Contact details</p>
		<p>Ensure any movable objects owned by each development which are external to the building are either secured to prevent them from floating away or are brought inside the building. This includes objects such as garbage bins, storage containers or external furniture.</p>	<p>Business Manager or appointed Flood Wardens</p>	<p>Means of securing floating objects</p>
		<p>Ensure forecasts, warnings and rainfall/stream gauges and local conditions on the site are monitored at least every two hours and advise management accordingly.</p>	<p>Business Manager or appointed Flood Wardens</p>	<p>Smartphone/tablet/computer with internet access, subscription to a weather warning service</p>

During a Flood					
	Alert Level 4: BoM forecasts Penrith gauge level is expected to exceed 8.9m (23.0m AHD)	Advise staff that are not on the premises that the business is expected to be isolated by flooding and is closing and for them not to come to work until further notice.	Business Manager or appointed Flood Wardens	Contact details	
		Cancel all appointments and deliveries until the flood threat has passed.	Business Manager or appointed Flood Wardens	Contact details	
	OR	BoM issues a major flood warning for Nepean River is issued	Direct staff on site to leave and proceed to their homes via The Northern Road.	Business Manager or appointed Flood Wardens	Motor vehicles
		NSW SES issues an evacuation order	Direct staff on site who are not able to travel to their homes to travel to the Sydney Olympic Precinct at Homebush.	Business Manager or appointed Flood Wardens	Motor vehicles
		Direct anyone present who does not have private transport to travel with those who do have private transport.	Business Manager or appointed Flood Wardens	Motor vehicles	
		Sweep the premises following evacuation to ensure that all have left the site, all floatable infrastructure is safely and securely stored and power, water and other utilities are turned off as necessary.	Business Manager or appointed Flood Wardens		

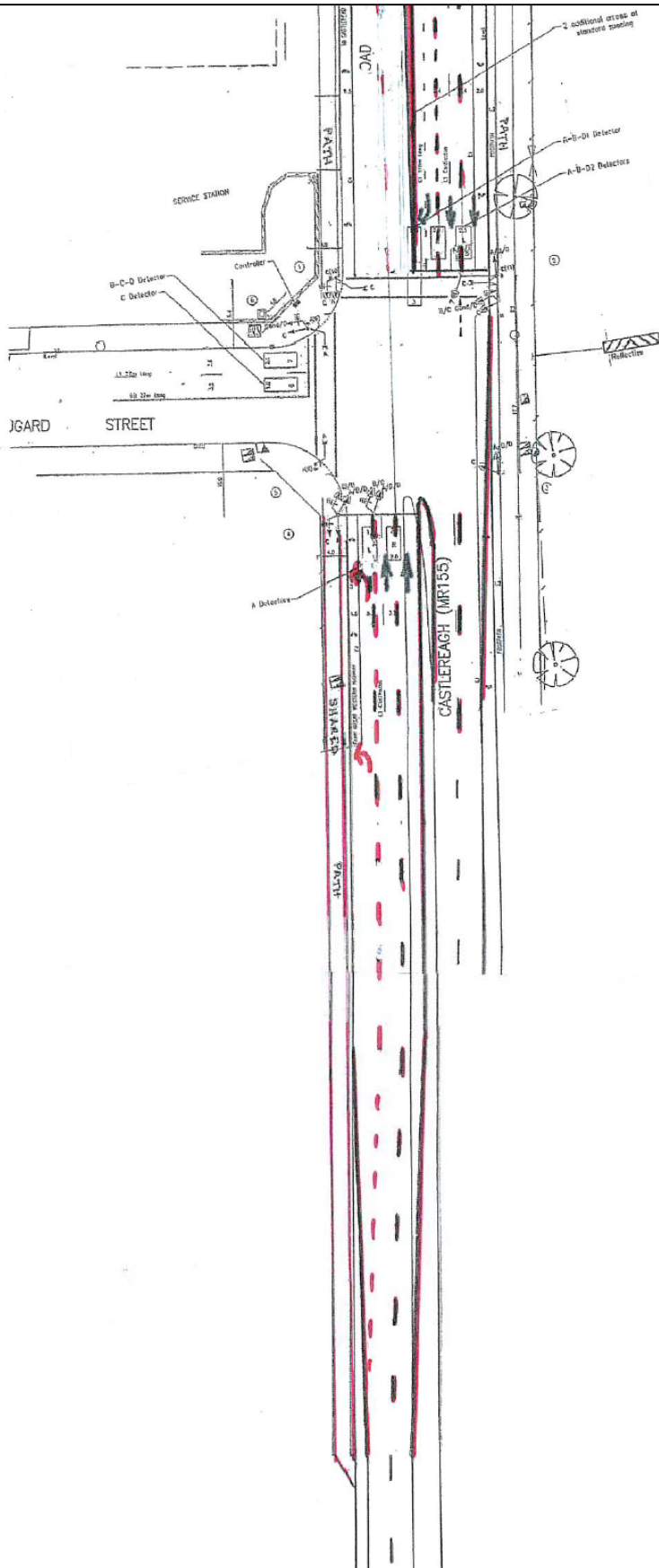
	<p>Alert Level 5: When floodwaters are over Lugard Street</p>	<p>Shelter in the building until flooding has passed</p>	<p>Business Manager or appointed Flood Wardens</p>	
		<p>Contact NSW SES on 132 500 (if possible) and advise of your situation</p>	<p>Business Manager or appointed Flood Wardens</p>	<p>Telephone</p>

<i>After a Flood</i>				
		No owners, tenants or staff will be allowed to return to the site while flooding is still occurring or has recently occurred.	Business Manager or Strata Manager	N/A
		Owners, tenants and staff can return to the site only after the all clear has been given by emergency services or Council when the flood emergency has passed.	Business Manager or Strata Manager	Contact details for owners, tenants and staff
		Where necessary, the Community Association will organise for the site to be appropriately cleaned and utilities checked by professionals before any re-use of the site if floodwaters have entered the site.	Community Association	Utilities contacts
	When emergency services give the all clear to return	<p>Before site clean up and repair, a hazard assessment will be undertaken, safe work methods statements prepared and personal protective equipment supplied consistent with the known hazards which can be associated with floods:</p> <ul style="list-style-type: none"> • Slips, trips and falls • Sharp debris • Venomous animals • Contaminated water and sediments 	Community Association	WHS representative to perform assessment with correct SWMS and PPE.
		When evacuation has been triggered, the Community Association will organise a de-brief with business owners and operators in the precinct and may invite emergency services and/or Council staff to participate. The flood event and response procedures, including the use of the FERP and individual FERPs, will be reviewed to identify changes required or considered beneficial to the operation of the plan.	Community Association	FERP and information on what occurred

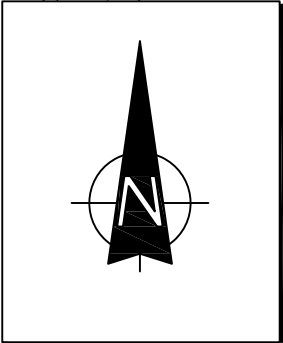
		Changes may be made to the FERPs and the requirements for future emergency evacuation should the review identify any improvements which may be made.	Community Association	FERP
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APPENDIX B – EMERGENCY CONTACTS LIST

Name	Organisation	Role	Contact
	Body Corporate	Site Manager	???
	Business subject of FERP	General Manager	???
	Emergency Services	Fire/ambulance/police	000
	State Emergency Service	SES Local Controller	132 500
	Bureau of Meteorology	NSW Flood Warning Centre	(02) 9296 1511
	Nepean Hospital	Emergency Department	(02) 4734 2000
	Endeavour Energy	Electricity Supply	131 003
	Sydney Water	Water & Sewerage	13 20 90
		Gas Supply	
		Telecommunications	
		Waste Disposal	



LEGEND



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**CONCEPT FOR POTENTIAL
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NOT TO SCALE
 01/03/2022

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Nepean Business Park – Old Castlereagh Road

Vegetation Management Plan



Prepared for: The Directors - Great River NSW Pty Ltd
Date: 8 February 2021
Revision: 1

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1 Introduction

This Vegetation Management Plan (VMP) has been prepared to define the management framework for planted native vegetation in land zoned Environment under the State Environmental Planning Policy (Penrith Lakes Scheme) 1989 located adjacent to the Old Castlereagh Road (the 'Management Zone'), generally as shown in **Figure 1**. This Management Zone forms part of the Nepean Business Park (the Site).



Figure 1. Management Zone

1.1 Background

The Nepean Business Park is a proposed subdivision for employment purposes within the Penrith Lakes Scheme area of the City of Penrith local government area (LGA). The proposal is to create 93 allotments across the 49 ha Site for employment purposes with residual lots 200 to 203 being for environmental and recreational purposes (see **Figure 2**).



Figure 2. Subdivision proposal illustrating environmental zones

The land was historically excavated to a depth of approximately 15m for quarrying purposes, then used as a tailings pond for quarrying by-product and is currently undergoing the necessary rehabilitation works. This prior land use has resulted in minimal vegetation remaining on-site being a composite of plantings, unassisted regeneration and remnant unmanaged vegetation (**Figure 1**).

1.2 Purpose/ Objectives

This VMP provides the management specifications required to allow for the ongoing protection of environmental values contained within this Management Zone as identified in Section 1. Therefore, the main objectives of this VMP are to:

- Protect existing native trees and shrubs within the Management Zone identified for retention;
- Remove and control exotic plant species that diminish the floristic character of native vegetation found within the local area;
- Restore the Management Zone to a patch of native vegetation by introducing native trees, shrubs and groundcovers; and
- Demonstrate a stable patch of native vegetation comprising native species in the tree, midstorey and groundcover strata and minimal exotic flora cover.

The VMP has been prepared to address the relevant parts of the Penrith Lakes Development Control Plan (DCP) Stage 1 (November 2021) in particular:

- Control 2 of Section 3.4 (replacement plantings);
- Control 5 of Section 4.4 (retention of vegetation in landscape setting); and
- Control 7 of Section 4.4 (Protection and enhancement of remnant vegetation and riparian areas).

1.3 Management Zone

This VMP applies to a single Management Zone as identified in Section 1. The Management Zone comprises native trees and shrubs.

1.4 Implementation

The VMP comprises three implementation phases as listed below:

- Construction phase;
- Establishment works; and
- Maintenance period.

Performance/ completion criteria are specified and benchmark the expectations of the VMP, with VMP milestone achievement to be verified through routine monitoring. Adaptive management principles are outlined to aid VMP implementation where monitoring works indicate a need for alternate remedies to achieve the purpose/ objectives of the VMP.

The VMP is to be implemented for a minimum of 5 years and deemed to have met

its objectives and may cease to operate following this timeframe provided satisfactory accomplishment of the performance/ completion criteria for the maintenance period is demonstrated.

1.5 Site vegetation

The ecological assessment (RPS 2021) for the site has noted an area of continuous native vegetation at the rear of the site (adjoining the Nepean River) and a row of planted trees adjoining Old Castlereagh Road. Most of the planted trees along Old Castlereagh Road are locally native and constitute Forest Redgum (*Eucalyptus tereticornis*), Blue Box (*Eucalyptus baueriana*), Prickly Moses (*Melaleuca styphelioides*) and Snow-in-summer (*Melaleuca linariifolia*).

The ground layer in this location was largely disturbed, containing numerous weed species, including weedy groundcovers, woody shrubs, and small trees. Several exotic species were noted within the ecological assessment (RPS 2021), these include ground layer species such as Rhodes Grass (*Chloris gayana**), Paddy's Lucerne (*Sida rhombifolia**), African Lovegrass (*Eragrostis curvula**), Fireweed (*Senecio madagascariensis**), Purpletop (*Verbena* spp.*), Fleabane (*Conyza* spp.*), Medic (*Medicago* spp.*), Pitchforks (*Bidens pilosa**), Kikuyu (*Cenchrus clandestinus**) and Wild Oats (*Avena* spp.*).

The following weedy shrubs to small trees were also noted within the ecological assessment (RPS 2021); Small-leaved Privet (*Ligustrum sinense*), Large-leaved Privet (*Ligustrum lucidum**) and African Olive (*Olea europaea* subsp. *cuspidata**).

The ecological assessment (RPS 2021) also noted the following native species *Dianella caerulea*, *Acacia falcata*, *Cynodon dactylon*, *Microlaena stipoides*, *Oplismenus aemulus*, *Einadia hastata*, *Acacia longifolia* and *Desmodium varians*.

1.6 Fauna habitat

The ecological assessment (RPS 2021) noted some common fauna species but detailed the very limited fauna habitat onsite with potential for fauna using nectar resources and some of the grassy understorey. No hollows were present in the native vegetation with hollow formation limited to a few very old orchard species (some of these being dead) and therefore unlikely to support hollow nesting mammals or birds. The grassy understorey is largely exotic and weedy but provides some habitat values for common reptiles and birds. Some nesting by finches was noted (RPS 2021).

1.7 Connectivity

The planted vegetation within the Management Zone is narrow and isolated from proximal remnant vegetation to such an extent that limits its ecological value. The vegetation provides structure for localised movements of highly mobile fauna (i.e. birds).

2 Environmental zone protection and management

To ensure that the environmental values of this Management Zone is adequately protected, managed, and maintained into the future the management plan sets out the necessary maintenance and management during:

- Construction phase;
- Establishment period; and
- Maintenance.

A description of these is provided in the following sections.

2.1 Construction phase

The following steps must be undertaken prior to construction works commencing on site and are required for the duration of the construction phase until reasonable establishment as determined by a suitably qualified environmental specialist.

2.1.1 Vegetation protection fencing and signage

Prior to commencement of works a high visibility construction fence, rope or barrier will be required around the existing vegetation to be protected. This will be installed at the margin of tree protection zones established for retained or individual trees or along the outside of the environmental protection zone. This is designed to protect existing vegetation from damage during the construction phase.

Site staff are prohibited from excavating or disturbing the ground layer, park vehicles or store or place any materials within the fenced zone. Waterproof signage to this effect must be provided on all protection fencing for the duration of site construction works.

2.1.2 Sediment erosion control

Sediment erosion fencing will be required throughout the construction phase to ensure no damage to existing vegetation occurs during earthworks and any rainfall events. To manage the likely compaction caused by encroachment of fill over the root zone of trees, this material is encouraged to be moved manually or with minimal machinery. It is preferable that any fill within the root zone be topsoil material sourced from onsite to improve or maintain the soil conditions under this disturbed vegetation. Planting, watering, and mulching in accordance with this

VMP will also assist in stabilising these areas.

2.1.3 Primary weed management

Primary weed management will be undertaken by a suitably qualified bush regenerator following the construction of vegetation protection fencing, signage and sediment erosion control measures. These works will reduce the bulk of the weed infestation on site and will allow management and planting preparation to begin. These works will be carried out in a manner as to protect the existing vegetation and to reduce competition between revegetation plantings.

Spot spraying with appropriate herbicide (glyphosate or similar) and manual hand weeding should be sufficient to initiate the control of weed over during the primary phase. Following the initial primary works that will remove many weed species, it is important to follow up with removal of all remaining or emerging environmental weeds and replace these with local ground layer species. These works must be carried out by a suitably qualified bush regenerator or similar.

Dependent on the size of individual plants, hand pulling, cut paint or drill frilling with application of appropriate herbicide (e.g., glyphosate) will be required. This would be best managed early in the primary phase and establishment to ensure woody weeds are not resprouting following earthworks.

The ecological assessment (RPS 2021) also noted the presence of a Weed of National Significance (WONS) the Asparagus Fern (*Asparagus aethiopicus**), also requiring biosecurity duties. Asparagus fern requires careful removal to ensure the full crown is killed or removed. It also requires expert application of appropriate selective herbicide as spot spraying alone is unlikely to be sufficient. The works must be carried out by a suitably qualified bush regenerator (i.e. all weeding works, in particular the woody weeds and WONS).

2.2 Establishment period

Establishment works involve secondary weed management and revegetation of the Management Zone using plantings of native groundcovers, shrubs and trees. Revegetation works may occur during the construction period but is not recommended prior to achievement of performance targets for weed management as such works are premature and likely inefficient.

Secondary weed management is to be applied by an experienced bush regenerator. Spot spraying and hand removal is recommended, as required, to ensure weed cover remains at background levels (i.e. <5% cover). It is

recommended that biannual secondary weed management be performed (i.e. spring and autumn) to reduce the potential for weed propagation.

Revegetation methods will include the use of suitable/ appropriate revegetation approaches available for establishing the understorey noting the requirement to meet relevant performance standards specified in Section 3. Approaches taken are to be consistent with the local landscape to increase diversity and encourage recovery. Native grass, forb and herb species is recommended for the batters in accordance with the Landscape Plan to stabilise soils and aid regeneration works by minimizing places for exotic species to grow, flourish and generate seed banks that would undermine the VMP objectives. For this purpose, the consideration of the species found in PCT 835 is recommended.

To diversify the ground and shrub layer and replace all removed vegetation it is recommended that revegetation of understorey and midstorey occurs within the environment zone. The species revegetated must relate to the vegetation community being reconstructed and will comprise trees, shrubs, and groundcovers species consistent with those listed in Appendix 1.

Planting densities should achieve quick vegetative cover and root mass to maximise stability. Planting should be regularly watered and mulched using bark or forest mulch to assist plant survival and weed control.

2.2.1 Species Selection

Where additional tree planting can be facilitated within the environmental zone the following species should be considered for use; Forest Redgum (*Eucalyptus tereticornis*), Blue Box (*Eucalyptus baureana*) Rough-barked Apple (*Angophora floribunda*) and *Eucalyptus amplifolia* subsp. *amplifolia*.

To increase vegetation community health and diversity within the Management Zone, it is recommended that supplementary management and revegetation of understorey and midstorey occur in this location. The following species are recommended for supplementary planting:

- midstorey or shrubs; Prickly Moses (*Melaleuca styphelioides*) Sickle Wattle (*Acacia falcata*), Sydney Golden Wattle (*Acacia longifolia*) and Snow-in-summer (*Melaleuca linariifolia*).
- ground layer; *Dianella caerulea*, *Microlaena stipoides*, *Oplismenus aemulus*, *Einadia hastata*, *Desmodium varians*, *Themeda triandra* and *Dianella revoluta*.

2.2.2 Planting Density

Where additional replacement tree planting can be facilitated, trees will be planted at 1 per 16 m², or as selected by the landscape architect. Where required,

planting density for shrubs is 1 per 4 m² and groundcovers are recommended to be planted at a minimum rate of 2 per 1 m² to achieve the performance targets outlined in **Section 3**.

These plantings densities will be developed by the project landscape architect to assist with reducing weed occurrence and will allow for a high ecological value environmental conservation area as well as accommodating compensatory planting requirement.

2.2.3 Compensatory Tree plantings

Trees removed for the development are to be replaced at a ratio of 2:1. Tree plantings are to be performed by an experienced bush regenerator. The GPS location and species used is to be recorded for future monitoring purposes. A unique tree number is to be provided to each planting and applied in the field for ease of recognition.

2.2.4 Ameliorants

Mulch is recommended to be spread, and where required tree guards erected to reduce predation. Propagules used for revegetation works will be sourced from a nursery specialising in local provenance. Salvaged hollows and branches can be used to supplement available ground layer habitat within the environmental buffer zone.

2.2.5 Plant Loss

Plant losses will be replaced, mulch replenished where necessary and weeds will continue to be controlled over this timeframe.

2.3 Maintenance

The ongoing maintenance of the Management Zone aims to continue the outcomes generated during the establishment period. Maintenance includes ongoing suppression of weed cover and planting of native vegetation where and as required.

Repeated secondary weed management is to be applied as required to maintain <5% weed cover. Natural regeneration is to be encouraged where possible using bush regeneration techniques.

Access is to be limited to the Management Zone to reduce the incidence of illegal dumping and weed invasion. This area will be required to be fenced for safety purposes using materials consistent with the landscape planning for the site. Fencing will be permeable fauna friendly fencing allowing for fauna to move safely

into the landscape zone. Fences are prohibited along lot boundaries where they traverse the Management Zone to prevent isolation of lands and interrupt connectivity.

3 Performance Targets/ Completion Criteria

Performance targets/ completion criteria by management stages are provided in the following table.

Management Phase	Native vegetation	Weed Management
Construction	<ul style="list-style-type: none"> Erection of fencing, signage around the tree protection zones to provide protection for retained native vegetation. Signage and education of site staff to ensure non-disturbance of any form within the fenced off area. Trees identified for retention are retained and appropriated managed. 	<ul style="list-style-type: none"> Primary weed management works to be completed by bush regeneration specialists. Weed cover to be controlled in preparation for planting (i.e. >95% weed cover removed).
Establishment	<ul style="list-style-type: none"> Native understorey and midstorey revegetation works generate > 40% vegetation cover for at least two consecutive monitoring events. Compensatory tree plantings (2:1) are established with locations of each planting to be recorded with a GPS and tree number provided for future identification. 	<ul style="list-style-type: none"> Use secondary weed management practices to suppress weed cover to less than 5%.
Maintenance	<ul style="list-style-type: none"> Mean understorey native vegetation cover exceeds 40% across the management zone for a period of two consecutive years. All compensatory tree plantings survive for a minimum of 24 consecutive months. 	<ul style="list-style-type: none"> Weed cover is stable and remains less than 5% for two consecutive years with minimal intervention.

Cessation of the VMP is not before 5 years and relies on satisfactory achievement of the maintenance performance criteria.

4 Monitoring

Monitoring works are to be performed to annually assess the efficacy of management actions against the performance targets specified in Section 3.

4.1 Method

Monitoring is to comprise of five 50 m long transects. Each transect is to be randomly placed but spatially representative. The presence of native vegetation or weed cover is to be assessed at each 1 m interval of the transect (i.e. point intercept). The sum result for native and weed cover is to be converted to a percent cover and compared with relevant performance measures.

Species richness lists are to be obtained along each of the transects with such data to be used to determine the success of planting and weed management (e.g. species diversity index).

Compensatory tree plantings are to be inspected. Measures obtained include tree health and height. Survival rates are to be calculated (i.e. live versus dead plantings) with such data to be used to define any additional planting requirements.

4.2 Baseline

Monitoring is to include a baseline condition state as a means for quantifying the pre-management period. This is to be performed prior to but within 6 months of construction works.

4.3 Frequency

Monitoring is to be performed annually and at the same time of year as the baseline monitoring event. It is recommended that annual monitoring occur in September of each year as this will provide the best measure of performance.

4.4 Reporting

An annual monitoring report is to be supplied to the consent authority each year for the duration of the VMP. Monitoring is to persist for at least two years into the maintenance period with monitoring cessation to be determined by compliance with performance standards and not before a minimum 5 year implementation period.

5 Adaptive Management

An Adaptive Management Framework is to be used to account for uncertainties and to improve management response. The adaptive management framework actions are detailed below noting this VMP represents steps 1 to 4 (i.e. implementation of management actions), with any specifications for adaptive management to be determined through steps 5 to 7 (i.e. monitoring).

1. Describe - Undertake and complete comprehensive baseline biodiversity data collection.
2. Model – Model the biological environment and its response to certain management actions/decisions.
3. Identify – Set clear biodiversity management objectives.
4. Do – Implement the modelled biological management action.
5. Learn – Use the monitoring program to evaluate the biological response to management actions against objectives and performance targets. Where required, prepare draft adaptive management response and include in annual monitoring report.
6. Consult – Share draft adaptive management response with relevant stakeholders, receive feedback and implement revised management actions.
7. Adapt – Implement revised and approved adaptive management actions.

Draft adaptive management responses are to be defined through Step 5 and approved and reported through the Annual Monitoring Report as specifications in the 'Annual Works Program'.

6 References

BioNet Vegetation Classification (2021),

<https://www.environment.nsw.gov.au/NSWVCA20PRapp/DataEntry/PlantCommunity.aspx?M=E&PID=835>. Accessed October 2021.

Great River NSW Pty Ltd (2020) Landscape Development Application. Penrith, NSW S18-007, Clouston Associates.

Standards Australia (2009), AS 4970-2009 Australian Standard Protection of trees on development sites. Standards Australia, Sydney.

RPS (2021), Flora and Fauna Assessment Report. Nepean Business Park. Report prepared by RPS, Carrington NSW 2294.

Appendix 1

Recommended Species List

Common Name	Scientific Name	Growth Form
Forest Redgum	<i>Eucalyptus tereticornis</i>	Tree
Rough-barked Apple	<i>Angophora floribunda</i>	Tree
Cabbage Gum	<i>Eucalyptus amplifolia</i> subsp. <i>amplifolia</i>	Tree
Green Wattle	<i>Acacia parramattensis</i>	Shrub (midstratum)
Blackthorn	<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	Shrub (midstratum)
	<i>Sigesbeckia orientalis</i>	Shrub (midstratum)
Weeping Grass	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Grass
Basket Grass	<i>Oplismenus aemulus</i>	Grass
Kidney Weed	<i>Dichondra repens</i>	Herb
Whire Grass	<i>Entolasia marginata</i>	Grass
Forest Nightshade	<i>Solanum prinophyllum</i>	Shrub (groundcover)
Whiteroot	<i>Lobelia purpurascens</i>	Herb
Slender tick trefoil	<i>Pullenia gunnii</i>	Herb
Forest Hedgehog Grass	<i>Echinopogon ovatus</i>	Grass
Scurvy Weed	<i>Commelina cyanea</i>	Herb
Trailing Speedwell	<i>Veronica plebeia</i>	Herb

Nepean Business Park – Nepean River

Vegetation Management Plan



Prepared for: The Directors - Great River NSW Pty Ltd
Date: 8 February 2021
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1 Introduction

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Figure 1. Management Zone

1.1 Background

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The VMP has been prepared to address the relevant parts of the Penrith Lakes Development Control Plan (DCP) Stage 1 (November 2021) in particular:

- Control 2 of Section 3.4 (replacement plantings);
- Control 4 of Section 3.5 (management of riparian corridors);
- Control 6 of Section 3.5 (enhance/ restore riparian vegetation);
- Control 5 of Section 4.4 (retention of vegetation in landscape setting); and
- Control 7 of Section 4.4 (Protection and enhancement of remnant vegetation and riparian areas).

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- Establishment works; and
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1.5 Site vegetation

The ecological assessment (RPS 2021) for the site has noted an area of continuous native vegetation at the rear of the site (adjoining the Nepean River) and a row of planted trees adjoining Old Castlereagh Road. Most of the planted trees along Old Castlereagh Road are locally native and constitute Forest Redgum (*Eucalyptus tereticornis*), Blue Box (*Eucalyptus baueriana*), Prickly Moses (*Melaleuca styphelioides*) and Snow-in-summer (*Melaleuca linariifolia*).

The ground layer in this location was largely disturbed, containing numerous weed species, including weedy groundcovers, woody shrubs, and small trees. Several exotic species were noted within the ecological assessment (RPS 2021), these include ground layer species such as Rhodes Grass (*Chloris gayana**), Paddy's Lucerne (*Sida rhombifolia**), African Lovegrass (*Eragrostis curvula**), Fireweed (*Senecio madagascariensis**), Purpletop (*Verbena* spp.*), Fleabane (*Conyza* spp.*), Medic (*Medicago* spp.*), Pitchforks (*Bidens pilosa**), Kikuyu (*Cenchrus clandestinus**) and Wild Oats (*Avena* spp.*).

The following weedy shrubs to small trees were also noted within the ecological assessment (RPS 2021); Small-leaved Privet (*Ligustrum sinense*), Large-leaved Privet (*Ligustrum lucidum**) and African Olive (*Olea europaea* subsp. *cuspidata**).

The ecological assessment (RPS 2021) also noted the following native species *Dianella caerulea*, *Acacia falcata*, *Cynodon dactylon*, *Microlaena stipoides*, *Oplismenus aemulus*, *Einadia hastata*, *Acacia longifolia* and *Desmodium varians*.

1.6 Fauna habitat

The ecological assessment (RPS 2021) noted some common fauna species but detailed the very limited fauna habitat onsite with potential for fauna using nectar resources and some of the grassy understorey. No hollows were present in the native vegetation with hollow formation limited to a few very old orchard species (some of these being dead) and therefore unlikely to support hollow nesting mammals or birds. The grassy understorey is largely exotic and weedy but provides some habitat values for common reptiles and birds. Some nesting by finches was noted (RPS 2021).

1.7 Connectivity

The planted vegetation within the Management Zone is narrow and isolated from proximal remnant vegetation to such an extent that limits its ecological value. The vegetation provides structure for localised movements of highly mobile fauna (i.e. birds).

2 Environmental zone protection and management

To ensure that the environmental values of this Management Zone is adequately protected, managed, and maintained into the future the management plan sets out the necessary maintenance and management during:

- Construction phase;
- Establishment period; and
- Maintenance.

A description of these is provided in the following sections.

2.1 Construction phase

The following steps must be undertaken prior to construction works commencing on site and are required for the duration of the construction phase until reasonable establishment as determined by a suitably qualified environmental specialist.

2.1.1 Vegetation protection fencing and signage

Prior to commencement of works a high visibility construction fence, rope or barrier will be required around the existing vegetation to be protected. This will be installed at the margin of tree protection zones established for retained individual trees or along the outside of the environmental protection zone. This is designed to protect existing vegetation from damage during the construction phase.

Site staff are prohibited from excavating or disturbing the ground layer, park vehicles or store or place any materials within the fenced zone. Waterproof signage to this effect must be provided on all protection fencing for the duration of site construction works.

2.1.2 Sediment erosion control

Sediment erosion fencing will be required throughout the construction phase to ensure no damage to existing vegetation occurs during earthworks and any rainfall events. To manage the likely compaction caused by encroachment of fill over the root zone of trees, this material is encouraged to be moved manually or with minimal machinery. It is preferable that any fill within the root zone be topsoil material sourced from onsite to improve or maintain the soil conditions under this

disturbed vegetation. Planting, watering, and mulching in accordance with this VMP will also assist in stabilising these areas.

2.1.3 Primary weed management

Primary weed management will be undertaken by a suitably qualified bush regenerator following the construction of vegetation protection fencing, signage and sediment erosion control measures. These works will reduce the bulk of the weed infestation on site and will allow management and planting preparation to begin. These works will be carried out in a manner as to protect the existing vegetation and to reduce competition between revegetation plantings.

Spot spraying with appropriate herbicide (glyphosate or similar) and manual hand weeding should be sufficient to initiate the control of weed over during the primary phase. Following the initial primary works that will remove many weed species, it is important to follow up with removal of all remaining or emerging environmental weeds and replace these with local ground layer species. These works must be carried out by a suitably qualified bush regenerator or similar.

Dependent on the size of individual plants, hand pulling, cut paint or drill frilling with application of appropriate herbicide (e.g., glyphosate) will be required. This would be best managed early in the primary phase and establishment to ensure woody weeds are not resprouting following earthworks.

The ecological assessment (RPS 2021) also noted the presence of a Weed of National Significance (WONS) the Asparagus Fern (*Asparagus aethiopicus**), also requiring biosecurity duties. Asparagus fern requires careful removal to ensure the full crown is killed or removed. It also requires expert application of appropriate selective herbicide as spot spraying alone is unlikely to be sufficient. The works must be carried out by a suitably qualified bush regenerator (i.e. all weeding works, in particular the woody weeds and WONS).

2.2 Establishment period

Establishment works involve secondary weed management and revegetation of the Management Zone using plantings of native groundcovers, shrubs and trees. Revegetation works may occur during the construction period but is not recommended prior to achievement of performance targets for weed management as such works are premature and likely inefficient.

Secondary weed management is to be applied by an experienced bush regenerator. Spot spraying and hand removal is recommended, as required, to

ensure weed cover remains at background levels (i.e. <5% cover). It is recommended that biannual secondary weed management be performed (i.e. spring and autumn) to reduce the potential for weed propagation.

Revegetation methods will include the use of suitable/ appropriate revegetation approaches available for establishing the understorey noting the requirement to meet relevant performance standards specified in Section 3. Approaches taken are to be consistent with the local landscape to increase diversity and encourage recovery. Native grass, forb and herb species is recommended for the batters in accordance with the Landscape Plan to stabilise soils and aid regeneration works by minimizing places for exotic species to grow, flourish and generate seed banks that would undermine the VMP objectives. For this purpose, the consideration of the species found in PCT 835 is recommended.

To diversify the ground and shrub layer and replace all removed vegetation it is recommended that revegetation of understorey and midstorey occurs within the environment zone. The species revegetated must relate to the vegetation community being reconstructed and will comprise trees, shrubs, and groundcovers species consistent with those listed in Appendix 1.

Planting densities should achieve quick vegetative cover and root mass to maximise stability. Planting should be regularly watered and mulched using bark or forest mulch to assist plant survival and weed control.

2.2.1 Species Selection

Where additional tree planting can be facilitated within the environmental zone the following species should be considered for use; Forest Redgum (*Eucalyptus tereticornis*), Blue Box (*Eucalyptus baureana*) Rough-barked Apple (*Angophora floribunda*) and *Eucalyptus amplifolia* subsp. *amplifolia*.

To increase vegetation community health and diversity within the Management Zone, it is recommended that supplementary management and revegetation of understorey and midstorey occur in this location. The following species are recommended for supplementary planting:

- midstorey or shrubs; Prickly Moses (*Melaleuca styphelioides*) Sickle Wattle (*Acacia falcata*), Sydney Golden Wattle (*Acacia longifolia*) and Snow-in-summer (*Melaleuca linariifolia*).
- ground layer; *Dianella caerulea*, *Microlaena stipoides*, *Oplismenus aemulus*, *Einadia hastata*, *Desmodium varians*, *Themeda triandra* and *Dianella revoluta*.

2.2.2 Planting Density

Where additional replacement tree planting can be facilitated, trees will be

planted at 1 per 16 m², or as selected by the landscape architect. Where required, planting density for shrubs is 1 per 4 m² and groundcovers are recommended to be planted at a minimum rate of 2 per 1 m² to achieve the performance targets outlined in **Section 3**.

These plantings densities will be developed by the project landscape architect to assist with reducing weed occurrence and will allow for a high ecological value environmental conservation area as well as accommodating compensatory planting requirement.

2.2.3 Compensatory Tree plantings

Trees removed for the development are to be replaced at a ratio of 2:1. Tree plantings are to be performed by an experienced bush regenerator. The GPS location and species used is to be recorded for future monitoring purposes. A unique tree number is to be provided to each planting and applied in the field for ease of recognition.

2.2.4 Ameliorants

Mulch is recommended to be spread, and where required tree guards erected to reduce predation. Propagules used for revegetation works will be sourced from a nursery specialising in local provenance. Salvaged hollows and branches can be used to supplement available ground layer habitat within the environmental buffer zone.

2.2.5 Plant Loss

Plant losses will be replaced, mulch replenished where necessary and weeds will continue to be controlled over this timeframe.

2.3 Maintenance

The ongoing maintenance of the Management Zone aims to continue the outcomes generated during the establishment period. Maintenance includes ongoing suppression of weed cover and planting of native vegetation where and as required.

Repeated secondary weed management is to be applied as required to maintain <5% weed cover. Natural regeneration is to be encouraged where possible using bush regeneration techniques.

Access is to be limited to the Management Zone to reduce the incidence of illegal dumping and weed invasion. This area will be required to be fenced for safety purposes using materials consistent with the landscape planning for the site.

Fencing will be permeable fauna friendly fencing allowing for fauna to move safely into the landscape zone. Fences are prohibited along lot boundaries where they traverse the Management Zone to prevent isolation of lands and interrupt connectivity.

3 Performance Targets/ Completion Criteria

Performance targets/ completion criteria by management stages are provided in the following table.

Management Phase	Native vegetation	Weed Management
Construction	<ul style="list-style-type: none"> Erection of fencing, signage around the tree protection zones to provide protection for retained native vegetation. Signage and education of site staff to ensure non-disturbance of any form within the fenced off area. Trees identified for retention are retained and appropriated managed. 	<ul style="list-style-type: none"> Primary weed management works to be completed by bush regeneration specialists. Weed cover to be controlled in preparation for planting (i.e. >95% weed cover removed).
Establishment	<ul style="list-style-type: none"> Native understorey and midstorey revegetation works generate > 40% vegetation cover for at least two consecutive monitoring events. Compensatory tree plantings (2:1) are established with locations of each planting to be recorded with a GPS and tree number provided for future identification. 	<ul style="list-style-type: none"> Use secondary weed management practices to suppress weed cover to less than 5%.
Maintenance	<ul style="list-style-type: none"> Mean understorey native vegetation cover exceeds 40% across the management zone for a period of two consecutive years. All compensatory tree plantings survive for a minimum of 24 consecutive months. 	<ul style="list-style-type: none"> Weed cover is stable and remains less than 5% for two consecutive years with minimal intervention.

Cessation of the VMP is not before 5 years and relies on satisfactory achievement of the maintenance performance criteria.

4 Monitoring

Monitoring works are to be performed to annually assess the efficacy of management actions against the performance targets specified in Section 3.

4.1 Method

Monitoring is to comprise of five 50 m long transects. Each transect is to be randomly placed but spatially representative. The presence of native vegetation or weed cover is to be assessed at each 1 m interval of the transect (i.e. point intercept). The sum result for native and weed cover is to be converted to a percent cover and compared with relevant performance measures.

Species richness lists are to be obtained along each of the transects with such data to be used to determine the success of planting and weed management (e.g. species diversity index).

Compensatory tree plantings are to be inspected. Measures obtained include tree health and height. Survival rates are to be calculated (i.e. live versus dead plantings) with such data to be used to define any additional planting requirements.

4.2 Baseline

Monitoring is to include a baseline condition state as a means for quantifying the pre-management period. This is to be performed prior to but within 6 months of construction works.

4.3 Frequency

Monitoring is to be performed annually and at the same time of year as the baseline monitoring event. It is recommended that annual monitoring occur in September of each year as this will provide the best measure of performance.

4.4 Reporting

An annual monitoring report is to be supplied to the consent authority each year for the duration of the VMP. Monitoring is to persist for at least two years into the maintenance period with monitoring cessation to be determined by compliance with performance standards and not before a minimum 5 year implementation period.

5 Adaptive Management

An Adaptive Management Framework is to be used to account for uncertainties and to improve management response. The adaptive management framework actions are detailed below noting this VMP represents steps 1 to 4 (i.e. implementation of management actions), with any specifications for adaptive management to be determined through steps 5 to 7 (i.e. monitoring).

1. Describe - Undertake and complete comprehensive baseline biodiversity data collection.
2. Model – Model the biological environment and its response to certain management actions/decisions.
3. Identify – Set clear biodiversity management objectives.
4. Do – Implement the modelled biological management action.
5. Learn – Use the monitoring program to evaluate the biological response to management actions against objectives and performance targets. Where required, prepare draft adaptive management response and include in annual monitoring report.
6. Consult – Share draft adaptive management response with relevant stakeholders, receive feedback and implement revised management actions.
7. Adapt – Implement revised and approved adaptive management actions.

Draft adaptive management responses are to be defined through Step 5 and approved and reported through the Annual Monitoring Report as specifications in the 'Annual Works Program'.

6 References

BioNet Vegetation Classification (2021),

<https://www.environment.nsw.gov.au/NSWVCA20PRapp/DataEntry/PlantCommunity.aspx?M=E&PID=835>. Accessed October 2021.

Great River NSW Pty Ltd (2020) Landscape Development Application. Penrith, NSW S18-007, Clouston Associates.

Standards Australia (2009), AS 4970-2009 Australian Standard Protection of trees on development sites. Standards Australia, Sydney.

RPS (2021), Flora and Fauna Assessment Report. Nepean Business Park. Report prepared by RPS, Carrington NSW 2294.

Appendix 1

Recommended Species List

Common Name	Scientific Name	Growth Form
Forest Redgum	<i>Eucalyptus tereticornis</i>	Tree
Rough-barked Apple	<i>Angophora floribunda</i>	Tree
Cabbage Gum	<i>Eucalyptus amplifolia</i> subsp. <i>amplifolia</i>	Tree
Green Wattle	<i>Acacia parramattensis</i>	Shrub (midstratum)
Blackthorn	<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	Shrub (midstratum)
	<i>Sigesbeckia orientalis</i>	Shrub (midstratum)
Weeping Grass	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Grass
Basket Grass	<i>Oplismenus aemulus</i>	Grass
Kidney Weed	<i>Dichondra repens</i>	Herb
Whire Grass	<i>Entolasia marginata</i>	Grass
Forest Nightshade	<i>Solanum prinophyllum</i>	Shrub (groundcover)
Whiteroot	<i>Lobelia purpurascens</i>	Herb
Slender tick trefoil	<i>Pullenia gunnii</i>	Herb
Forest Hedgehog Grass	<i>Echinopogon ovatus</i>	Grass
Scurvy Weed	<i>Commelina cyanea</i>	Herb
Trailing Speedwell	<i>Veronica plebeia</i>	Herb