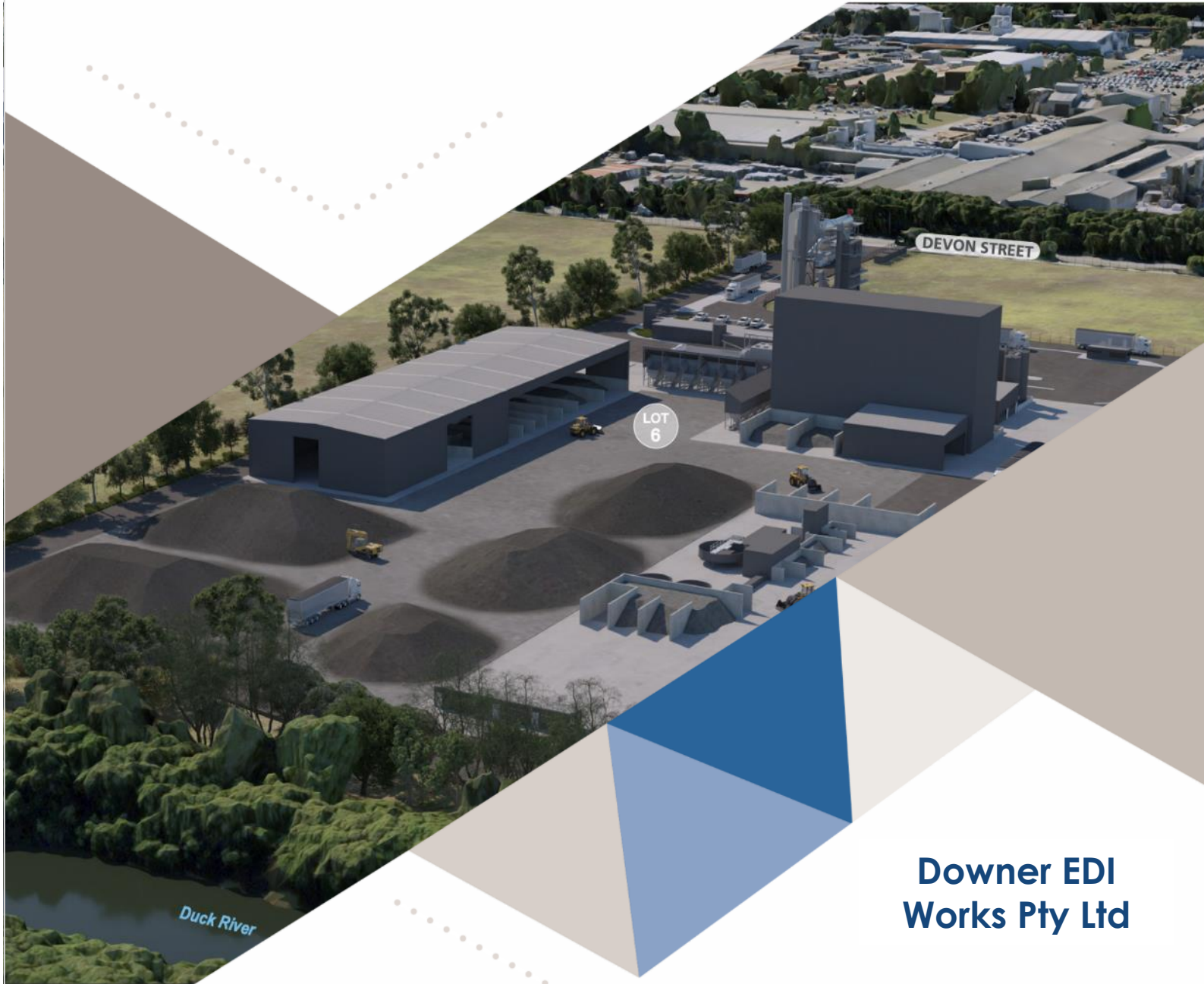


MOLINO STEWART

ENVIRONMENT & NATURAL HAZARDS



**Downer EDI
Works Pty Ltd**

**Downer Sustainable Road Resource Centre
Construction Phase
Flood Emergency Response Plan
Final**

Downer Sustainable Road Resource Centre Construction Phase

Flood Emergency Response Plan

Final

Client: Downer EDI Works Pty Ltd

Prepared by:

Molino Stewart Pty Ltd

Suite 3, Level 1, 20 Wentworth Street, Parramatta NSW 2150, Australia

PO Box 614, Parramatta CBD BC, Parramatta NSW 2124

T +61 2 9354 0300 www.molinostewart.com.au

ABN 95 571 253 092

ACN 067 774 332

Cover photo from: Central Sydney Industrial Estate incorporating the Sustainable Road Resource Centre State Significant Development Application Environmental Impact Statement (September 2020) prepared by Element Environment for VE Property Pty Ltd and Downer EDI Works Pty Ltd.

February 2021

© Molino Stewart Pty Ltd. All rights reserved

Molino Stewart has prepared this document for the sole use of the Client and for a specific purpose, each as expressly stated in the document. No other party should rely on this document without the prior written consent of Molino Stewart. Molino Stewart undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. This document has been prepared based on the Client's description of its requirements and Molino Stewart's experience, having regard to assumptions that Molino Stewart can reasonably be expected to make in accordance with sound professional principles. Molino Stewart may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.



Document Control

Document Reference	1262 Downer Sustainable Road Resource Centre Construction Phase FERP Final.Docx
Project	Downer Sustainable Road Resource Centre Construction Phase
Document Type	Flood Emergency Response Plan
Author	Filippo Dall'Osso; Kelsey Sanborn

Revision History

Date	Version	Name	Comments
28/01/2021	1.0	Filippo Dall'Osso	Draft for client review
03/02/2021	2.0	Filippo Dall'Osso	Final incorporating client comments

Document Approval

For Molino Stewart	
Name	Dr Filippo Dall'Osso
Position	Principal
For Downer EDI Works Pty Ltd	
Name	Jeffery Lord
Position	Project Manager

Contents

1262 Downer Sustainable Road Resource Centre Construction Phase FERP final.docx | 3/02/2021

1	Introduction	1
1.1	Background	1
1.2	Scope of this Report	2
2	Description of the Proposed Development	4
2.1	Site Overview	4
2.1.1	Access	4
2.1.2	Topography and Drainage	4
2.2	The Proposed Road Resource Centre	8
2.3	The Construction Process	10
2.3.1	Civil Works for Lot 6	10
2.3.2	Construction of Lot 6 Facilities	10
2.3.3	Working Hours and People on Site	11
3	Flood Risks	12
3.1	Flood Generating Weather	12
3.2	Flood Probabilities	12
3.3	Flooding of the Site	13
3.3.1	Available Flood Model Results	13
3.3.2	Flood Levels and Depths	14
3.3.3	Frequency of Flooding	14
3.3.4	Flood Hazard	15
3.3.5	Flood Duration and Rate of Rise	15
4	Flood Forecasts and Warnings	31
4.1	Bureau of Meteorology (BoM)	31
4.2	Floodsmart	31
5	Emergency Management Considerations	34
5.1	Consultation with the NSWSES	34
5.2	The Emergency Response Strategy	34
6	Flood Emergency Response Plan	36
6.1.1	Priorities	36
6.2	Responsibilities	36
6.2.1	NSW State Emergency Services (NSWSES)	36
6.2.2	Site Management	36
6.3	What do to Before, During and After a Flood	37
6.3.1	Before a Flood	37



6.3.2	When a Flood is Possible	38
6.3.3	During a Flood	38
6.3.4	After a Flood	39
7	References	41

Appendices

Appendix A| Action Checklist

Appendix B| Emergency Contact List

List of Tables

Table 1.	Summary of the Conditions of Consent related to flooding and where in this report these are addressed.	1
Table 2.	Peak flood depths and levels in Lot 6.	14
Table 3.	FloodSmart warning messages.	32
Table 4.	Relevant FloodSmart warning messages for the site.	33

List of Figures

Figure 1.	Local context of the site (from: Element Environment, 2020a).	5
Figure 2.	Location of Lot 6 (Stage 1) within the final proposed subdivision plan (from: Element Environment, 2020b).	6
Figure 3.	Surface water management plan (from: Element Environment, 2020b).	7
Figure 4.	Layout of Lot 6 (from: Element Environment, 2020b).	9
Figure 5.	Peak flood depth for the 1% AEP flood on the Duck River (with concomitant steady flooding of the Parramatta River).	16
Figure 6.	Peak hydraulic hazard for the 1% AEP flood on the Duck River (with concomitant steady flooding of the Parramatta River; no trim of model).	17
Figure 7.	Peak flood depth for the PMF on the Duck River (with concomitant steady flooding of the Parramatta River).	18
Figure 8.	Peak hydraulic hazard for the PMF on the Duck River (with concomitant steady flooding of the Parramatta River; no trim of model).	19
Figure 9.	Peak flood depth for the 1% AEP overland flood.	20
Figure 10.	Peak hydraulic hazard for the 1% AEP overland flood (<5 cm trimmed out).	21
Figure 11.	Peak flood depth for the overland PMF.	22
Figure 12.	Peak hydraulic hazard for the overland PMF (<5 cm trimmed out).	23
Figure 13.	Parramatta River peak PMF depth.	24
Figure 14.	Parramatta River peak PMF hazard.	25



Figure 15. Flood hazard vulnerability curves (source: Smith et al., 2015).	26
Figure 16. Mainstream PMF Hydrographs at Devon Street.	27
Figure 17. Mainstream PMF Hydrographs at James Ruse Drive Low Point.	28
Figure 18. Overland PMF Hydrographs at Devon Street.	29
Figure 19. Overland PMF Hydrographs at Grand Avenue Low Point.	30



1 | Introduction

1.1 Background

The proposed Central Sydney Industrial Estate and Downer Sustainable Road Resource Centre (SSD-10459), located on Lot 100 DP 1168951 at 9 Devon Street (Rosehill), is State Significant Development (SSD) involving:

1. A staged 15-lot industrial subdivision and relevant infrastructure works to create a new 35-hectare Central Sydney Industrial Estate (the Estate) on the site of the former Shell Clyde refinery. The proponent of this subdivision and works is VE Property (VEP); and
2. The development and operation of a road resource facility in one of the lots (i.e. Lot 6) obtained through the above subdivision. Such facility is referred to as the “Downer’s Sustainable Road Resource Centre” and will include an asphalt plant, reclaimed asphalt pavement processing facilities, a bitumen products plant and a detritus road waste recycling plant. Downer EDI Works Pty Ltd has agreed with VEP to acquire Lot 6 of the above proposed subdivision to build the road resource facility. Lot 6 will become available as a result of the Stage 1 of the subdivision.

The Development Application for the stages of work on this site from applicant VE Property Pty Ltd has been approved subject to conditions. The development conditions related to flood risks are summarised in Table 1. The table also include a reference to which parts of this report address each condition.

Table 1. Summary of the Conditions of Consent related to flooding and where in this report these are addressed.

Condition	Addressed in Section	Notes
B23. Prior to the commencement of construction, the Applicant must prepare a Flood Emergency Response Plan (FERP). The FERP must form part of the CEMP and OEMP required by conditions C2 and C5 and must:		
(a) <i>be prepared by a suitably qualified and experienced person(s);</i>	1.2	
(b) <i>address the provisions of the Floodplain Development Manual (2005) and any relevant guidelines;</i>	1.2	
(c) <i>be prepared in consultation with the State Emergency Service;</i>	5.1	
(d) <i>include details of:</i> i. <i>the flood emergency responses for both construction and operation phases of the development;</i>	6	This FERP only covers the construction phase. A subsequent FERP will cover the operation phase.

ii.	<i>predicted flood levels;</i>	3.3.2	
iii.	<i>flood warning time and flood notification;</i>	4 and 5.2	
iv.	<i>assembly points and evacuation routes;</i>	5.2	
v.	<i>evacuation and refuge protocols; and</i>	6	
vi.	<i>awareness training for employees and contractors.</i>	6.3.1	
B24. The Applicant must: (a) not commence construction until the FERP required by condition B23 is submitted to the Planning Secretary for information purposes; and (b) <i>implement the most recent version of the FERP for the duration of the development.</i> (c) <i>implement the most recent version of the Flood Emergency Response Plan for the duration of the development.</i>		N/A	Noted.
B25. All habitable building floor levels must be no lower than the 1% Annual Exceedance Probability flood plus 500 mm of freeboard. B26. All structures that are built below the 1% Annual Exceedance Probability flood must be constructed from flood compatible building components to ensure structural stability during a flood event.		N/A	Conditions B25 to B26 do not pertain to emergency planning and as such are not addressed by this report.

1.2 Scope of this Report

This report is the Flood Emergency Response Plan (FERP) for the site preparation and construction of the Downer Sustainable Road Resource Centre in Lot 6, and fulfills the requirements of condition B23 with regard to construction activities. Flood emergency management procedures for the operation of the Downer Sustainable Road Resource Centre and the construction of the remaining industrial lots are addressed in separate FERPs.

As per condition B23 (a), this report is prepared by qualified and experienced flood consultants from Molino Stewart. The work has been prepared by Steven Molino who is a founding Principal of Molino Stewart with more than 35 years' experience in floodplain management. Steven is a leading expert in flood emergency planning in NSW, and particularly western Sydney. He is a Registered Professional Engineer NPER 3 Civil and Environmental (1053737). Working with Steven is, Dr Filippo Dall'Osso who has 14 years' experience in floodplain risk management and flood emergency response in NSW.

This FERP has been prepared in a consistent manner with the Floodplain Development Manual (2005). All staff at Molino Stewart are extremely familiar with the Floodplain Development Manual (2005) and have used this to produce several flood emergency response plans and floodplain risk management studies and plans for clients ranging from private developers, local councils to State-Government Organisations.

An Environmental Impact Statement (EIS) has been prepared for the site by Element Environment Pty Limited (Element) on behalf of VEP for submission to the NSW Department of Planning, Industry and Environment (DPIE) to gain SSD approval. The EIS included a flooding assessment produced by WMAWater. Following review of the EIS by government agencies and other relevant stakeholders, response to submissions were produced that included a number of clarifications and refinements to the original plan. This FERP draws on information presented in these documents, which are:

- Central Sydney Industrial Estate incorporating the Sustainable Road Resource Centre State Significant Development Application: Environmental Impact Statement (Element Environment, 2020a)
- Central Sydney Industrial Estate incorporating the Sustainable Road Resource Centre State Significant Development Application: Response to Submissions (Element Environment, 2020b)
- Central Sydney Industrial Estate incorporating Downer Sustainable Road Resource Centre Flooding Assessment (WMAWater, 2020a)
- Central Sydney Industrial Estate incorporating Downer Sustainable Road Resource Centre Review of Flooding Submissions (WMAWater, 2020b)

2 | Description of the Proposed Development

2.1 Site Overview

Lot 6 (the site) will be located in the eastern part of the proposed Industrial Estate, at 9 Devon Street, Rosehill (lot 100 in deposited plan 1168951) within Parramatta Local Government Area (LGA) (Figure 1 and 2). Lot 6 has an area of approximately 7 ha and it is zoned IN3 Heavy Industrial.

The site is in the Duck River catchment, and the river is adjacent to the southern site boundary. The site is west of the confluence of Duck River and Parramatta River, with the latter river located approximately 900 m north of the site.

2.1.1 Access

During construction and operations, Lot 6 will have a single driveway onto Devon Street (Figure 4). Access to Devon Street from James Ruse Drive (to the site's west) is via Grand Avenue and Colquhoun Street or Durham Street. Alternatively, Devon Street can be accessed from the south from Parramatta Road via Wentworth Street, Kay Street, Unwin Street and Colquhoun Street.

2.1.2 Topography and Drainage

The current topography of the site provides a relatively flat site for the former Clyde Refinery. Ground levels vary from approximately 2 m AHD to 5 m AHD. The south-western extent was historically raised by approximately 2 m above the surrounding landform. The land becomes flatter towards the downstream reach from Parramatta Road to its confluence with Parramatta River near Silverwater Bridge.

Construction of Lot 6 will involve initial earthworks that will redefine the topography of the site. This will include grading of the lot and the construction of lightly tiered pads. The pad in the northeast section of the lot will be at RL 4.2 m AHD and the southern section of the lot will be at RL 3.5 m AHD. Allowing for 0.3 m pavement over Lot 6, the finished flood level of the pad in the north will be at RL 4.5 m AHD and the southern pad will be at RL 3.8 m AHD (Element Environment, 2020a). The ground level where the proposed Lot 6 driveway connects to Devon Street will be 4.42 m AHD.

After the earthworks are completed, the site will drain to the south towards Duck River. The lowest area within the lot will be approximately 1 m AHD within the riparian zone adjacent to Duck River in the southwest corner of the site. It is proposed to build a stormwater bioretention basin in the southwestern part of the site, directly to the north of the riparian zone at RL 2.0 m AHD (Figure 3).

A drainage easement will extend 5 m into the lot along the eastern boundary of the lot. A pit and pipe stormwater drainage system will be constructed around the inside of the lot boundary and through the centre of the lot (Figure 3).

Central Sydney Industrial Estate incorporating the Sustainable Road Resource Centre
STATE SIGNIFICANT DEVELOPMENT - ENVIRONMENTAL IMPACT STATEMENT

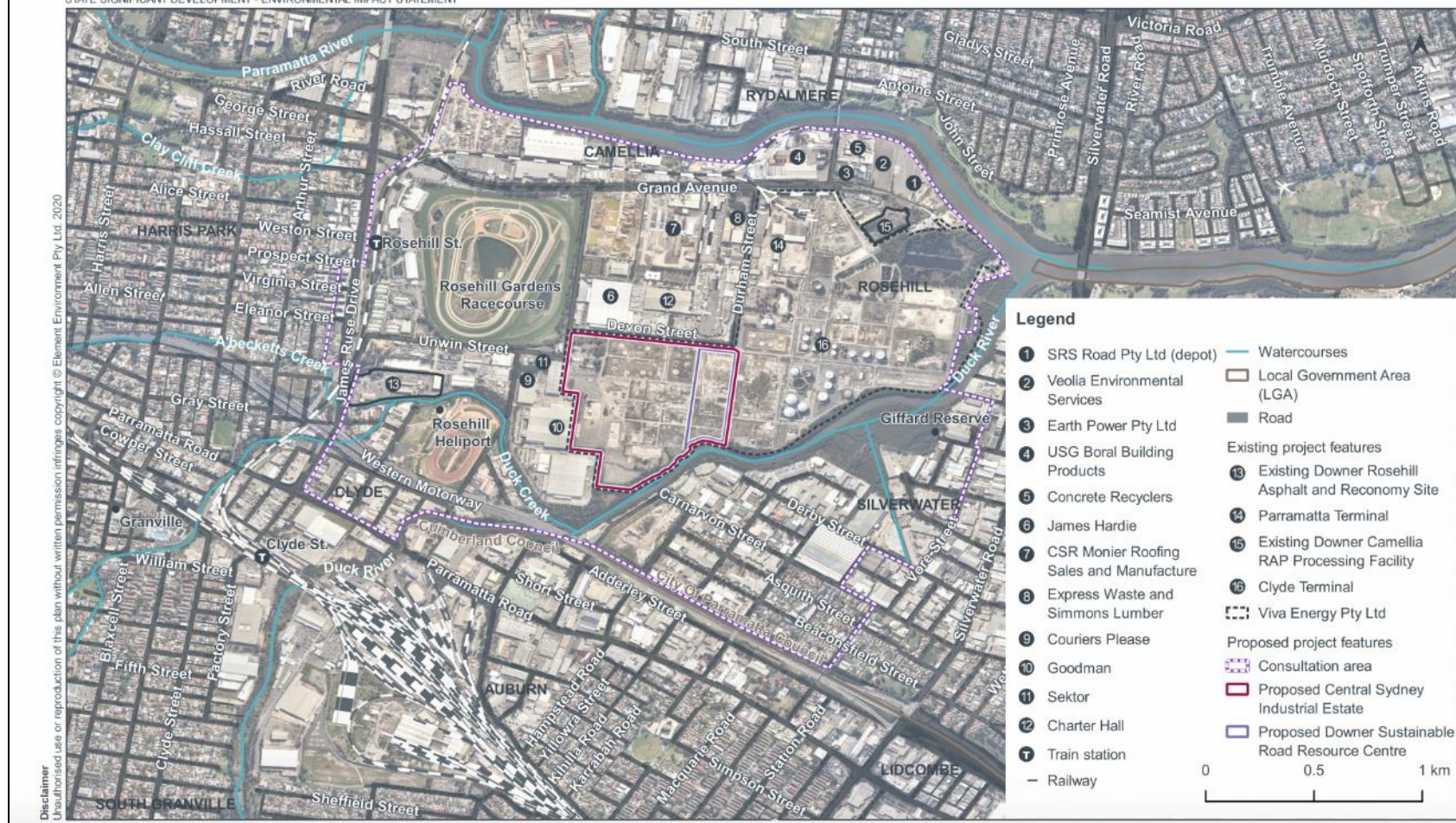


Figure 1. Local context of the site (from: Element Environment, 2020a).

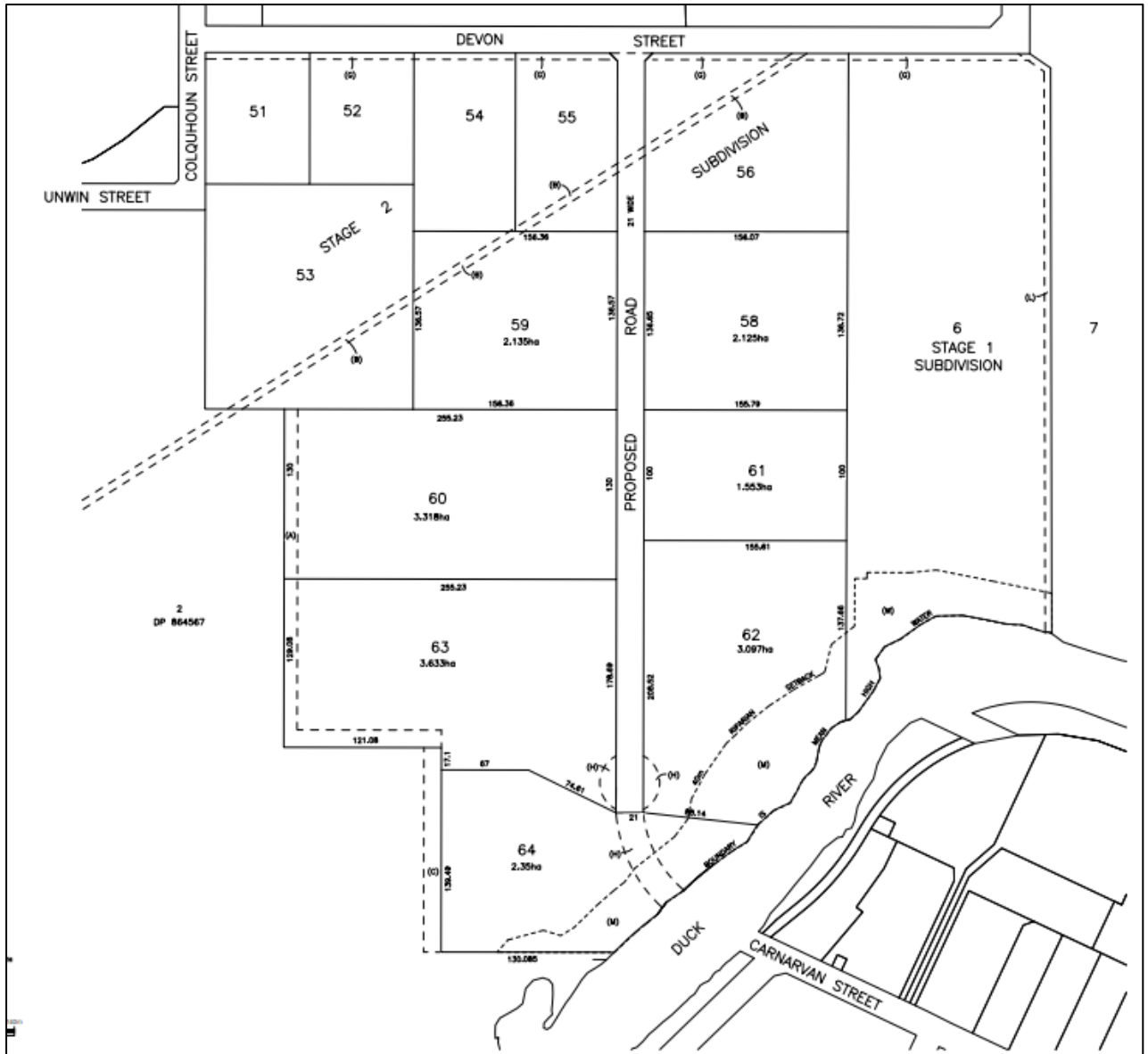


Figure 2. Location of Lot 6 (Stage 1) within the final proposed subdivision plan (from: Element Environment, 2020b).

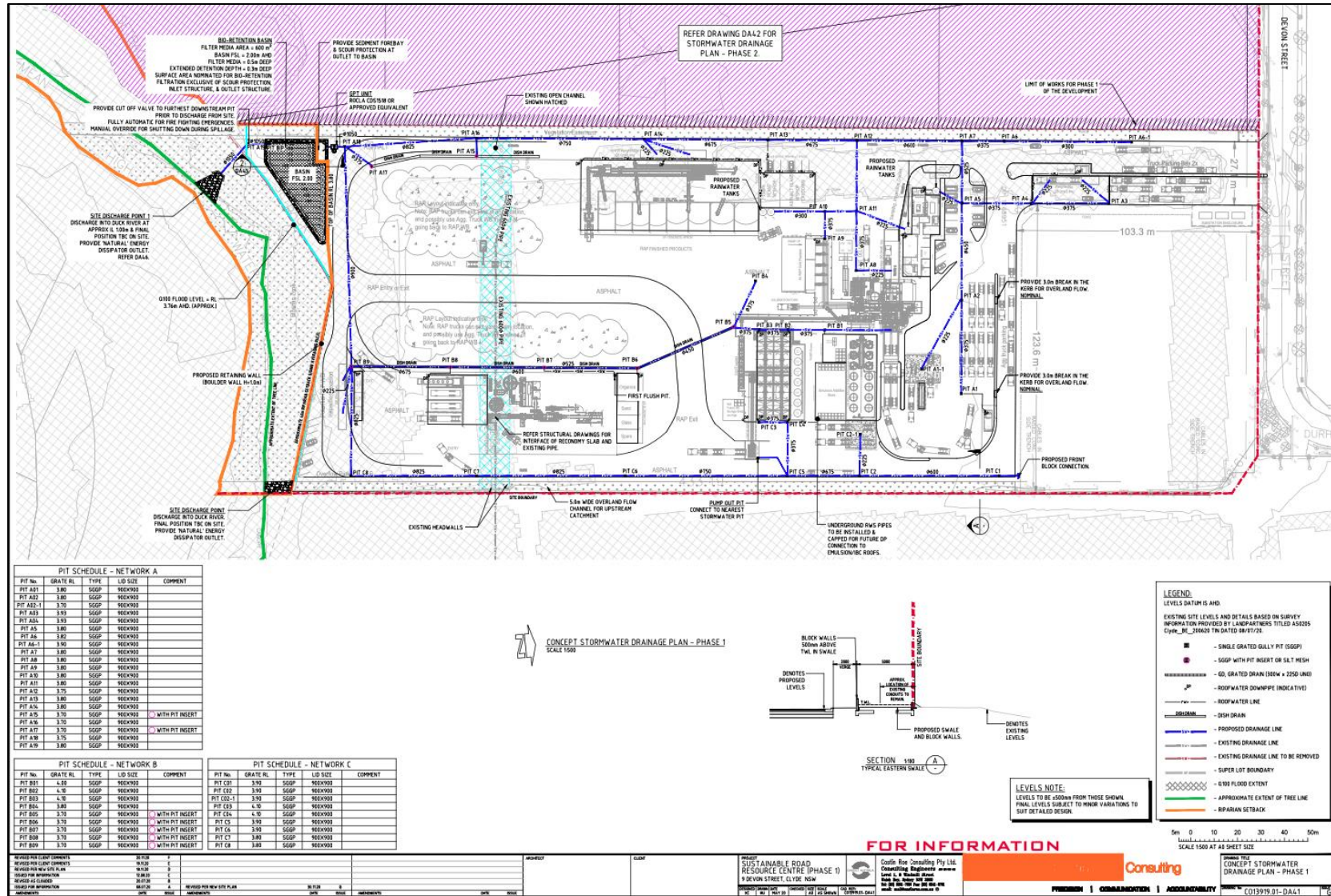


Figure 3. Surface water management plan (from: Element Environment, 2020b).

2.2 The Proposed Road Resource Centre

The Downer Sustainable Road Resource Centre will be located in Lot 6 (Figure 4). In the northeast corner of the lot, there will be an elevated pad to be used as a laydown area during construction. After construction, it will be repurposed, leased or sold and subject to a new future development application.

The finished development will include the following Facilities:

- **Asphalt plant:** Downer proposes to construct and operate a new fixed Ammann Universal HRT Stationary asphalt plant, which will produce up to 550,000 tonnes per annum (tpa) of asphalt. The maximum height of fixed equipment will be 41 m, and approximately two thirds of the outside of the asphalt plant will be clad.
- **Reclaimed asphalt pavement (RAP) facility:** Up to 250,000 tpa of RAP will be transported in tip trucks to the site and stored in dedicated RAP stockpile areas. The RAP will be granulated and screened for use in the production of asphalt or for pavement materials. The RAP plant will be located in a shed that will be enclosed on the north, west and south sides, and open on the east side for loading and removal of product. Up to 90,000 tpa of RAP will be stored on site at a time on a 10,000 m² stockpile area, with maximum 10 m high stockpiles.
- **Bitumen products plant:** A co-located emulsion plant is proposed to manufacture approximately 15,000 tpa of products.
- **Reconomy:** Downer proposes to construct and operate a new Reconomy facility on Lot 6. The Reconomy facility will provide a recycling option for the following wastes which are traditionally landfilled:
 - a. Street sweeper/stormwater pit waste.
 - b. Non-destructive digging mud.

Reconomy uses a customised material screening and processing plant and water treatment to recover materials which are used in the manufacture of asphalt and other road products. The facility will process up to 40,000 tpa of road sweepings, gully waste and mud from non-destructive excavation.

Central Sydney Industrial Estate incorporating the Sustainable Road Resource Centre
STATE SIGNIFICANT DEVELOPMENT - RESPONSE TO SUBMISSIONS

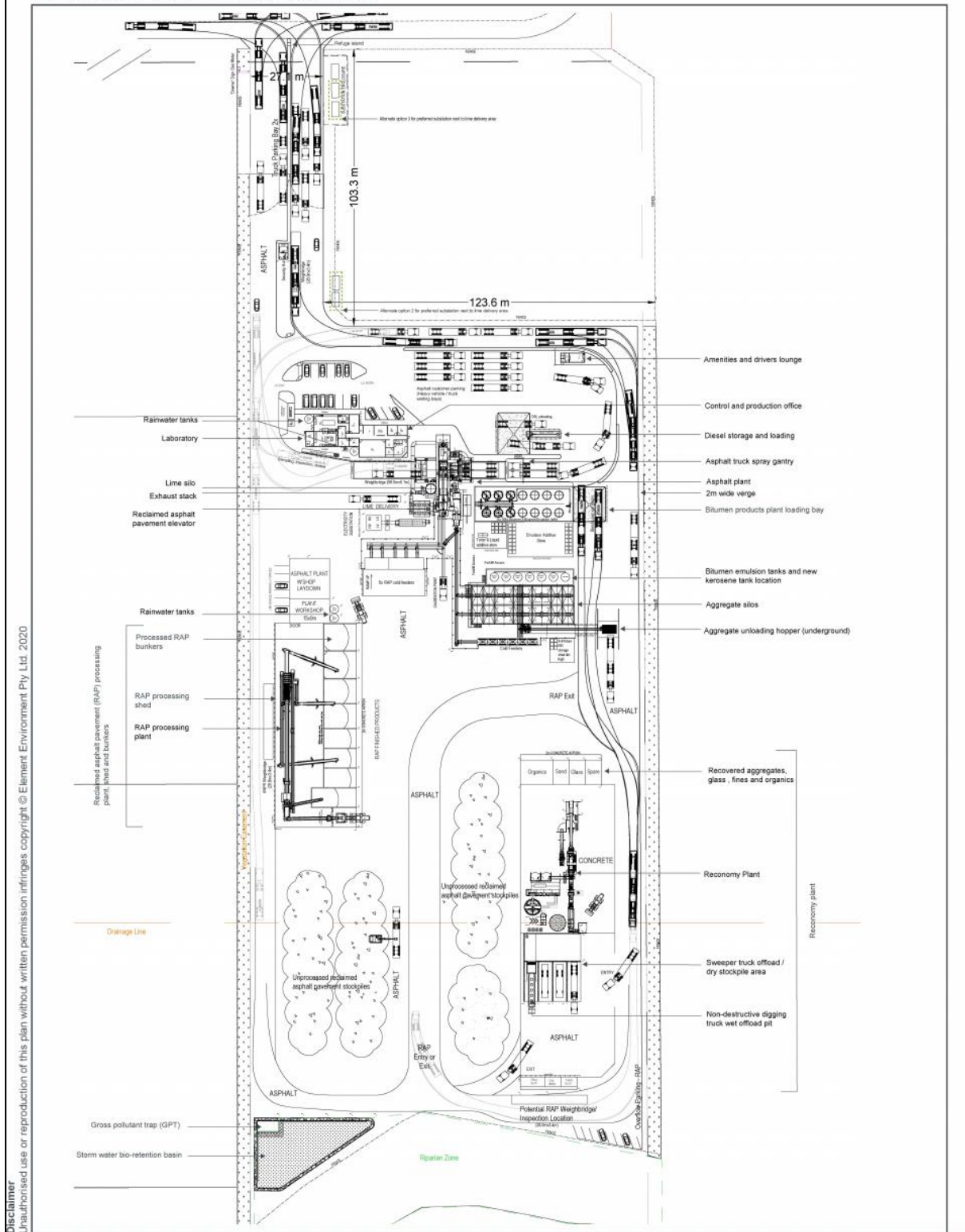


Figure 4. Layout of Lot 6 (from: Element Environment, 2020b).

2.3 The Construction Process

This FERP will only address the construction of Lot 6, which is the site for the Downer Sustainable Road Resource Centre. Lot 6 will be obtained as Stage 1 of the subdivision process, while Stages 2 and 3 will generate the other 14 lots.

The proposed start date of construction of Stage 1 is the beginning of February 2021, and it is proposed to conclude in December 2021 (11 months). The first stage of construction will take place in the first half of 2021 and will include civil works to prepare Lot 6 for construction of the Downer Sustainable Road Resource Centre. The construction of the road resource centre's components will take place in the second half of 2021 and will occur simultaneously to the civil works on the remaining lots.

2.3.1 Civil Works for Lot 6

The civil works for Lot 6, as well as for the remaining lots, are:

- **Site establishment:** Installation of site office, generator and amenities.
- **Earthworks:** Earthworks will be required after the lots are prepared to compact and stabilise the ground surface and prepare pads for the proposed structures.
- **Drainage:** Stormwater management structures will be constructed.
- **Services:** Water, sewer, electrical, gas and telecommunications services will be installed.
- **Footings and slabs:** After the ground surface is prepared, footings will be excavated/piled and filled with concrete in areas where structures will require stabilisation, and concrete building pads will be poured.
- **Paving:** Pavement areas of Lot 6 requiring extra stabilisation and strengthening (e.g. heavily trafficked areas) will be paved with concrete and remaining areas will be paved with asphalt.
- **Barriers:** Aluminium, concrete and/or water filled plastic barriers will be installed in areas where traffic must be separated from pedestrian areas and/or to prevent vehicles crossing lanes/protect structures.
- **Line marking and signage:** Lines will be marked on internal roads and speed limit and other signs will be erected.

2.3.2 Construction of Lot 6 Facilities

The components of the Downer Sustainable Road Resource Centre will be constructed simultaneously, and some activities will overlap with the civil works. Construction will comprise:

- **Asphalt plant:** Construction of the asphalt plant including construction of concrete foundations then pre-fabrication of some components on the ground and lifting into place, and fabrication of other components in-place (approximately 22 weeks).
- **Reclaimed asphalt pavement (RAP) facility:** Construction of the RAP facility including construction of foundation of the main building, installation of stormwater and drainage structures, construction of foundations for specific plant items, pouring and tilt-up of concrete bunker walls, construction of shed frame, receipt and installation of plant, installation of wall and roof cladding and stormwater connection (approximately 19 weeks).
- **Reconomy facility:** Construction of the Reconomy facility including construction of foundations for specific plant items and receipt and installation of plant (approximately 18 weeks).

- **Bitumen products plant:** Construction of the bitumen products plant including construction of foundation of the main building; installation of stormwater and drainage structures; construction of foundations for specific plant items; construction of shed frame; receipt and installation of plant, tanks and silos; installation of wall; and roof cladding and stormwater connection (approximately 9 months).

2.3.3 Working Hours and People on Site

Stage 1 construction works will generally occur between 7am and 6pm Monday to Friday, and between 8am and 1pm on Saturday, although some construction will be required outside of these hours. Construction will take place at night-time and on Sundays when required. Construction on public holidays will be avoided.

There will be a maximum of 85 personnel on site at any one time during the construction of the Downer Sustainable Road Resource Centre, with a maximum of 53 light and 75 heavy vehicles per day.

3 | Flood Risks

3.1 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, it may occur when well-developed cloud bands extend across the interior from the oceans north and northwest of Australia.

Rainfall patterns are also dependent on longer term weather patterns. Flooding is more prevalent in a La Nina year when rainfall is significantly greater than the mean average rainfall. Thunderstorms, which generally occur during the summer, can also result in localised flooding which could impact specifically on the site.

In summary, there are many different weather events which could cause flooding on the site.

3.2 Flood Probabilities

Flood probability can be expressed in more than one way. For example, a flood may be described as having a 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 Annual Exceedance Probability (AEP). A 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. A flood with a 1% AEP 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. There were four floods of about this size on the Georges River between 1860 and 1889 but there has not been another since. This underlines the randomness of flood frequency.

Bigger floods can and do occur. There were several floods with greater than a 1% AEP experienced in Eastern Australia in early 2011. Some reached levels which have a 1 in 2,000 (0.05%) AEP. A flood with a 1 in 500 (0.2%) AEP 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 (1 in 10,000 or less), events approaching a PMF have been recorded.

Flooding may occur at any time of year and at any time of day.

3.3 Flooding of the Site

The site can be affected or isolated by three types of flooding:

- Mainstream flooding from the Duck River
- Mainstream flooding from the Parramatta River
- Overland local flooding due to intense rainfall

The above flooding mechanisms can occur independently or concurrently. When occurring concurrently, in most cases they will reach their peak at different times. It is however not uncommon to have overland flooding caused by intense rain just before floodwaters rise from the river.

3.3.1 Available Flood Model Results

Downer supplied the hydraulic model results for the Duck River mainstream flooding, and local overland flooding. In both cases, the model was run under existing conditions (i.e. with no proposed development in place) and design conditions (i.e. with the proposed development in place). The existing conditions models are not relevant to this report and will not be further discussed. Further details about the flood model results used to inform the emergency plan are provided below:

- **Duck River mainstream model:** This is the TUFLOW hydraulic model produced as a part of the Duck River and Duck Creek Flood Study (WMAWater, 2012). The critical storm duration adopted was the 2-hour event for the flood study. WMAWater (2020a) re-ran the mainstream model incorporating the design conditions accounting for all landworks. For the 1% AEP event and the PMF, the model assumed a concomitant steady 1% AEP event and a PMF in the Parramatta River. As such, the model shows the site being already flooded at the first model timestep, before any contributions from the Duck River. This is considered to be a very conservative scenario as it assumes two concomitant low probability events, in two distinct catchments. While it is likely that the Parramatta River will be flooding to some extent during a PMF from the Duck River, it is extremely unlikely that two PMFs would occur at the same time.
- **Overland flow model:** An overland flow model was produced by WMAWater (2020a) as a part of the flooding assessment included in the site's EIS (Element Environment, 2020a). This is a TUFLOW "Direct Rainfall" or "Rainfall on the Grid" one / two-dimensional hydraulic model. Design conditions that account for the proposed landworks were incorporated into the model. Several storm durations were run from 25 to 360 minutes, and the 120-minute event was adopted as the critical storm duration. All models were run with an assumption of 100% blockage as this is Council's preference for overland flood risk assessments. Importantly, the overland model assumed that all the depressions in the terrain were already filled with water before the beginning of the rainfall. For this reason, this model cannot predict at what point in time the low points along the access roads would cut. However, the rate of rise is such that it can be expected that, in the worst case scenario, all low points along the access roads would cut within minutes from the beginning of the rainfall event.

No flood models for flooding from the Parramatta River alone were provided. However, because the Duck River flood model assumes a steady PMF level from the Parramatta River, we were able to extract the peak depth and hazard for a PMF from the Parramatta River only, without contributions from the Duck River, by exporting the Duck River model at its first time step.

Figures 5 to 12 show the peak depth and hydraulic hazard for the 1% AEP event and PMF of the Duck River (with concomitant steady flooding of the Parramatta River), and overland flooding.

Figure 13 and 14 show the peak depth and hazard of a PMF from the Parramatta River only.

3.3.2 Flood Levels and Depths

Table 2 shows the peak flood levels and depths within Lot 6. The available flood model results do not allow extracting peak depth and levels should the Duck River flood without contributions from the Parramatta River, or with a smaller flood event in the Parramatta River.

Table 2. Peak flood depths and levels in Lot 6.

Flood Type	Flood Event	Peak Depth (m)	Peak Level (m AHD)
Overland	1% AEP	0.72	3.93
	PMF	0.86	4.63
Mainstream (concurrent peak in Duck River and Parramatta River)	1% AEP	1.25	3.77
	PMF	4.09	6.13
Mainstream (Parramatta River only)	PMF	3.55	5.52
	1% AEP	NA	NA

3.3.3 Frequency of Flooding

(a) Mainstream Flooding

With regard to mainstream flooding, in the 1% AEP event the site is generally flood free and experiences minor affectation only at its southern boundary. This is assuming that a 1% AEP flood would peak at the same time in the Duck River and Parramatta River. Access to the site would be flood-free in this event, provided that there were no concurrent overland flooding.

In case the Duck River and the Parramatta River reached the peak of the PMF event at the same time, which is an extremely unlikely scenario, the site would be isolated and severely flooded.

The NSWSES have confirmed that the intersection between Hassall Street and James Ruse Drive, which is along one of the two access routes to the site, is cut by mainstream flooding from the Parramatta River in the 20% AEP event.

The second access route, south of the site along Unwin Street, Kay Street and Wentworth Street, crosses A'Becketts Creek and Duck Creek and the NSWSES has confirmed that this route would also be cut in the 20% AEP event of the Parramatta River.

(b) Overland Flooding

In the 1% AEP event, under the assumption of full blockage of the stormwater system, the site would experience some shallow flooding and its access roads would be cut at several locations.

In the PMF, the site would be isolated and would experience more extensive flooding.



The model does not allow extracting how often local flooding would cut access to the site, because in all events all the topographic low points were artefactually filled with water before the beginning of the rainfall. However, given the small size of the overland catchment and the frequency of flooding in the last few years, it is reasonable to expect that the site may become isolated by local flooding relatively often.

3.3.4 Flood Hazard

Hydraulic hazard is a function of flood depth and velocity and represents the threats posed by floodwaters to life and property. The Australian Rainfall and Runoff Manual classifies hydraulic hazard in six categories based on the type of impacts that floodwaters may be able to cause. These are shown in Figure 15. The available flood model results indicate that the peak hydraulic hazard on site would be as follows:

- Mainstream flooding (concurrent flood from Duck River and Parramatta River)
 - PMF: H3 to H5
 - 1% AEP Flood: H3 to H4 (only in the southern part of the site)
- Overland flooding
 - PMF: H3 to H4
 - 1% AEP Flood: H1 to H2

For reference, a PMF in the Parramatta River alone would cause a peak hazard at the site of H3 to H4.

The available flood model results do not allow extracting peak hazard should the Duck River flood without contributions from the Parramatta River, or with a smaller flood event in the Parramatta River.

Maps of the peak hydraulic hazard in each event are shown in Figure 6 (mainstream 1% AEP event), Figure 8 (mainstream PMF), Figure 10 (overland 1% AEP event), and Figure 12 (overland PMF).

3.3.5 Flood Duration and Rate of Rise

The available flood models were used to extract hydrographs of level and hydraulic hazard at low points in Devon Street, James Ruse Drive and Grand Avenue, in the mainstream and overland PMF events. These are shown in Figure 16 to Figure 19. The peak rate of rise is about 300 mm/hour in the mainstream PMF and up to 600 mm/hour in the overland flooding event. The peak of the PMF is reached within 2.5 hours from beginning of the rainfall for the mainstream PMF, and within 30 minutes for overland flooding.

Vehicular traffic is considered blocked when hydraulic hazard exceeds a value of 1. In a PMF of overland flooding this would happen within minutes from the beginning of the rainfall.

The hydrographs show that in a mainstream PMF, the site would remain isolated for about 6 to 8 hours.

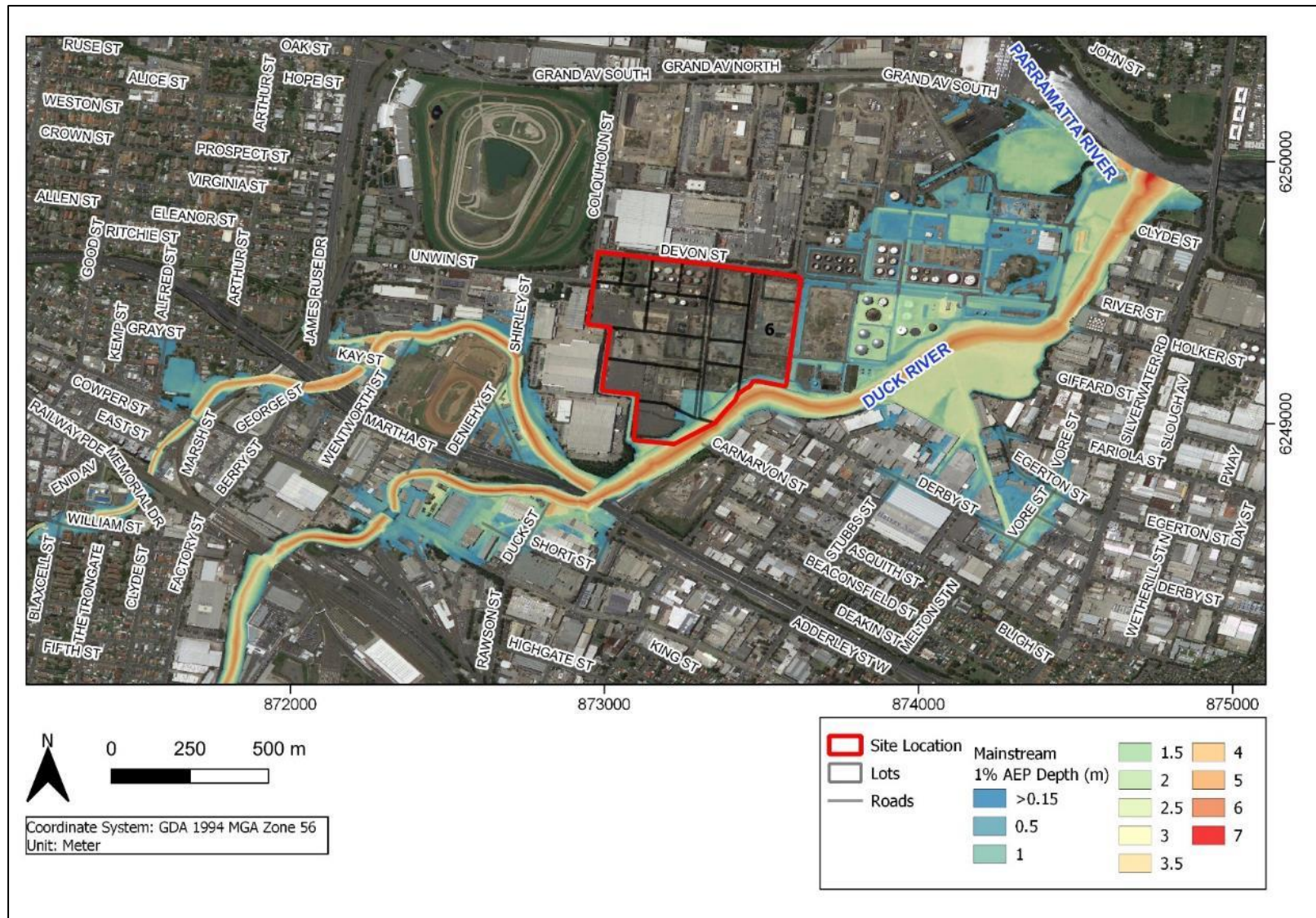


Figure 5. Peak flood depth for the 1% AEP flood on the Duck River (with concomitant steady flooding of the Parramatta River).

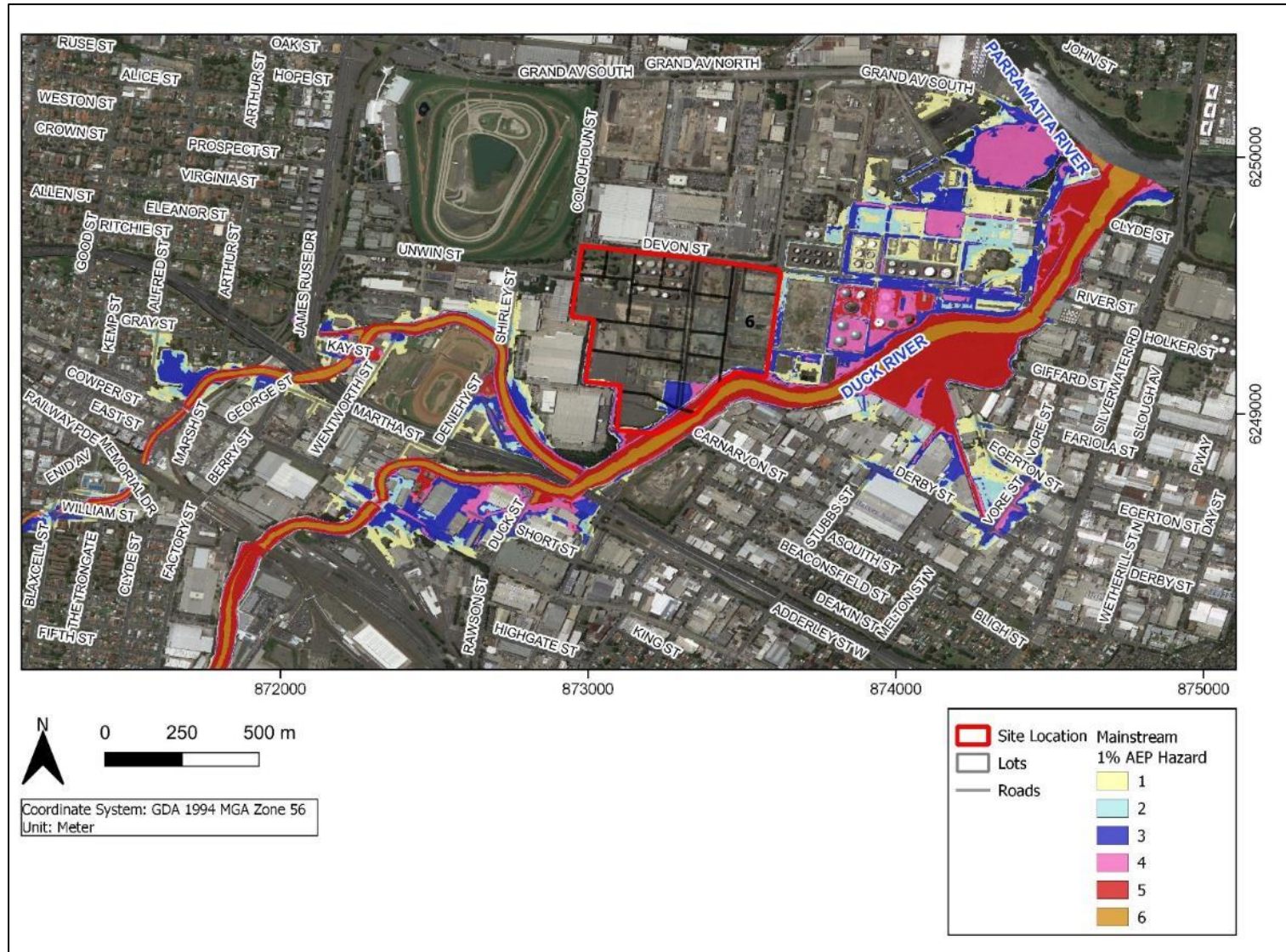


Figure 6. Peak hydraulic hazard for the 1% AEP flood on the Duck River (with concomitant steady flooding of the Parramatta River; no trim of model).

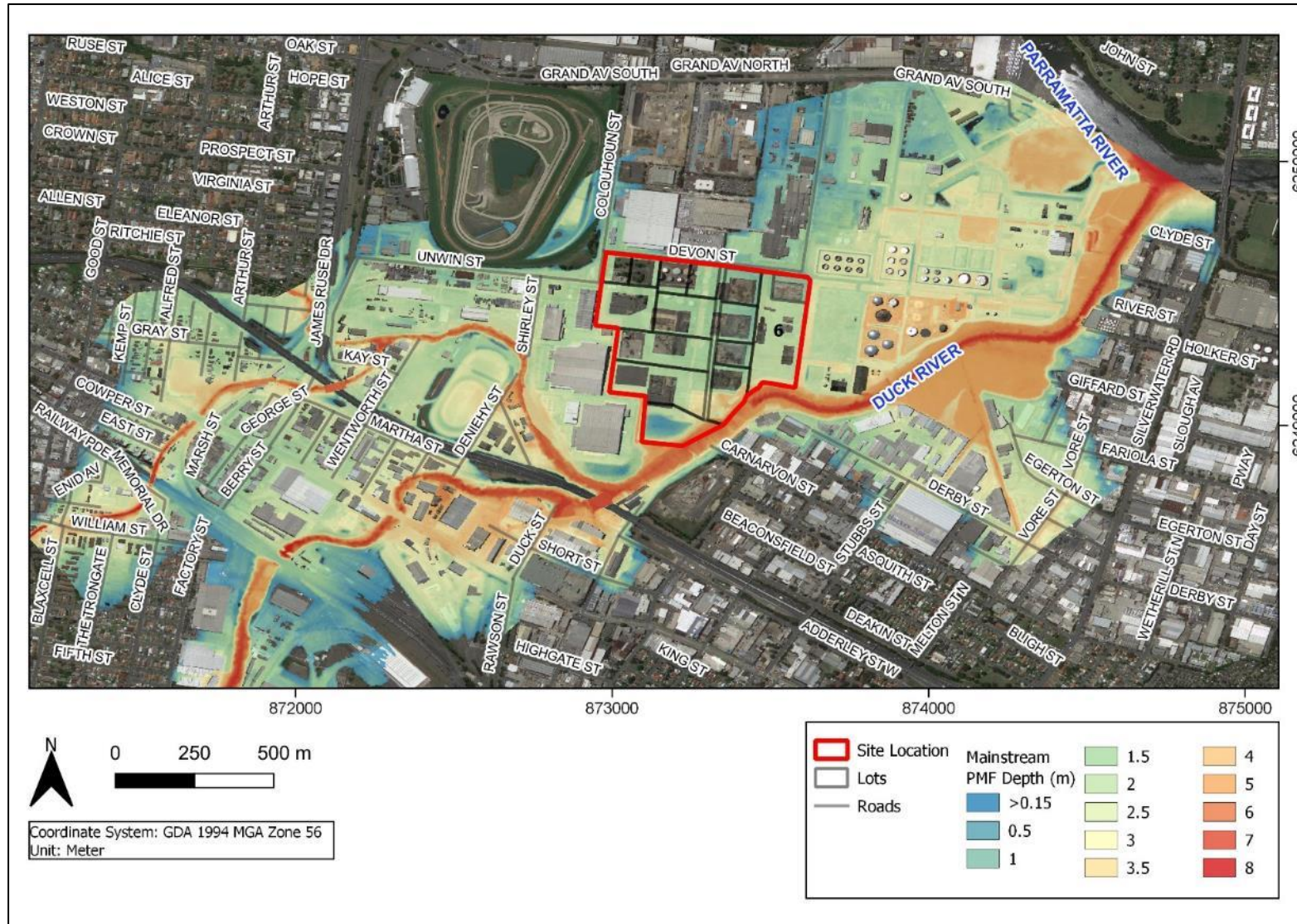


Figure 7. Peak flood depth for the PMF on the Duck River (with concomitant steady flooding of the Parramatta River).

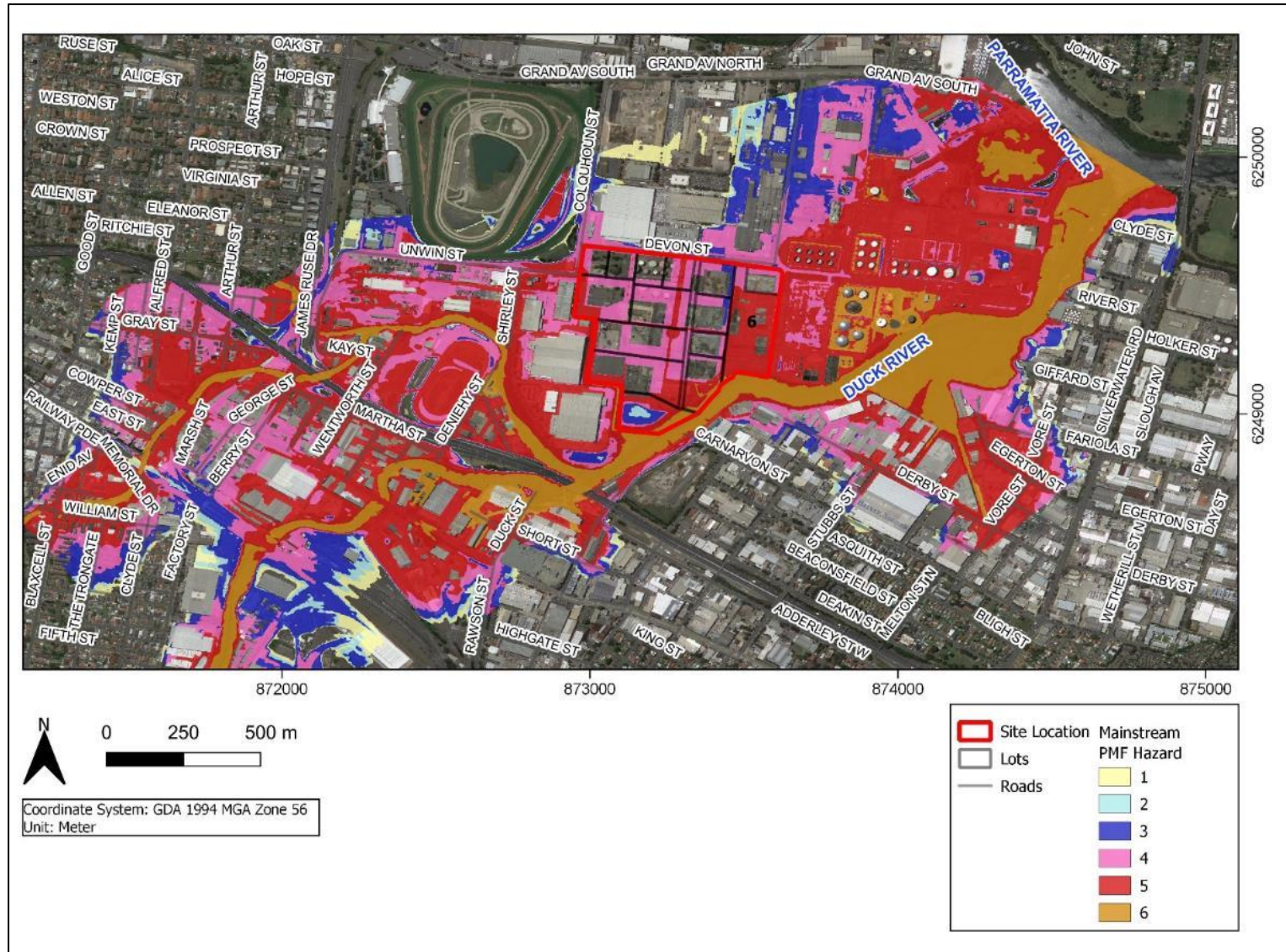


Figure 8. Peak hydraulic hazard for the PMF on the Duck River (with concomitant steady flooding of the Parramatta River; no trim of model).

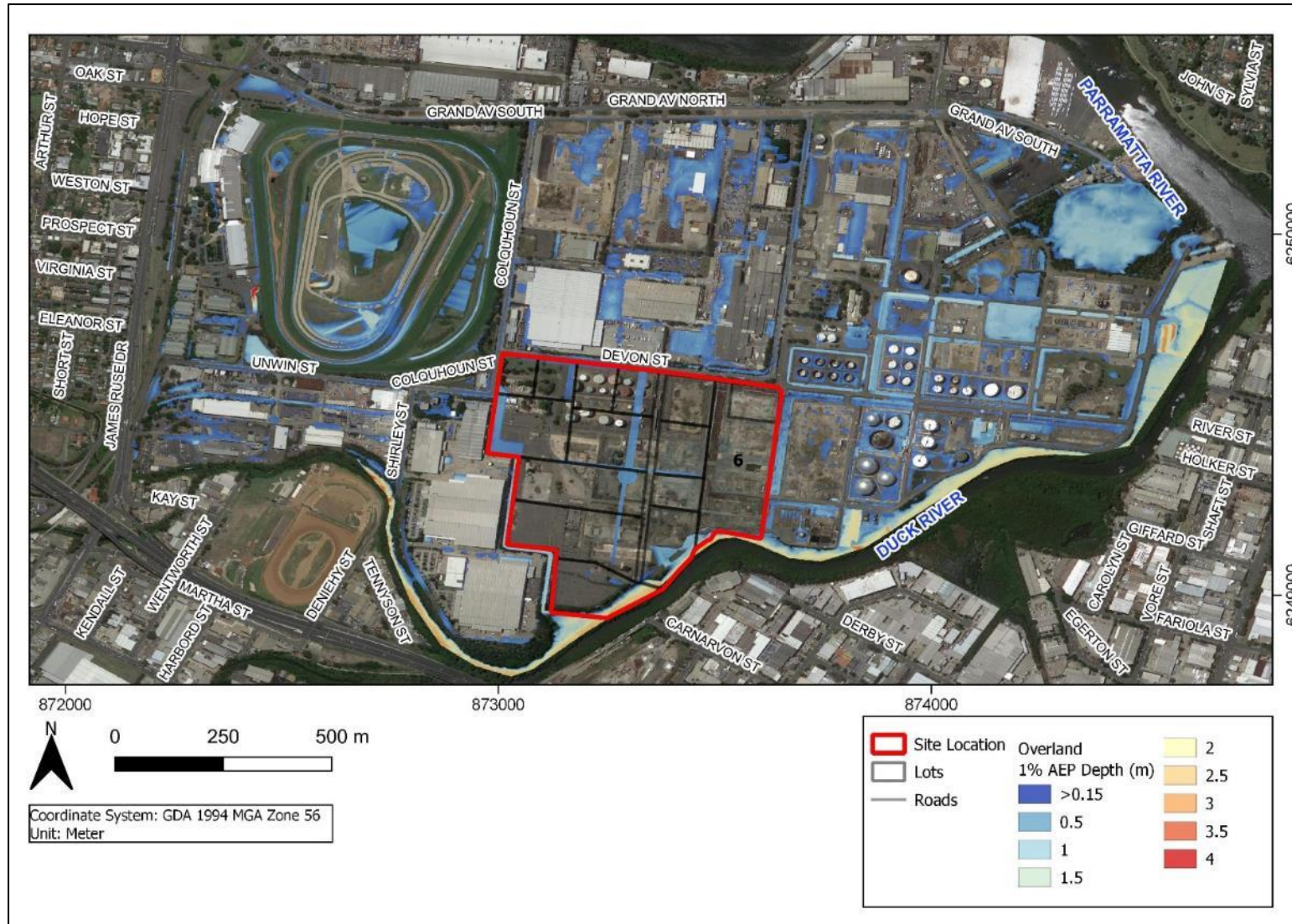


Figure 9. Peak flood depth for the 1% AEP overland flood.

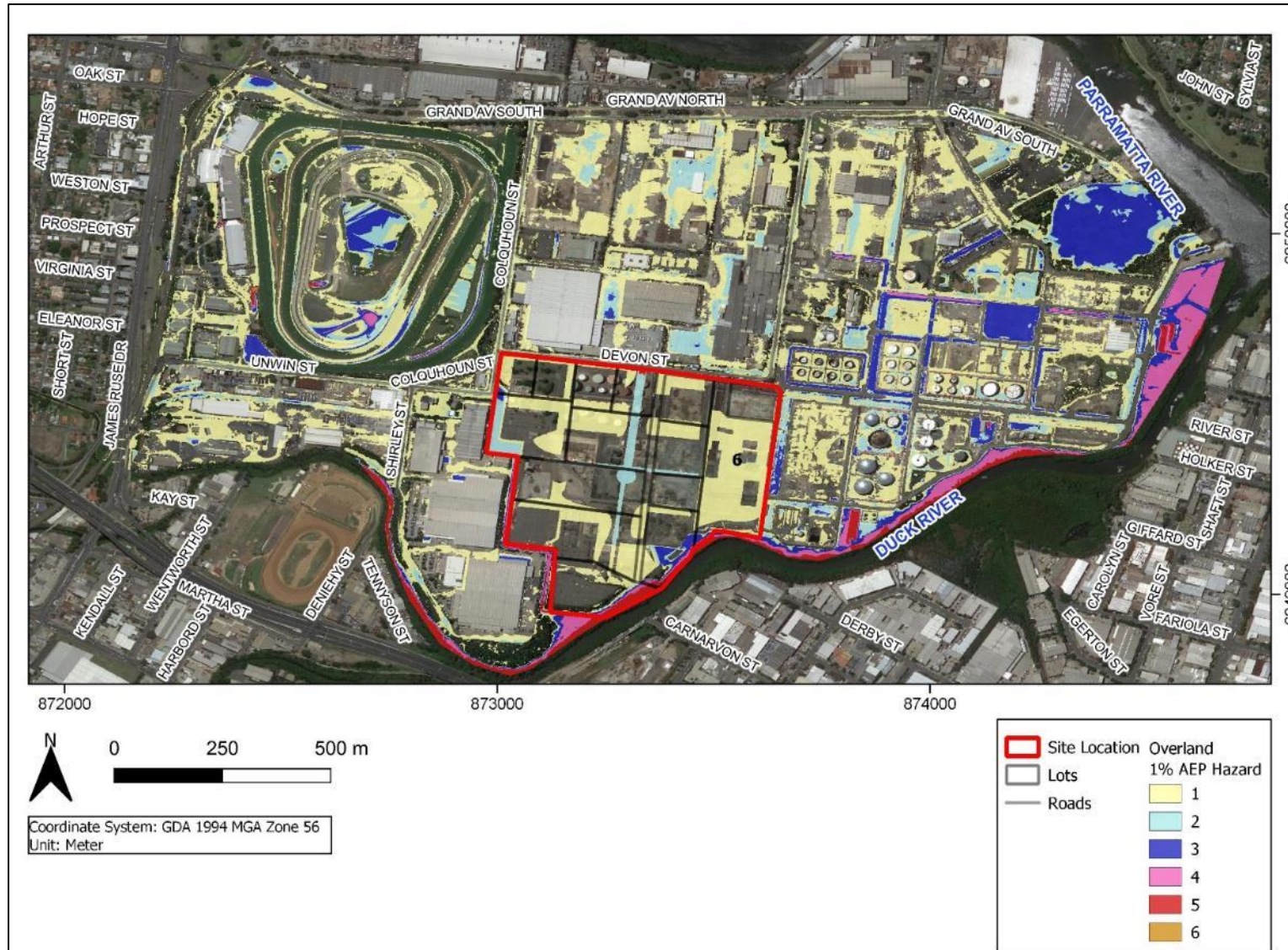


Figure 10. Peak hydraulic hazard for the 1% AEP overland flood (<5 cm trimmed out).

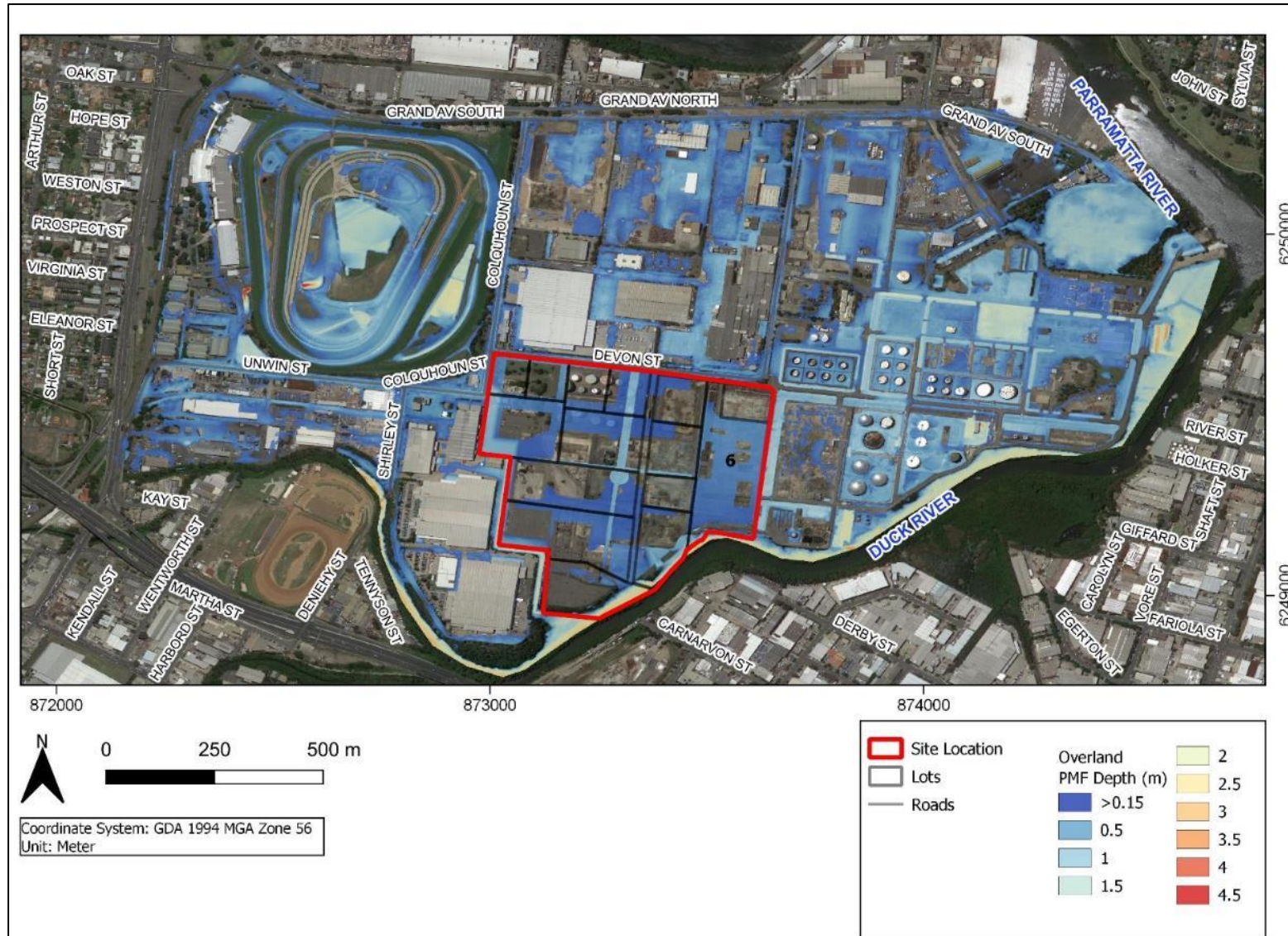


Figure 11. Peak flood depth for the overland PMF.

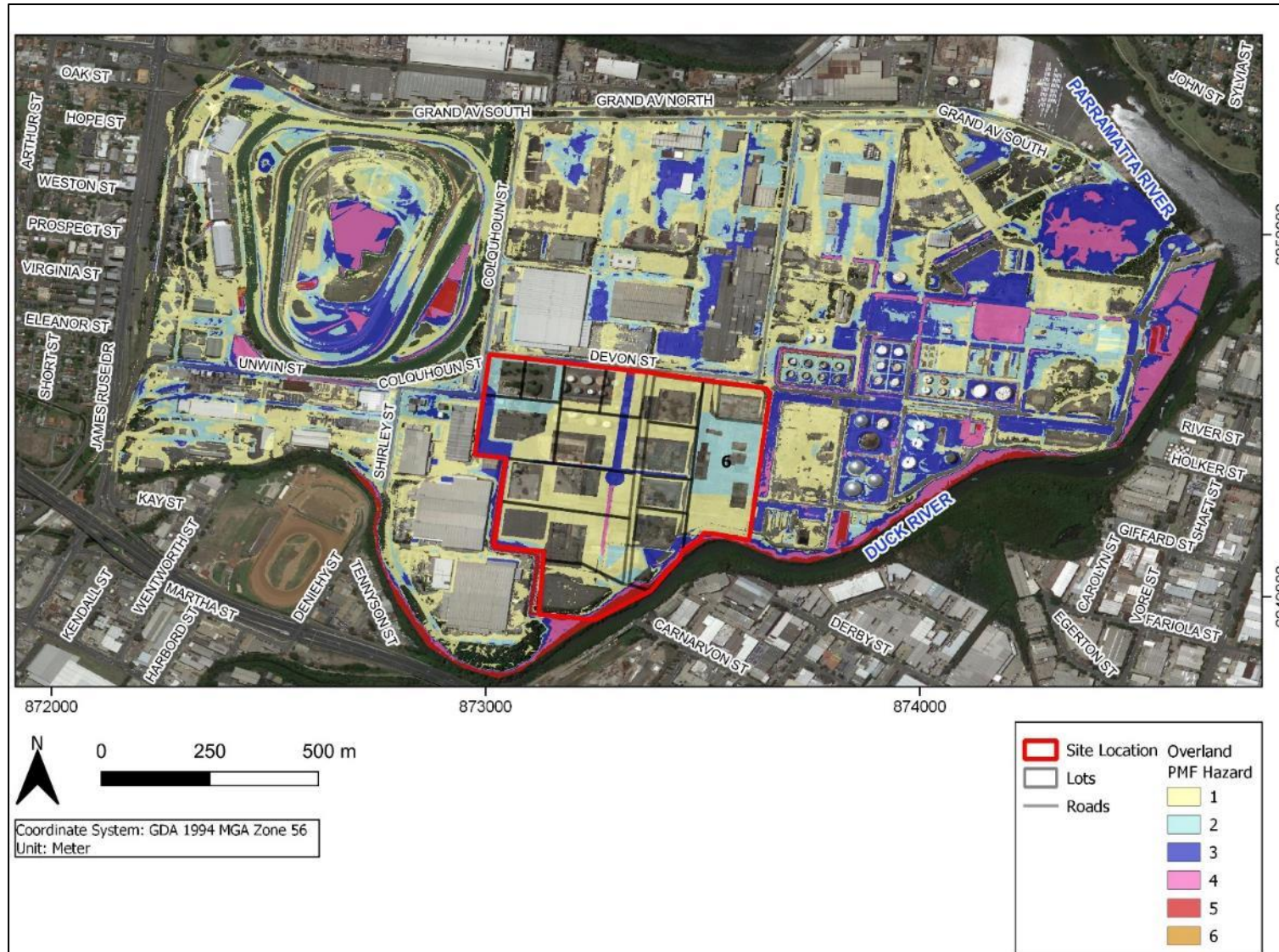


Figure 12. Peak hydraulic hazard for the overland PMF (<5 cm trimmed out).

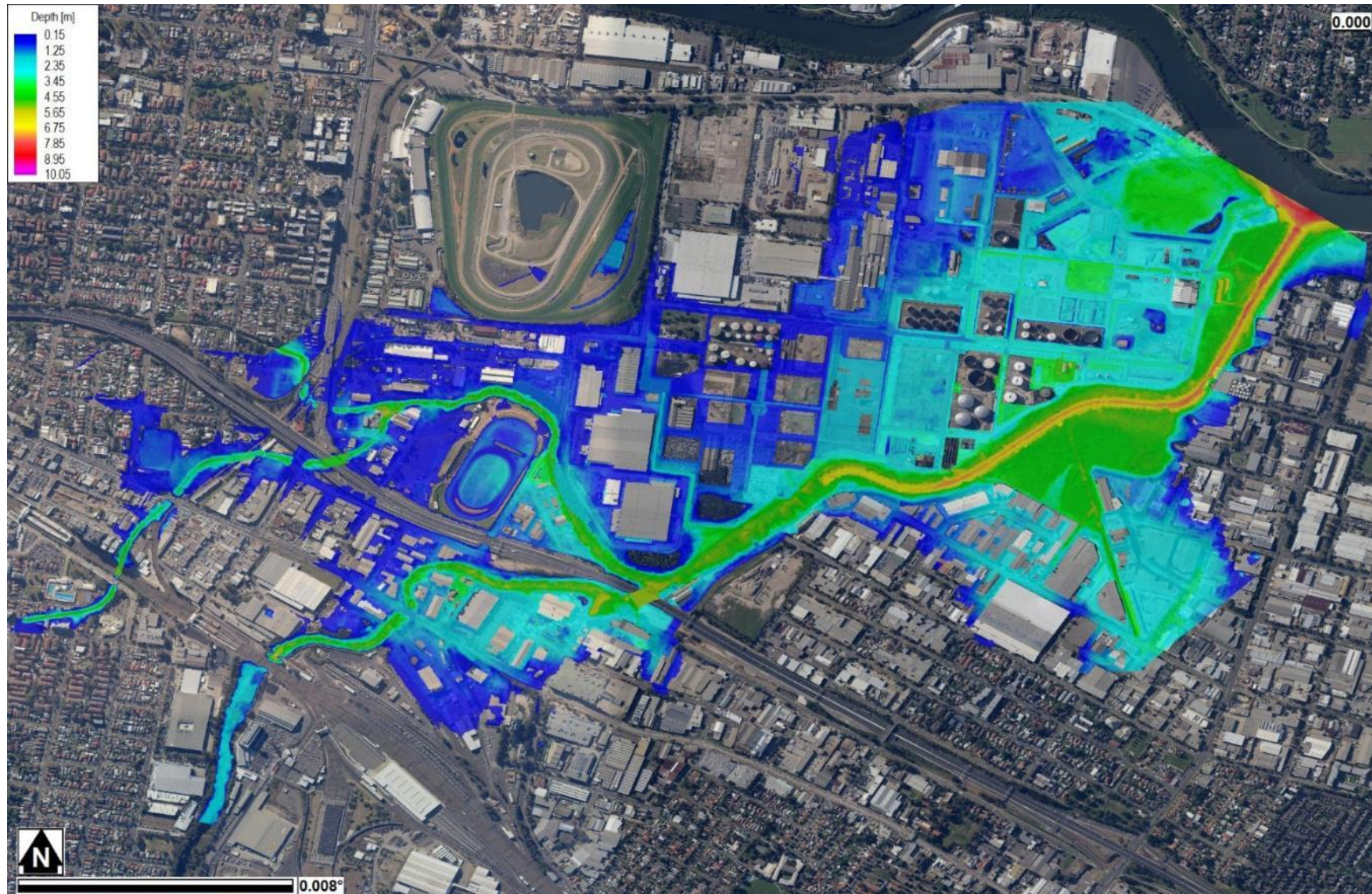


Figure 13. Parramatta River peak PMF depth.

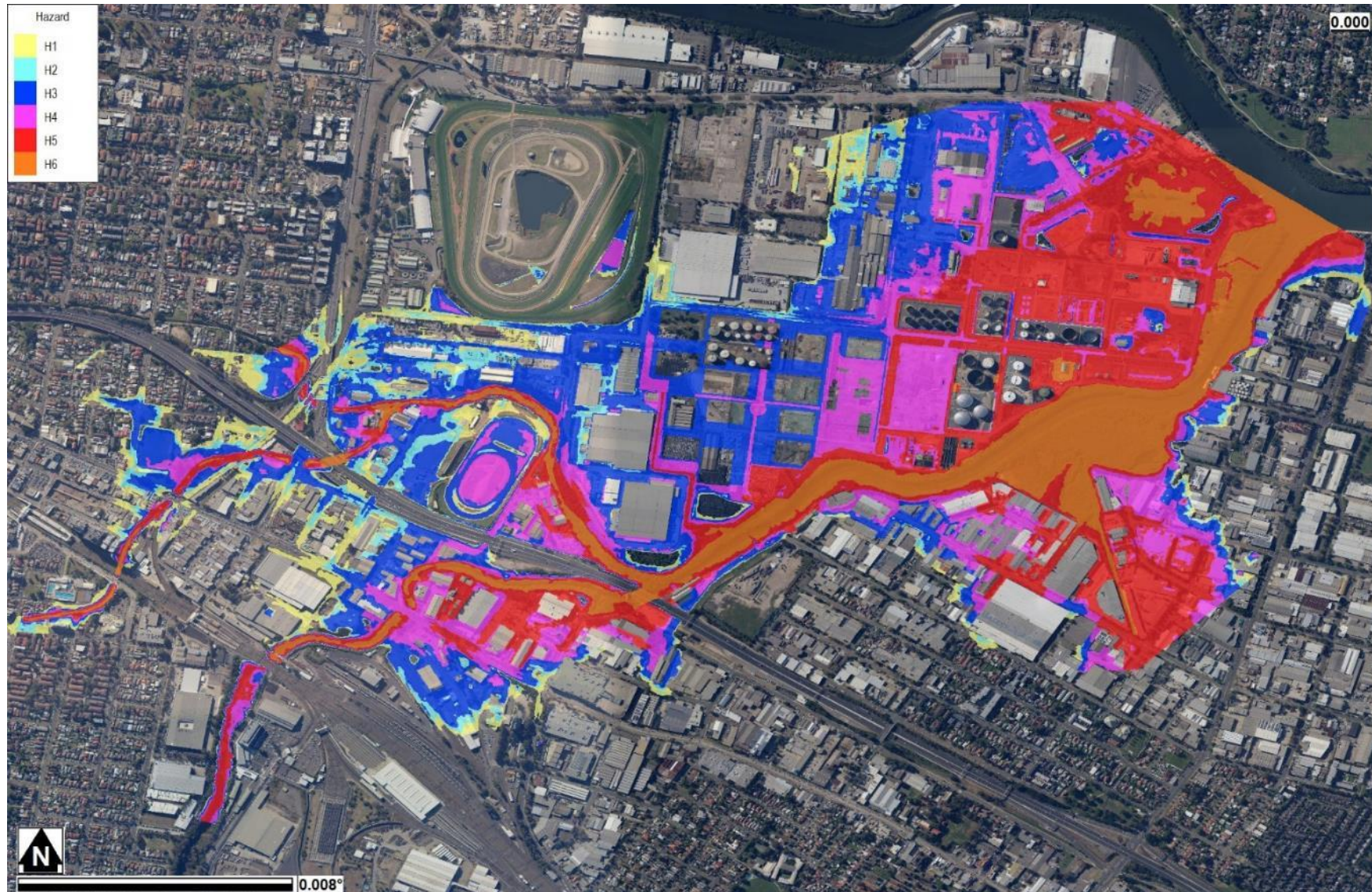


Figure 14. Parramatta River peak PMF hazard.

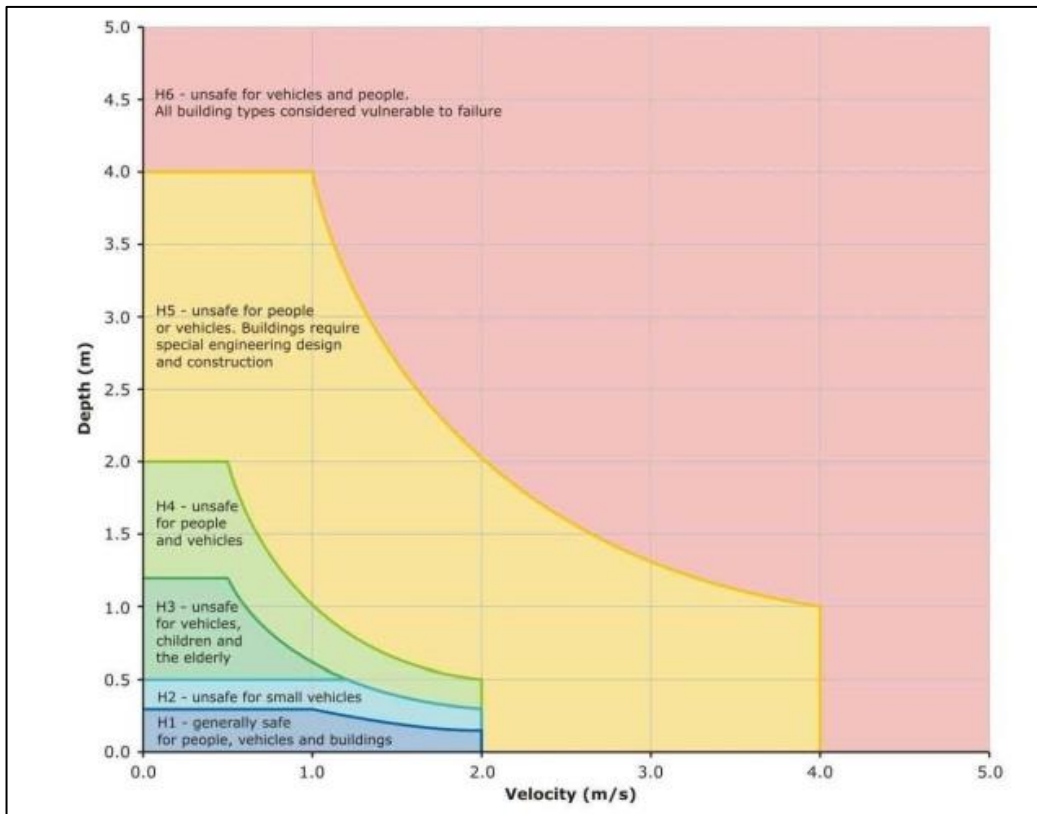


Figure 15. Flood hazard vulnerability curves (source: Smith et al., 2015).

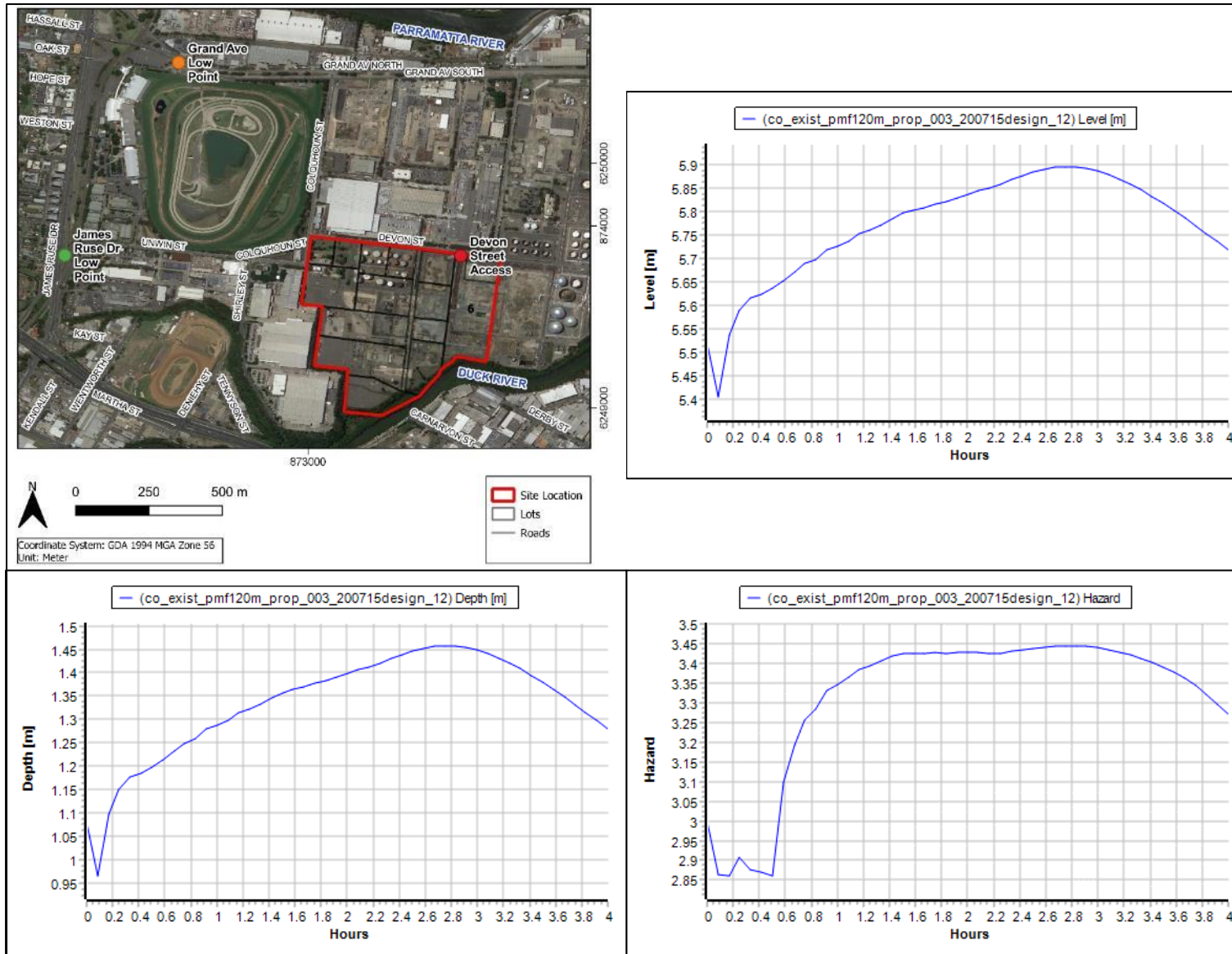


Figure 16. Mainstream PMF Hydrographs at Devon Street.

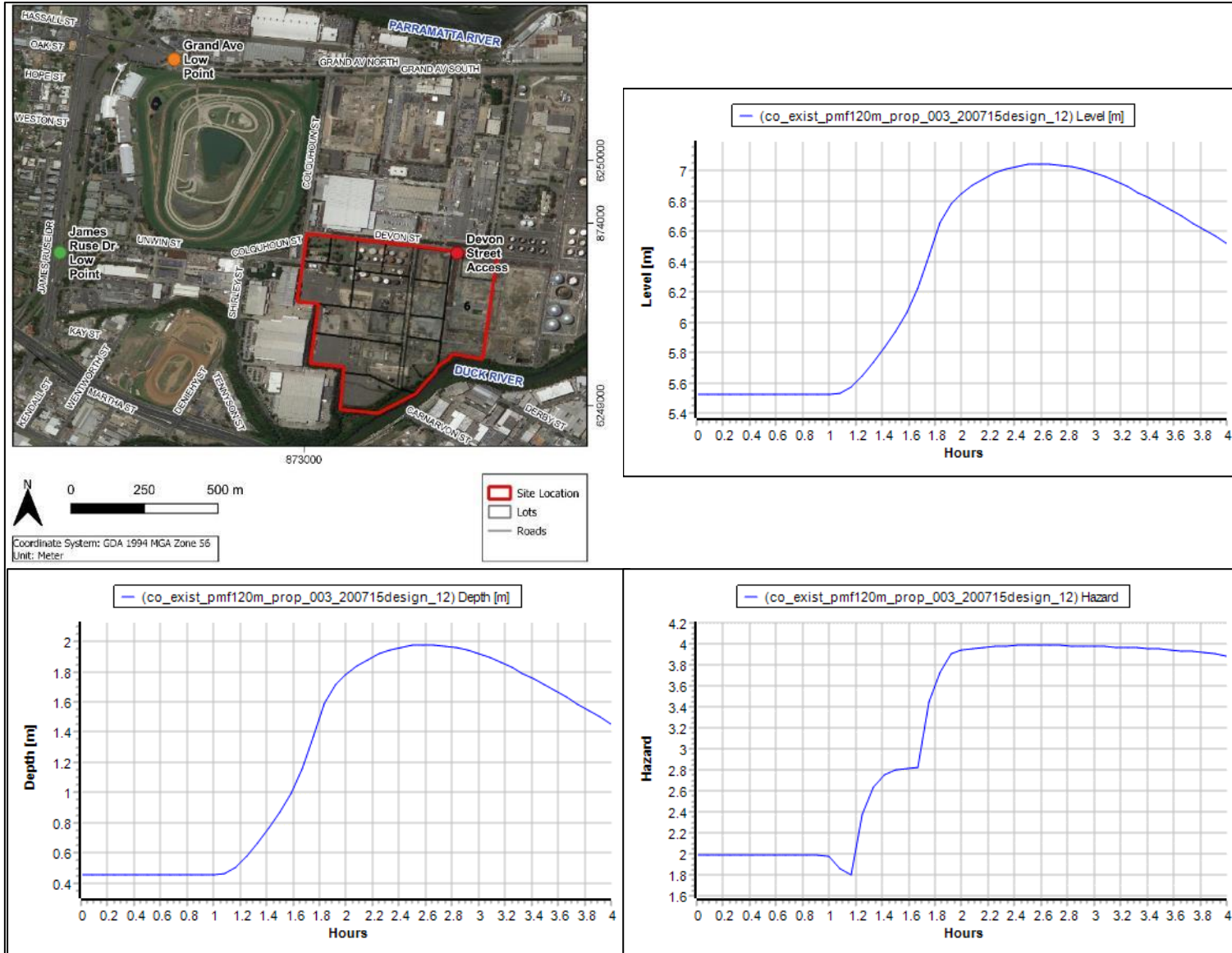


Figure 17. Mainstream PMF Hydrographs at James Ruse Drive Low Point.

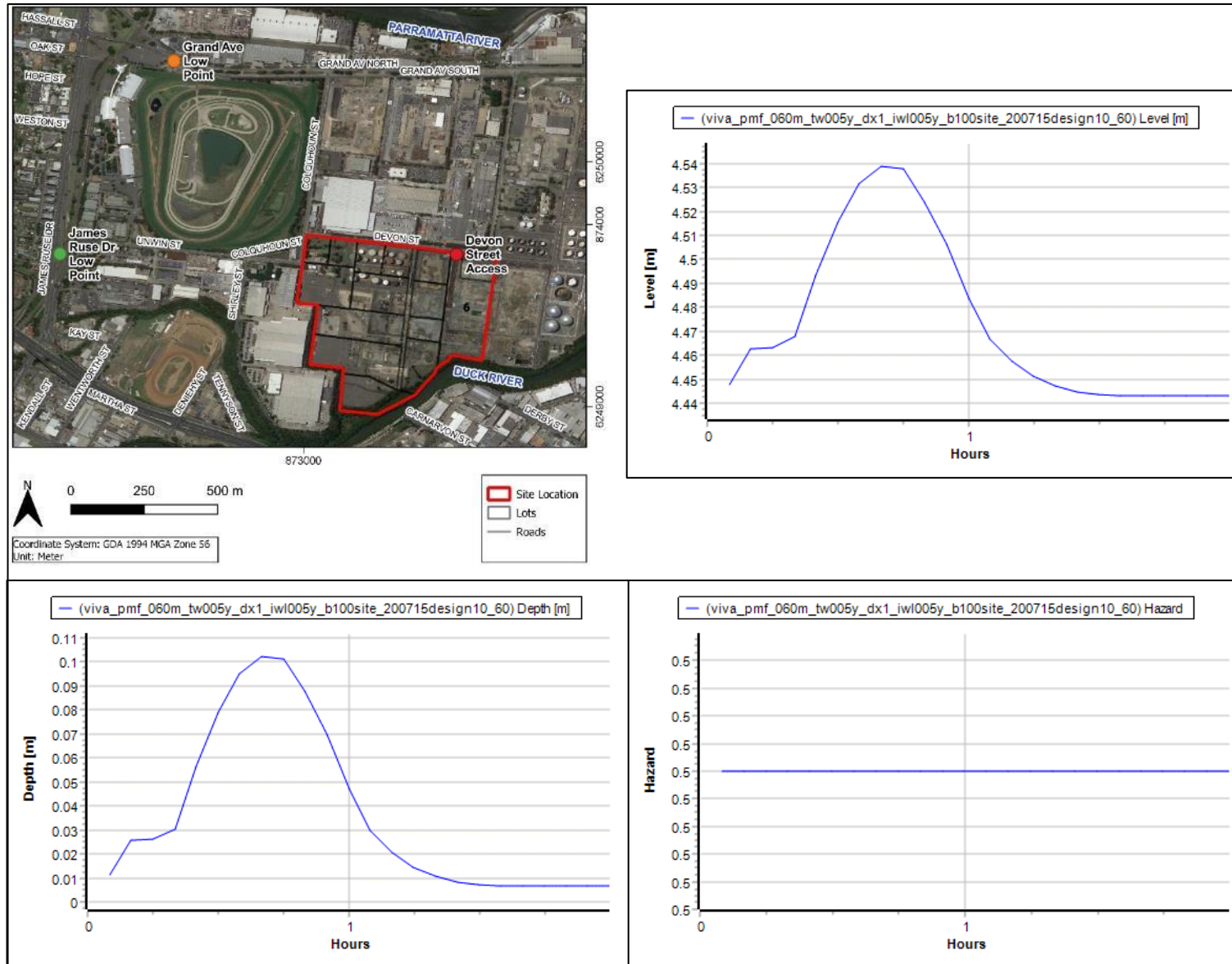


Figure 18. Overland PMF Hydrographs at Devon Street.

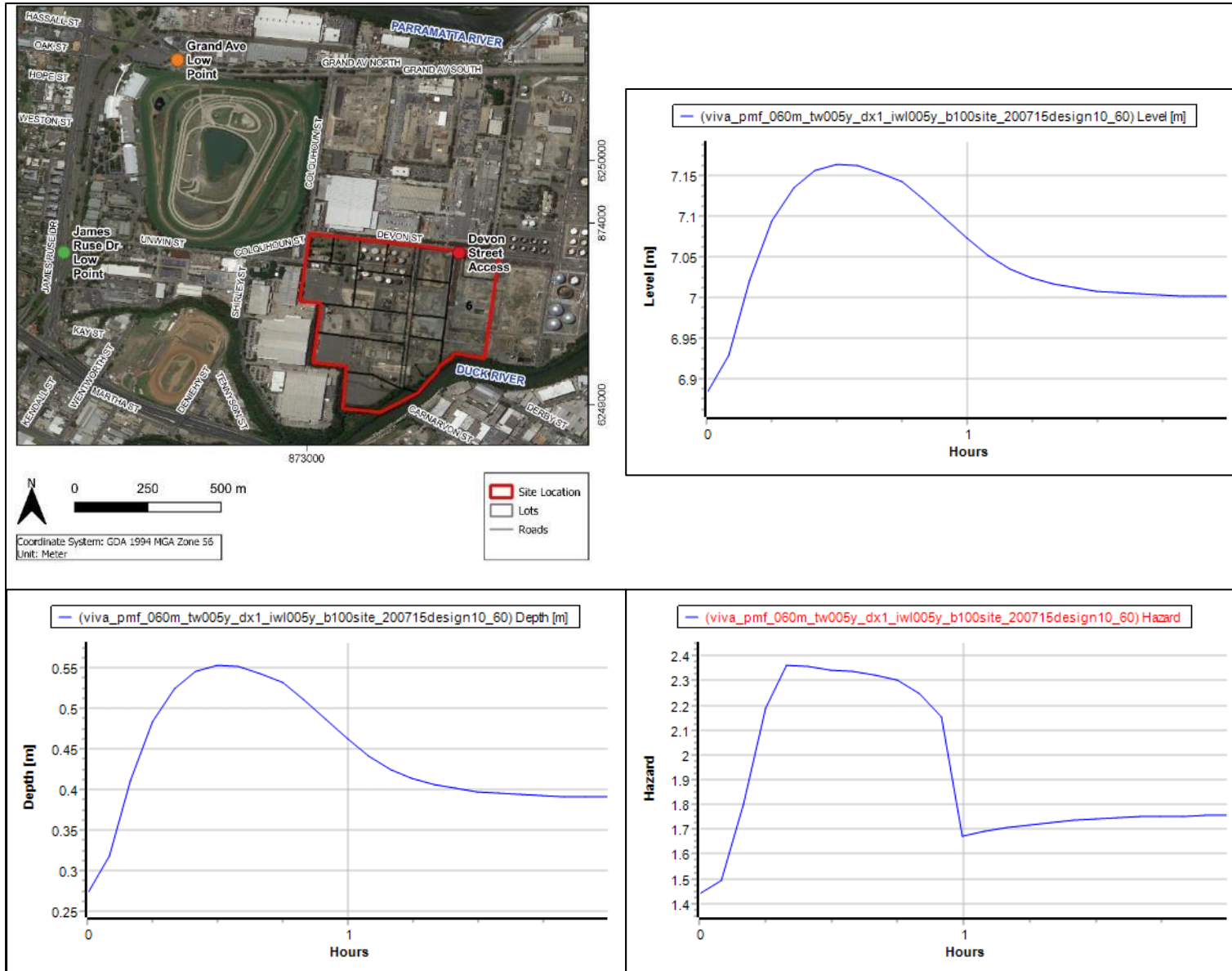


Figure 19. Overland PMF Hydrographs at Grand Avenue Low Point.

4 | Flood Forecasts and Warnings

Monitoring the weather forecasts and warnings will be an integral step in managing the flood risk of the site.

4.1 Bureau of Meteorology (BoM)

The Bureau of Meteorology (BoM) has a number of generalised warning products that could provide an indication of an increased flood threat:

- **Severe Weather Warnings:** The BoM issues Severe Weather Warnings whenever severe weather is occurring in an area or is expected to move into an area. The warnings describe the area under threat and the expected hazards. Warnings are issued with varying lead-times, depending on the weather situation, and range from just an hour or two to 24 hours or sometimes more. The key subtype of Severe Weather Warning to be monitored for the site are warnings with reference to flash flooding for the Sydney Metropolitan Area. These are issued directly to the media by the BoM when there is a high probability of flash flooding as a result of intense rainfall. New South Wales weather warnings are issued by the BoM and can be found at the following link: www.bom.gov.au/nsw/warnings/.
- **A Flood Watch for the Parramatta River area:** A Flood Watch is a “heads-up” that flood producing rainfall is forecast and flooding may eventuate. These are usually issued one or two days in advance of the expected flooding and about 25% of the time flooding does not eventuate.

In addition to the above listed warning products, the 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 the following website: <http://www.bom.gov.au/jsp/watl/rainfall/pme.jsp>

The radar service on the BoM website also shows current rainfall locations and intensities. The radar station to be used for the site would be the Sydney Terrey Hills Radar (<http://www.bom.gov.au/products/IDR714.loop.shtml#skip>).

4.2 Floodsmart

In addition to the information provided by the BoM, the City of Parramatta Council has put in place a local flood warning system for the Parramatta River which is freely available to anyone subscribing to the service. The system is called “FloodSmart.” While FloodSmart does not cover Rosehill, it does cover the Parramatta CBD. As there are no significant inputs to the Parramatta River (i.e. converging rivers) between the CBD and the site location, any flood warnings for the Parramatta CBD would also apply to the site.

FloodSmart can be accessed at the following link:

<https://www.cityofparramatta.nsw.gov.au/recreation-environment/floodsmart-parramatta/flood-warning-service>

FloodSmart provides flood early warning messages via text, email, or automated voice message. The types of flood warnings provided are summarised in Table 3.

Table 3. FloodSmart warning messages.

Type of Warning Message	Description
<p>MINOR: High risk areas may experience property flooding</p>	<ul style="list-style-type: none"> • Risk to life from fast flowing or deep water near the river or creek • Closure of roads most at risk of flooding • Flooding of land near rivers, creeks, low spots and recreational areas • Water levels may be high for many hours
<p>MODERATE: High and Medium risk areas may experience property flooding.</p>	<ul style="list-style-type: none"> • High risk to life from fast-flowing or deep water near the river or creek • Closure of many bridges and roads • Widespread flooding in areas not necessarily near the river • Water levels may be high for many hours
<p>MAJOR: High, Medium and Low risk areas may experience property flooding</p>	<ul style="list-style-type: none"> • Damage is possible to buildings and infrastructure • Extreme risk to life from fast-flowing deep water even in areas not near the river or creek • Closure of many bridges, roads and transport routes • Widespread deep flooding in many areas not necessarily near the river • Water levels may be high for many hours
<p>NO FURTHER IMPACT</p>	<ul style="list-style-type: none"> • The local conditions should now be improving: • No further flooding is expected in the next 12 hours • Flood levels will continue to drop <p>However:</p> <ul style="list-style-type: none"> • There may still be dangerous fast flowing water near the river or creek • Debris and contamination may still cause problems in areas that have been flooded

Lot 6 is located between the 1% AEP and PMF levels from the Parramatta River and as such it is in a Low Hazard area with respect to the FloodSmart warning system. Therefore it would only potentially experience flooding when there is a Major Flood Warning for the CBD. However, the evacuation route low point at the intersection between James Ruse Drive and Grand Avenue is a High Hazard area and may be cut by floodwaters following a Minor Flood Warning for the Parramatta River. Similarly, access to the site from the south via Unwin Street and Kay Street goes across A’Becketts Creek and the Duck Creek and it is likely to flood frequently when the Parramatta River level is high.

Therefore, a Minor Flood Warning for Parramatta CBD indicates that the site may be isolated by floodwaters within two hours. It is noted that such warning is not issued for overland flooding events, nor for mainstream events coming down the Duck River alone.

Table 4. Relevant FloodSmart warning messages for the site.

Location at Risk	Floodsmart Hazard Classification	Relevant FloodSmart Flood Warning (Parramatta River only)
Low point at intersection of Grand Avenue and James Ruse Drive	High	Minor; No Further Impact
Low point at intersection of Unwin Street and A'Becketts Creek and Duck Creek	High	Minor; No Further Impact
Lot 6	Low	Major; No Further Impact

5 | Emergency Management Considerations

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

- Evacuate to an area above the reach of floodwaters in the PMF. This is the NSWSES preferred response, provided that the risks of evacuating are deemed acceptable;
- Take Shelter in Place (SIP) within the site and wait until floodwaters have receded and the emergency has passed. SIP is to be considered an alternative to evacuation only when the risks of evacuating are higher than the risks of SIP. SIP requires flood-free access to a suitable shelter above the PMF level. The shelter must be protected from the weather, be structurally stable in a PMF and have sufficient floor area for all people likely to be on site at any one time.

Both evacuation and SIP are considered as possible flood emergency response strategies in this FERP. This section provides a summary of the flood emergency response analysis (for evacuation and SIP) that was undertaken as part of this FERP to inform the identification of the most suitable response strategy and management actions.

5.1 Consultation with the NSWSES

The flood emergency response strategy for the construction phase of Lot 6 presented in this report was established in consultation with the NSWSES during two online meetings held on 21 and 27 January 2021. The meetings were attended by:

- Three representatives from the NSWSES (i.e. Peter Cinque, Shelly Stingmore, and Jacqueline Kenner);
- A representative of Downer (Neville Hattingh of Element Environment);
- Molino Stewart's Principals Steven Molino and Dr Filippo Dall'Osso, and Dr Kelsey Sanborn.

A copy of this report was provided by Downer EDI Works Pty Ltd to the NSWSES for any additional feedback.

5.2 The Emergency Response Strategy

While the site itself is only severely affected in mainstream and overland events greater than the 1% AEP, all evacuation routes may become cut within minutes after the beginning of a rainfall event by overland flooding or mainstream flooding. Such routes are:

- North-west of the site via Devon Street, Colquhoun Street, Grand Avenue, and then north on James Ruse Drive; or
- South-west of the site via Devon Street, Colquhoun Street, Unwin Street, Kay Street, and then south on Wentworth Street.

While in most flood events floodwaters would not reach the site, in extreme events floodwaters may keep rising after all evacuation routes are cut to affect the site with hazardous floodwaters. Flood depths on site would exceed 2 m in the mainstream PMF and may reach a peak hydraulic hazard of H5, which may pose a risk to the stability of buildings that were not purposely engineered to

withstand flood forces. It should be emphasized that this event represents the absolute worst-case scenario of a concurrent PMF peak in the Duck River and Parramatta River catchments. The probability of this is much smaller than a single PMF event, which has a probability of occurrence in the order of 1 in 1,000,000 each year. As such, we consider the probability of a concurrent PMF events to be negligible for emergency planning purposes. More realistically, in the worst credible scenario of a PMF in the Duck River with a 1% AEP tailwater level in the Parramatta River the site would not experience hydraulic hazards in excess of H4 (safe for buildings).

Based on the above considerations it was concluded that both evacuation and Shelter in Place could be effective flood emergency response strategies for the site, in principle. However, during the construction phase, there will be no suitable shelters within the site and early evacuation was deemed to be the only practical alternative.

It was agreed with the NSWSES that the following triggers should be used for a site evacuation:

- A Floodsmart Minor Flood Warning for Parramatta CBD; or
- A Flood Watch for the Parramatta River, followed by a BoM Severe Weather Warning with reference to flash flooding for the Sydney Metropolitan Area.

The above triggers will provide a minimum of one hour of notice before the site may become isolated, however in most instances the notice will be greater. Given the nature of the development (i.e. a construction site) the minimum notice was deemed acceptable, especially in consideration of the following items:

- Everyone on site will be pre-alerted when there is a Flood Watch active for the Parramatta River that evacuation may be required. A Flood Watch is usually issued one to two days in advance;
- There will be people on site less than 50% of the time. This corresponds to the construction working hours provided in Section 2.3.3;
- There will be mobile offices with access to power and internet for continued monitoring of the evacuation triggers;
- Everyone on site will have access to a vehicle and will quickly be able to drive out should an evacuation order be issued;
- There will be no more than 85 people on site at any one time. If they all have individual vehicles, there will be no more than 85 vehicles evacuating the site. The NSWSES assumes a minimum evacuation rate of 600 cars per lane per hour. Based on this, it would take less than 10 minutes for 85 vehicles to clear the site.
- Regardless of flood risk, the construction site will often be closed in any rainfall event, even in light rain, or when severe thunderstorms are predicted, because most construction activities cannot proceed in bad weather.

6 | Flood Emergency Response Plan

6.1.1 Priorities

This FERP recognises that protection of life is of critical and primary importance. This FERP is principally concerned with the safety and comfort of personnel. All flood emergency responses recommended in this FERP are to recognise the primacy of life and wellbeing over protection of property.

Nonetheless, it is recommended that the site management and staff take all necessary measures outside of this FERP to manage the risks which flooding poses to the site and its property.

The FERP sets emergency management prevention, preparedness and response measures that are relevant to a flood emergency. It does not cover broader emergency management guidance for any type of hazard that could affect the site.

6.2 Responsibilities

The responsibility of successful implementation of the Flood Emergency Response Plan lies with the site management. However the NSW SES, as the State combat agency for flood events, and the NSW Police Force have the right to and may intervene before, after or during a flood to provide guidance or prescriptive directions.

6.2.1 NSW State Emergency Services (NSWSES)

The NSWSES is the lead combat agency for flooding in NSW. It can command resources from other government organisations including local councils, Transport for NSW and the Police to assist in flood operations under its command.

Under the State Emergency and Rescue Management Act, 1989, the NSWSES has the power to direct any citizen or organisation to take actions in response to flooding. This includes the power to order evacuations.

Any flood response directive issued by the NSWSES or by delegated authority to others acting on its behalf must be followed by site management and staff. This includes any order to evacuate the site or not evacuate the site, irrespective of what decisions have been made by management in accordance with this FERP.

6.2.2 Site Management

A Project Manager will be on site at all times during construction of Lot 6. The Project Manager, or a trained staff member nominated by the Project Manager, will be in charge of monitoring the evacuation triggers and ensuring a successful emergency response exercise.

6.3 What do to Before, During and After a Flood

This section provides the list of actions to be undertaken before, after and during a flood. These are also provided as a checklist in Appendix A.

6.3.1 Before a Flood

TRIGGER FOR ACTION #1: Always

ACTIONS:

- The site Project Manager will make all staff on site aware of the possibility of flooding and the procedures to be followed in a flood.
- The Project Manager will appoint a Flood Warden. This should be a senior staff member who is familiar with this Flood Emergency Response Plan and who is always on site when the site is open. If necessary, to ensure that at least one Flood Warden is always on site, the Project Manager may appoint two or more Flood Wardens.
- An airhorn will be kept on site at all times. This is to be used to alert everyone on site in case of emergency. All staff on site will be trained during their site induction to immediately go to the muster point at the front of the site when the airhorn sounds.
- A set of at least two wireless radio communication transceivers with charged spare batteries will be kept on site at all times. The Flood Warden will make sure that the main and spare batteries are changed at all times.
- A flood warning sign will be kept on the premises. The sign should read a message to this effect:
The site is temporarily closed due to flood risk. For your own safety, leave the area immediately. You will be notified once it is safe to come back.
- The Project Manager and the Flood Warden will make sure they always have a personal smartphone or tablet handy. The smartphone/ tablet will need to have 3G/4G/5G internet access and at least 12 hours independent power supply.
- Using the above smartphone/ tablet, the Project Manager and the Flood Warden will subscribe to the City of Parramatta Council's Floodsmart warning system for the area of Parramatta CBD, and will make sure that the relevant notifications are given "push-up" priority (i.e. high-priority) so that these can be read as soon as they are received.
- Using the above smartphone/ tablet, the Project Manager and the Flood Warden will bookmark links to the BoM warning webpage and Floodsmart for easy access.
- Every morning, the site Project Manager will check the Bureau of Meteorology weather forecast and warnings. At the time this report was prepared, the BoM weather forecast and warnings for NSW were available at the following link: [New South Wales Warnings Summary \(bom.gov.au\)](https://www.bom.gov.au/newswales/summary/).
- An emergency contact sheet will be kept on site. A suggested format for these details and other necessary contact details is provided in Appendix B.
- The Project Manager will keep an updated register of the people who are on site at all times. The list will have to include as a minimum name, mobile number, and emergency contact details.
- The Project Manager will maintain an emergency kit including a portable radio and torch with spare batteries and a first aid kit.

6.3.2 When a Flood is Possible

TRIGGER FOR ACTION #2: When there is an active BoM Flood Watch for the Parramatta River

ACTIONS (during working hours):

- The site Project Manager will notify the Flood Warden(s) that there is a risk that the site may flood and the procedures to be followed in a flood.
- The Project Manager and the Flood Warden(s) will notify everyone on site, as well as any workers arriving to the site later in the day, that there is a risk that the site may flood and the procedures to be followed in a flood.
- The Flood Warden will monitor the BoM warning webpage and any notifications from Floodsmart every 30 minutes.
- Everyone on site will ensure they can be ready to evacuate within 30 minutes should an evacuation order be issued by the Project Manager.

ACTIONS (outside working hours):

- The site Project Manager will monitor the BoM warning webpage and any notifications from Floodsmart every two hours, and one last time one hour before any works commence at the site.
- Upon opening of the site, the actions to be undertaken during working hours, listed above, will apply.

6.3.3 During a Flood

TRIGGER FOR ACTION #3:

When there is an active Flood Watch for the Parramatta River and the BoM issues a Severe Weather Warning with risk of flash flooding or local flooding for the Sydney Metropolitan Area,

OR

TRIGGER FOR ACTION #4:

When a Floodsmart Warning for Minor, Moderate or Major Flooding is issued for the Parramatta River.

Note: a Floodsmart flood warning may or may not be preceded by a BoM Flood Watch.

ACTIONS (during working hours):

- The Flood Warden will notify the Project Manager that the site must be immediately evacuated.
- The Flood Warden will take the radio transceiver, the flood warning sign and the register of everyone who is on site and go to the site vehicular access point on Devon Street).
- The Project Manager will issue an evacuation order by sounding the airhorn. As per the site induction training, everyone on site will immediately muster at the front of the site where the Project Manager or Flood Warden will notify them of the reason for the evacuation and any evacuation procedures to comply with.
- The Project Manager will sound the airhorn every five minutes until everyone has left the site.

- As each vehicle leaves the site, the Flood Warden will record they have left in the register and will remind all drivers that under no circumstances they should drive through floodwaters.
- The Project Manager will contact the NSWSES and communicate that the site is being evacuated as per the FERP.
- Using the radio transceiver, the Flood Warden will let the Project Manager know when everyone has left. The Flood Warden will put the flood warning sign in place and then leave the site.
- The Project Manager will patrol the site on their car for no more than five minutes to ensure that no one is left on the premises. They will then shut off all power supplies, close access to the site and leave.
- Once the Project Manager has evacuated, they will contact everyone due to arrive to the site on that day and communicate that the site is closed due to flood risk until further notice.
- The Project Manager will keep monitoring the BoM weather warnings and any further notifications from Floodsmart every two hours.

ACTIONS (outside working hours):

- The Project Manager will contact everyone expected to go to the site on the following day and communicate that the site will be closed due to flood risk until further notice.
- The Project Manager will keep monitoring the BoM weather warnings and any Floodsmart notifications every two hours.

6.3.4 After a Flood

TRIGGER FOR ACTION #5:

When a Floodsmart notification of “No Further Impact” for Parramatta CBD is received,

OR

If a Floodsmart flood warning for Parramatta CBD was never issued, when the BoM cancels the Severe Weather Warning with risk of flash flooding for the Sydney Metropolitan area.

ACTIONS:

- The Project Manager will inspect the site to check if access roads are clear and if the site was affected by flooding.
- If access roads are clear and the site was not affected, the emergency has passed and the site can re-open.
- If access roads are not clear, the Project Manager will return for an inspection after at least two hours. Under no circumstances should the Project Manager drive through floodwaters.
- If access roads are clear but the site was affected by flooding, the Project Manager will organise access to the site making sure that any precautionary measures recommended by the NSWSES are put in place.
- Extra care will be taken of potential slips on a muddy floor if floodwaters have entered the mobile offices or other structures.
- All flood-affected parts of the premises will be appropriately cleaned and utilities checked by professionals before anyone can return to the site.

- A hazard assessment will be undertaken for the clean-up, safe work methods statements will be prepared and personal protective equipment supplied consistent with the known hazards which can be associated with floods:
 - Slips, trips and falls;
 - Sharp debris;
 - Venomous animals;
 - Contaminated water and sediments.
- Following the re-commencement of the site activities, a de-brief will be held with key management staff and may involve Council flood staff or the NSWSES. The flood event and response, including the use of this FERP and any emergency procedures will be reviewed.
- Changes may be made to the FERP and the requirements for future emergency response should the review identify any improvements which may be made.



7 | References

- Element Environment, 2020a. Central Sydney Industrial Estate incorporating the Sustainable Road Resource Centre State Significant Development Application: Environmental Impact Statement. Prepared for VE Property Pty Ltd and Downer EDI Works Pty Ltd.
- Element Environment, 2020b. Central Sydney Industrial Estate incorporating the Sustainable Road Resource Centre State Significant Development Application: Response to Submissions. Prepared for VE Property Pty Ltd and Downer EDI Works Pty Ltd.
- Smith, G., McLuckie, D., 2015. Delineating hazardous flood conditions to people and property, 2015 Floodplain Management Australia National Conference, Brisbane, QLD, 19-22 May 2015.
- WMAWater, 2012. Duck River and Duck Creek Flood Study. Prepared for Parramatta City Council.
- WMAWater, 2020a. Central Sydney Industrial Estate incorporating Downer Sustainable Road Resource Centre Flooding Assessment. Prepared for VE Property Pty Ltd.
- WMAWater, 2020b. Central Sydney Industrial Estate incorporating Downer Sustainable Road Resource Centre Review of Flooding Submissions. Prepared for VE Property Pty Ltd.

Appendix A | Action Checklist

Stage	Trigger for Action	Action	Who is responsible	What is needed
Before a flood	Always	The site Project Manager will make all staff on site aware of the possibility of flooding and the procedures to be followed in a flood.	Project Manager	N/A
		The Project Manager will appoint a Flood Warden. This should be a senior staff member who is familiar with this Flood Emergency Response Plan and who is always on site when the site is open. If necessary, to ensure that at least one Flood Warden is always on site, the Project Manager may appoint two or more Flood Wardens.	Project Manager and Flood Warden(s)	N/A
		An airhorn will be kept on site at all times. This is to be used to alert everyone on site in case of emergency. All staff on site will be trained during their site induction to immediately go to the muster point at the front of the site when the airhorn sounds.	Project Manager	Airhorn
		A set of at least two wireless radio communication transceivers with charged spare batteries will be kept on site at all times. The Flood Warden will make sure that the main and spare batteries are changed at all times.	Project Manager	Wireless radios with batteries
		A flood warning sign will be kept on the premises. The sign should read a message to this effect: <i><u>The site is temporarily closed due to flood risk. For your own safety, leave the area immediately. You will be notified once it is safe to come back.</u></i>	Project Manager	Flood warning sign
		The Project Manager and the Flood Warden will make sure they always have a smartphone or tablet handy. The smartphone/	Project Manager and	Smartphone or tablet, internet

Stage	Trigger for Action	Action	Who is responsible	What is needed
		tablet will need to have 3G/4G/5G internet access and at least 12 hours independent power supply.	Flood Warden(s)	and back-up power
		Using the above smartphone/ tablet, the Project Manager and the Flood Warden will subscribe to the City of Parramatta Council's FloodSmart warning system for the area of Parramatta CBD, and will make sure that the relevant notifications are given "push-up" priority (i.e. high-priority) so that these can be read as soon as they are received.	Project Manager and Flood Warden(s)	Smartphone or tablet and internet
		Using the above smartphone/ tablet, the Project Manager and the Flood Warden will bookmark links to the BoM warning webpage and FloodSmart for easy access.	Project Manager and Flood Warden(s)	Smartphone or tablet and internet
		Every morning, the site Project Manager will check the Bureau of Meteorology weather forecast and warnings. At the time this report was prepared, the BoM weather forecast and warnings for NSW were available at the following link: New South Wales Warnings Summary (bom.gov.au) .	Project Manager and Flood Warden(s)	Smartphone or tablet and internet
		An emergency contact sheet will be kept on site. A suggested format for these details and other necessary contact details is provided in Appendix B.	Project Manager	Emergency Contact Sheet
		The Project Manager will keep an updated register of the people who are on site at all times. The list will have to include as a minimum name, mobile number, and emergency contact details.	Project Manager	Register of people on site
		The Project Manager will maintain an emergency kit including a portable radio and torch with spare batteries and a first aid kit.	Project Manager	Emergency kit with radio, torch, batteries, and first aid kit

Stage	Trigger for Action	Action	Who is responsible	What is needed
When a flood is possible	<i>During working hours</i> When there is an active BoM Flood Watch for the Parramatta River	The site Project Manager will notify the Flood Warden(s) that there is a risk that the site may flood and the procedures to be followed in a flood.	Project Manager and Flood Warden(s)	N/A
		The Project Manager and the Flood Warden(s) will notify everyone on site, as well as any workers arriving to the site later in the day, that there is a risk that the site may flood and the procedures to be followed in a flood.	Project Manager and Flood Warden(s)	Phones
		The Flood Warden will monitor the BoM warning webpage and any notifications from Floodsmart every 30 minutes.	Flood Warden(s)	Smartphone or tablet and internet
		Everyone on site will ensure they can be ready to evacuate within 30 minutes should an evacuation order be issued by the Project Manager.	Everyone on site	N/A
	<i>Outside of working hours</i> When there is an active BoM Flood Watch for the Parramatta River	The site Project Manager will monitor the BoM warning webpage and any notifications from FloodSmart every two hours, and one last time one hour before any works commence at the site.	Project Manager	Internet
		Upon opening of the site, the actions to be undertaken during working hours, listed above, will apply.	Project Manager	N/A
During a flood	<i>During working hours</i> When there is an active Flood Watch for the Parramatta River and the BoM issues a Severe Weather Warning with risk of flash flooding or local flooding for the Sydney Metropolitan Area,	The Flood Warden will notify the Project Manager that the site must be immediately evacuated.	Project Manager and Flood Warden(s)	N/A
		The Flood Warden will take the radio transceiver, the flood warning sign and the register of everyone who is on site and go to the site vehicular access point on Devon Street.	Flood Warden(s)	Radio, warning sign and register of people on site

Stage	Trigger for Action	Action	Who is responsible	What is needed
	<p>OR</p> <p>When a FloodSmart Warning for Minor, Moderate or Major Flooding is issued for the Parramatta River.</p>	<p>The Project Manager will issue an evacuation order by sounding the airhorn. As per the site induction training, everyone on site will immediately muster at the front of the site where the Project Manager or Flood Warden will notify them of the reason for the evacuation and any evacuation procedures to comply with</p>	Project Manager	Airhorn
	<p><i>Note: a Floodsmart flood warning may or may not be preceded by a BoM Flood Watch.</i></p>	<p>The Project Manager will sound the airhorn every five minutes until everyone has left the site.</p>	Project Manager	Airhorn
		<p>As each vehicle leaves the site, the Flood Warden will record they have left in the register and will remind all drivers that under no circumstances they should drive through floodwaters.</p>	Flood Warden(s)	Register of people on site
		<p>The Project Manager will contact the NSWSES and communicate that the site is being evacuated as per the FERP.</p>	Project Manager	Phones
		<p>Using the radio transceiver, the Flood Warden will let the Project Manager know when everyone has left. The Flood Warden will put the flood warning sign in place and then leave the site.</p>	Flood Warden(s)	Radio
		<p>The Project Manager will patrol the site on their car for no more than five minutes to ensure that no one is left on the premises. They will then shut off all power supplies, close access to the site and leave.</p>	Project Manager	N/A
		<p>Once the Project Manager has evacuated, they will contact everyone due to arrive to the site on that day and communicate that the site is closed due to flood risk until further notice.</p>	Project Manager	Phones
		<p>The Project Manager will keep monitoring the BoM weather warnings and any further notifications from FloodSmart every two hours.</p>	Project Manager	Smartphone or tablet and internet

Stage	Trigger for Action	Action	Who is responsible	What is needed
	<p><i>Outside of working hours</i></p> <p>When there is an active Flood Watch for the Parramatta River and the BoM issues a Severe Weather Warning with risk of flash flooding or local flooding for the Sydney Metropolitan Area, OR</p> <p>When a FloodSmart Warning for Minor, Moderate or Major Flooding is issued for the Parramatta River.</p> <p><i>Note: a Floodsmart flood warning may or may not be preceded by a BoM Flood Watch.</i></p>	<p>The Project Manager will contact everyone expected to go to the site on the following day and communicate that the site will be closed due to flood risk until further notice.</p>	<p>Project Manager</p>	<p>Phones</p>
		<p>The Project Manager will keep monitoring the BoM weather warnings and any FloodSmart notifications every two hours.</p>	<p>Project Manager</p>	<p>Internet</p>
<p>After a flood</p>	<p>When a FloodSmart notification of “No Further Impact” for Parramatta CBD is received, OR</p> <p>If a FloodSmart flood warning was never issued, when the BoM cancels the Severe Weather Warning with risk of flash flooding for the Sydney Metropolitan area.</p>	<p>The Project Manager will inspect the site to check if access roads are clear and if the site was affected by flooding.</p>	<p>Project Manager</p>	<p>N/A</p>
		<p>If access roads are clear and the site was not affected, the emergency has passed and the site can re-open.</p>	<p>Project Manager</p>	<p>N/A</p>
		<p>If access roads are not clear, the Project Manager will return for an inspection after at least two hours. Under no circumstances should the Project Manager drive through floodwaters.</p>	<p>Project Manager</p>	<p>N/A</p>
		<p>If access roads are clear but the site was affected by flooding, the Project Manager will organise access to the site making sure that any precautionary measures recommended by the NSWSES are put in place.</p>	<p>Project Manager</p>	<p>TBC by NSWSES</p>

Stage	Trigger for Action	Action	Who is responsible	What is needed
		Extra care will be taken of potential slips on a muddy floor if floodwaters have entered the mobile offices or other structures.	Everyone on site	N/A
		All flood-affected parts of the premises will be appropriately cleaned and utilities checked by professionals before anyone can return to the site.	Project Manager	Cleaning supplies
		A hazard assessment will be undertaken for the clean-up, safe work methods statements will be prepared and personal protective equipment supplied consistent with the known hazards which can be associated with floods: Slips, trips and falls; Sharp debris; Venomous animals; Contaminated water and sediments.	Project Manager	Hazard assessment/ safe work methods statement
		Following the re-commencement of the site activities, a de-brief will be held with key management staff and may involve Council flood staff or the NSWSES. The flood event and response, including the use of this FERP and any emergency procedures will be reviewed.	Project Manager, Flood Warden(s), Council and NSWSES	FERP
		Changes may be made to the FERP and the requirements for future emergency response should the review identify any improvements which may be made.	Project Manager	FERP

Appendix B | Emergency Contact List

Name	Organisation	Role	Contact Details
	Downer	Project Manager	0403 550 384
	Downer	Flood Warden	0447 049 490
	Emergency Services	Fire/ambulance/police	000
	State Emergency Service	SES Local Controller	132 500
	Bureau of Meteorology	NSW Flood Warning Centre	02 9296 1511
	City of Parramatta Council	Customer Service Centre on	02 9806 5050
	Westmead Hospital		02 8890 5555