Appendix H

Flooding and Hydrology Assessment

Sydney Park Junction

Flooding and Hydrology Assessment

Final

Transport of NSW

Sydney Park Junction

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Executive Summary

A flooding assessment of the proposed King Street Gateway project has been undertaken, involving desktop review of existing flood studies covering the proposal site and surrounding catchment areas, in conjunction with review of the detailed design of the proposal. The assessment characterises the existing catchment and drainage conditions, considers the existing flooding issues in and around the proposal site including the occurrence of historic flooding problems, and provides a qualitative assessment of likely flooding impacts resulting from the proposal.

The assessment finds that there are not expected to be any significant impacts to existing flooding conditions resulting from the proposal, due to the generally minor nature of overland flooding in the proposal site and the minor changes to road profiles and drainage conditions. It is not expected that the proposed changes to the road would result in material impacts to flood flows which are currently conveyed to existing flood problem areas, nor would the proposal result in increased runoff rates or create obstruction to existing overland flows. Construction phase and cumulative impacts to flooding in combination with other development in the catchment areas are not expected to be significant. Any flooding impacts resulting from the proposal are not expected to be worsened as a result future climate change effects of increased rainfall intensity or sea level rise.

Given the assessment that there are expected to be only negligible impacts to flooding, no specific mitigation measures are proposed to manage the flood impacts resulting from the proposal.

The following recommendations are made:

- Should further design development result in more substantial changes to road and drainage design, it is recommended the potential for flooding impacts be reassessed and confirmed.
- While the proposal is not expected to result in any significant impacts to existing flooding conditions, in some areas the existing flooding is being contributed to by the current road drainage patterns. It is recommended that, where practical, Transport for New South Wales coordinate with City of Sydney Council and Inner West Council to make provisions for upgrading of drainage infrastructure to alleviate the existing flooding issues.

Glossary

Term	Meaning
AEIs	Areas of environmental interest
afflux	Increase in flood level as a result of obstruction to flow
AHD	Australian Height Datum. A common national surface level datum approximately corresponding to mean sea level.
Annual Exceedance Probability (AEP)	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. In this study AEP has been used consistently to define the probability of occurrence of flooding. The following relationships between AEP and ARI applies to this study (ARR, 2019).
ARR	Australian Rainfall and Runoff. Guidelines prepared by the Institute of Engineers Australia for the estimation of design floods. Reference is made to the 1987 or the 2019 versions of ARR, as specified.

Frequency Descriptor	EY	AEP (%)	AEP (1 in x)	ARI
Very frequent	**12**			
	6	99.75	1.002	0.17
	4	98.17	1.02	0.25
	3	95.02	1.05	0.33
	2	86.47	1.16	0.50
Frequent	**1**	**63.2**	1.58	1.00
	0.69	**50.00**	2	1.44
	0.5	39.35	2.54	2.00
	0.22	**20.00**	5	4.48
	0.2	18.13	5.52	5.00
Infrequent	0.11	**10.00**	10.00	9.49
	0.05	**5.00**	20	20.0
	0.02	**2.00**	50	50.0
	0.01	**1.00**	**100**	100
Rare	0.005	0.50	**200**	200
	0.002	0.20	**500**	500
	0.001	0.10	**1000**	1000
Extremely Rare	0.0005	0.05	**2000**	2000
	0.0002	0.02	5000	5000
			↓	
Extreme			PMP	

Term	Meaning
Average Annual Damage (AAD)	Depending on its size (or severity), each flood will cause a different amount of flood damage to a flood prone area. AAD is the average damage per year that would occur in a nominated development situation from flooding over a very long period of time.
Average Recurrence Interval (ARI)	The long-term average number of years between the occurrences of a flood as big as or larger than the selected event. For example, floods with a discharge as great as or greater than the 20 year ARI flood event will occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event. Also refer to Average Exceedance Probability (AEP), which is the industry standard terminology for definition of design flood events.
catchment	The land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location.
conveyance	The transport of flood water downstream.
development	Is defined in Part 4 of the EP&A Act In fill development: refers to the development of vacant blocks of land that are generally surrounded by developed properties and is permissible under the current zoning of the land. Conditions such as minimum floor levels may be imposed on infill development. New development: refers to development of a completely different nature to that associated with the former land use (e.g. The urban subdivision of an area previously used for rural purposes). New developments involve re-zoning and typically require major extensions of exiting urban services, such as roads, water supply, sewerage and electric power. Redevelopment: refers to rebuilding in an area (e.g. As urban areas age, it may become necessary to demolish and reconstruct buildings on a relatively large scale). Redevelopment generally does not require either re-zoning or major extensions to urban services.
discharge	The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second (m^3/s). Discharge is different from speed or velocity of flow, which is a measure of how fast the water is moving for example, metres per second (m/s).
DPIE	New South Wales Government Department of Planning, Infrastructure and Environment (Environment, Energy and Science).
effective warning time	The time available after receiving advice of an impending flood and before the floodwaters prevent appropriate flood response actions being undertaken. The effective warning time is typically used to move farm equipment, move stock, raise furniture, evacuate people and transport their possessions.
exceedances per year (EY)	The number of times an event is likely to occur or be exceeded within any given year.
flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.
flood fringe areas	The remaining area of flood prone land after floodway and flood storage areas have been defined.

Term	Meaning
flood liable land /flood prone land	Is synonymous with flood prone land (i.e.) land susceptibility to flooding by the probable maximum flood event. Note that the term flooding liable land covers the whole floodplain, not just that part below the FPL (see flood planning area)
floodplain	Area of land which is subject to inundation by floods up to and including the probable maximum flood event, that is flood prone land.
floodplain risk management options	The measures that might be feasible for the management of particular area of the floodplain. Preparation of a floodplain risk management plan requires a detailed evaluation of floodplain risk management options.
floodplain risk management plan	A management plan developed in accordance with the principles and guidelines in this manual. Usually includes both written and diagrammatic information describing how particular areas of flood prone land are to be used and managed to achieve defines objectives.
flood plan (local)	A sub-plan of a disaster plan that deals specifically with flooding. They can exist at state, division and local levels. Local flood plans are prepared under the leadership of the State Emergency Service.
flood planning levels (FPLs)	Are the combination of flood levels (derived from significant historical flood events or floods of specific AEPs) and freeboards selected for floodplain risk management purposes, as determined in management studies and incorporated in management plans. FPLs supersede the "designated flood" or the “flood standard” used in earlier studies.
flood proofing	A combination of measures incorporated in the design, construction and alteration of individual buildings and structures subject to flooding, to reduce or eliminate flood damages.
flood readiness	Readiness is an ability to react within the effective warning time.
flood risk	Potential danger to personal safety and potential damage to property resulting from flooding. The degree of risk varies with circumstances across the full range of floods. Flood risk in this manual is divided into 3 types, existing, future and continuing risks. They are described below. Existing flood risk: the risk a community is exposed to as a result of its location on the floodplain. Future flood risk: the risk a community may be exposed to as a result of new development on the floodplain. Continuing flood risk: the risk a community is exposed to after floodplain risk management measures have been implemented. For a town protected by levees, the continuing flood risk is the consequences of the levees being overtopped. For an area without any floodplain risk management measures, the continuing flood risk is simply the existence of its flood exposure.
flood storage areas	Those parts of the floodplain that are important for the temporary storage of floodwaters during passage of a flood. The extent and behaviour of flood storage areas may change with flood severity, and loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation. Hence, it is necessary to investigate a range of flood sizes before defining flood storage areas.
floodway areas	Those areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood levels.

Term	Meaning
freeboard	Provides reasonable certainty that the risk exposure selected in deciding on a particular flood chosen as the basis for the FPL is actually provided. It is a factor of safety typically used in relation to the setting of floor levels, levee crest levels, etc. Freeboard is included in the flood planning level.
hazard	A source of potential harm or situation with a potential to cause loss. In relation to this technical paper the hazard is flooding which has the potential to cause damage to the community.
hydraulics	The study of water flow in waterways; in particular, the evaluation of flow parameters such as water level and velocity.
hydrograph	A graph which shows how the discharge or stage/flood level at a particular location varies with time during a flood.
hydrology	The study of the rainfall and runoff process; in particular, the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of floods.
IFD	Intensity Frequency Duration. Describes rainfall in terms of intensity (typically mm/hr), frequency (e.g. ARI) and duration of the storm.
LEP	Local Environmental Plan
local overland flooding	Inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam.
LPI	Land and Property Information
m AHD	metres Australian Height Datum (AHD)
m/s	metres per second. Unit used to describe the velocity of floodwaters.
m^3/s	Cubic metres per second or "cumecs". A unit of measurement of creek or river flows or discharges. It is the rate of flow of water measured in terms of volume per unit time.
mainstream flooding	Inundation of normally dry land occurring when water overflows the natural or artificial banks of a stream, river, estuary, lake or dam.
modification measures	Measures that modify either the flood, the property or the response to flooding.
NSW	New South Wales
overland flow path	The path that floodwaters can follow as they are conveyed towards the main flow channel or if they leave the confines of the main flow channel. Overland flow paths can occur through private property or along roads.

Term	Meaning
probable maximum flood (PMF)	The largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation coupled with the worst flood producing catchment conditions. Generally, it is not physically or economically possible to provide complete protection against this event. The probable maximum flood defines the extent of flood prone land, that is, the floodplain.
probable maximum precipitation (PMP)	The PMP is the greatest depth of precipitation for a given duration meteorologically possible over a given size storm area at a particular location at a particular time of the year, with no allowance made for long-term climatic trends (World Meteorological Organisation, 1986). It is the primary input to probable maximum flood estimation.
risk	Chance of something happening that will have an impact. It is measured in terms of consequences and likelihood. In the context of this technical paper it is the likelihood of consequences arising from the interaction of floods, communities and the environment.
runoff	The amount of rainfall which ends up as a streamflow, also known as rainfall excess.
scour	Erosion by mechanical action of water, typically of soil.
stage	Equivalent to water level (both measured with reference to a specified datum)
SEARs	Secretary's Environmental Assessment Requirements
TUFLOW	TUFLOW is a computer program which is used to simulate free-surface flow for flood and tidal wave propagation. It provides coupled 1D and 2D hydraulic solutions using a powerful and robust computation. The engine has seamless interfacing with GIS and is widely used across Australia.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs was to provide a preliminary assessment of site contamination conditions in accordance with the scope of services set out in the contract between Jacobs and Transport for New South Wales (the Client). That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from the public domain, the Client (if any) and from observations made during the site inspection. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the proposal and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

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1. Introduction

1.1 Proposal identification

Transport for NSW proposes to improve the southern 'gateway' to King Street, Newtown by reducing the capacity of King Street, Princes Highway and Sydney Park Road and enhancing pedestrian and cyclist access along the Princes Highway, Sydney Park Road and King Street road corridors (the proposal).

The proposal objectives align with the strategic objectives articulated in the *Greater Sydney Region Plan* (Greater Sydney Commission, 2018), the *Road Safety Plan 2021* (Transport for NSW, 2018) and the *Future Transport Strategy 2056* (Transport for NSW, 2018).

The proposal is located about four kilometres south west of the Sydney Central Business District (CBD), in the suburbs of St Peters, Newtown, Erskineville and Alexandria along the boundary between the Inner West and Sydney Local Government Areas (LGAs). An overview of the proposal is provided in Figure 1-1.

Key features of the proposal would include:

- Reducing the Princes Highway/King Street carriageway from six lanes (generally) to four lanes(two lanes off-peak) from Campbell Street to Sydney Park Road, to accommodate a two way on-road segregated cycleway (on the western side of King Street between May Street and St Peters square), additional landscaping and community spaces to increase urban amenities
- Reducing the Sydney Park Road carriageway from four lanes to two lanes to accommodate a permanent solution for the existing temporary two-way on-road segregated cycleway (northern side), parking and additional landscaping to increase urban amenities,
- New mid-block pedestrian shared crossings to improve access across the Princes Highway/King Street and into Sydney Park, including:
  - A new mid-block pedestrian crossing on Princes Highway north of Short Street.
  - A new mid-block pedestrian and cyclist crossing on Princes Highway between May Street and Goodsell Street.
- Traffic signal and intersection reconfiguration works to improve safety, including:
  - Princes Highway/King Street and Sydney Park Road intersection:
    - King Street southbound approach: Reduce existing three though lanes and one left turn slip lane to a one through lane and one through/left turn lane
    - King Street northbound approach: Maintain existing two through lanes and reduce existing two dedicated right turn lanes to one lane
    - Sydney Park Road approach: Reduce existing two left turn lanes and two right turn lanes to one left turn lane and one right turn lane
    - Replacing existing signalised pedestrian crossing facilities with signalised shared crossing facilities on all approaches
  - Princes Highway/King Street and Goodsell Street intersection:
    - New raised zebra crossing to prioritise pedestrians at the entrance of Goodsell Street
  - Princes Highway/King Street and May Street intersection:
    - Removing traffic signals and re-configuring May Street to left in and left out only movements with a new raised zebra crossing to prioritise pedestrians at the entrance of May Street
  - Princes Highway/King Street and Barwon Park Road intersection:
    - Installing new traffic signals with new pedestrian crossings

- Sydney Park Road and Mitchell Road intersection:
  - Eastbound approach: Reduce existing two though lanes and one left turn lane to one through lane and a through/left turn lane
  - Westbound approach: Reduce existing one right turn lane, one through lane and one through/left turn lane to one through/right turn lane and one through/left turn lane
  - Mitchell Road approach: Change existing one right turn lane and one right/through/left turn lane to one bus dedicated right turn lane and one through/left turn lane

- Reducing the posted speed limit on Princes Highway from 50 kilometres per hour to 40 kilometres from Campbell Street to Goodsell Street
- Sydney Park carpark access on Kings St will be modified so that Barwon Park Road access will be entry only into the carpark, and King Street will be exit only from the carpark
- Adjustments and relocation of parking spaces along the road corridor
- Road re-surfacing at signalised intersections and along road corridor where required
- Providing dynamic community spaces on both sides of Princes Highway
- Providing landscaped buildouts on Sydney Park Road and Princes Highway
- Relocating the bus stops on Princes Highway near the Short Street intersection, and on Sydney Park Road near the Mitchell Road intersection
- Relocating utilities and adjustments to streetlights where required
- Removing the Princes Highway and Sydney Park Road corridors from the approved B-double freight access network
- Adjusting stormwater to accommodate designed works
- Relocating existing VMS and CCTV camera
- Relocating road signs and line marking works
- Temporary construction facilities, including site compounds and an ancillary facility at Burrows Road and Venice Street, Mascot.

King Street Gateway is located at the intersection of two major road conduits (King Street and Sydney Park Road), a significant cultural precinct, public transport infrastructure hub and one of the city's major green open spaces, Sydney Park.

High traffic and freight volumes on Princes Highway, the southern end of King Street and Sydney Park Road, combined with limited pedestrian crossing opportunities or cycling access, are presently creating an unsafe environment for all road users. The proposal is required to improve the safety, performance and efficiency of the King Street / Sydney Park Road intersection and the Sydney Park Road and Princes Highway/King Street road corridors, and to improve urban amenity and the "sense of place" along the road corridors. The proposal would also link the urban environment, Sydney Park, transport and pedestrian and cycling movements in a continuously integrated urban landscape that benefits local communities and visitors.

The proposal would be constructed in stages in two separate construction zones along Sydney Park Road and King Street/Princes Highway. This approach would minimise traffic impacts on road users, residents and businesses. Construction is expected to commence in middle 2022 and would take around 24 months to complete.

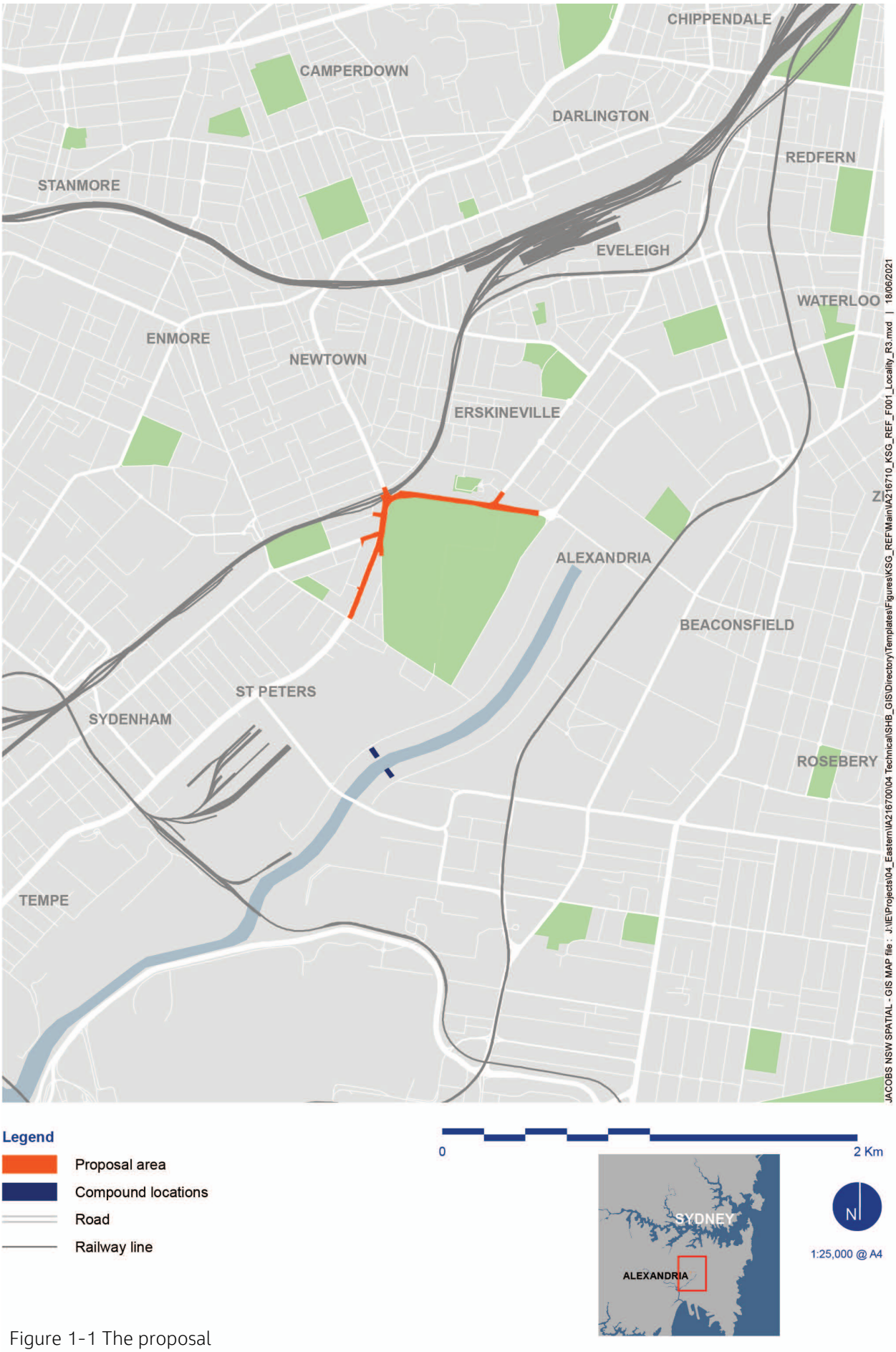

Figure 1-1 The proposal

1.2 Purpose of this report

This technical paper is one of several technical papers that form part of the Review of Environmental Factors. The purpose of this technical paper is to provide a qualitative assessment of potential flooding impacts resulting from the proposal. The assessment is based on a review of existing catchment and drainage characteristics in addition to existing flooding behaviour as defined in previous flood studies. The nature of the proposal as presented in the detailed design and changes from existing conditions are considered in the identification of potential flood impacts. Based on the assessed impacts, potential mitigation measures have been identified to manage any resultant flood impacts from the proposal.

1.3 Report structure

The structure of this report is outlined below:

- Section 2 – Assessment methodology. Definition of the study area and description of the assessment approach.
- Section 3 – Legislative and policy framework. Relevant policies and background to the flooding assessment.
- Section 4 – Existing environment: Description of the existing catchment characteristics, review of existing studies and available information and description of the existing flooding behaviour in the vicinity of the project site.
- Section 5 – Potential impacts. Assessment of the potential flooding impacts resulting from the operational phase of the proposal. Construction phase assessment, cumulative flood impacts and climate change impact assessment.
- Section 6 – Mitigation and management measures. Identified measures to mitigate the potential impacts of the proposal.
- Section 7 – Conclusions and recommendations.
- Section 8 – References.

2. Methodology

This section provides an overview of the study area and methodology for this flooding assessment.

2.1 Study area

For the purposes of this flooding assessment, the study area is defined as the construction footprint (referred to herein after as the proposal site), and surrounding land within approximately 500 metres of the site. This buffer distance from the proposal site is justified given the relatively minor flooding conditions in and around the proposal site.

2.2 Overall assessment approach

The objective of this study is to assess the potential flooding impacts resulting from the proposal and identify mitigation measures. The methodology for this flooding assessment is summarised below:

- Review of topographic, aerial photography and land use data to characterise the existing physical attributes of the study area
- Desktop review of available flood study reports relevant to the proposal to characterise existing flooding conditions and drainage patterns at the proposal site and the surrounding area
- Review of additional flooding information including details of historic flooding obtained from City of Sydney Council, Inner West Council and other sources
- Review the proposed design and performance objectives relevant to drainage and flooding
- Identify and qualitatively assess potential upstream / downstream flood impacts for the:
  - Construction phase
  - Operational phase.
- Review and identify the need for mitigation measures.

3. Legislative and policy context

The assessment has been undertaken generally in accordance with the following key guidelines and design references as applicable:

- NSW Floodplain Development Manual (NSW Government, 2005)
- Australian Rainfall and Runoff (ARR) 2019
- City of Sydney policies and plans
  - Sydney Local Environment Plan 2012 (City of Sydney)
  - Alexandra Canal Floodplain Risk Management Study and Plan (Cardno, 2014b)
- Inner West Council policies and plans
  - Marrickville Local Environment Plan 2011 (Inner West Council).

3.1 Floodplain Development Manual (NSW Government, 2005)

The assessment of potential flooding impacts of the proposal on existing flood regimes has been conducted in accordance with the requirements of the *Floodplain Development Manual* (NSW Government, 2005), which incorporates the NSW Government's *Flood Prone Land Policy*. The key objectives of this policy are to identify potential hazards and risks, reduce the impact of flooding and flood liability on owners and occupiers of flood prone property, and to reduce public and private losses resulting from floods. This policy also recognises the benefits of the use, occupation and development of flood prone land.

3.2 Australian Rainfall and Runoff 2019

Australian Rainfall and Runoff 2019 (ARR 2019) (Geoscience Australia, 2019) provides industry guidance on technical analysis and specifies design rainfall parameters for flooding and hydrologic studies in Australia. These guidelines have been adopted for new hydrologic assessment undertaken in this study.

The existing flood studies reviewed in this assessment are based on the design rainfall data provided in *Australian Rainfall and Runoff 1987* (ARR 1987) (Institute of Engineers Australia, 1987). The ARR 2019 design rainfall data provides design rainfall depths which vary from ARR 1987, due to analysis of an additional 30 years of data. For the 1% Annual Exceedance Probability (AEP) event the difference is from -13% to -29% compared to ARR 1987, for storm durations between 10 minutes and two hours, which are relevant to the proposal site.

3.3 City of Sydney policies and plans

3.3.1 Sydney Local Environment Plan 2012

The City of Sydney Council's Sydney Local Environment Plan 2012 (Sydney LEP 2012) adopts the Department of Planning, Industry and Environment's model flood planning clause as clause 7.15. The objectives of clause 7.15 (Flood Planning) are to:

- Minimise the flood risk to life and property associated with the use of land
- Allow development on land that is compatible with the land's flood hazard, considering projected changes as a result of climate change
- Avoid significant adverse impacts of flood behaviour on the community.

Clause 7.15 applies to land at or below the flood planning level.

Development consent must not be granted to development on land to which clause 7.15 applies unless the consent authority is satisfied that the development:

a) is compatible with the flood hazard of the land

b) is not likely to significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties

c) incorporates appropriate measures to manage risk to life from flood

d) is not likely to not significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses

e) is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding.

A word or expression used in clause 7.15 has the same meaning as it has in the NSW Government's *Floodplain Development Manual* published in 2005, unless it is otherwise defined in this clause.

In clause 7.15, *flood planning level* means the level of a 1:100 average recurrent interval (ARI) flood event plus 0.5 metres freeboard.

3.3.2 Alexandra Canal Floodplain Risk Management Study and Plan

The Alexandra Canal Floodplain Risk Management Study and Plan (Cardno, 2014b) was prepared for the City of Sydney to characterise the existing flooding conditions and develop flood risk mitigation measures, including structural options, for the Alexandra Canal catchment. One of the recommended measures was FM6 - Additional pipes from Macdonald Street and Coulson Street to Alexandra Canal, consisting of new trunk drainage (up to twin 1800 millimetre diameter pipes) which would run from the Coulson Street low point, a known flooding problem area about 170 metres north of Sydney Park Road via Huntley Street and discharge to the upstream end of Alexandra Canal. This option has the potential to reduce flooding in the Coulson Street low point and possibly on the proposal site.

3.4 Inner West Council policies and plans

3.4.1 Marrickville Local Environment Plan 2011

Inner West Council's Marrickville Local Environment Plan 2011 (Marrickville LEP 2011) adopts the Department of Planning and Environment's model flood planning clause as clause 6.3. The objectives of clause 6.3 (Flood Planning) are to:

- Minimise the flood risk to life and property associated with the use of land
- Allow development on land that is compatible with the land's flood hazard, considering projected changes as a result of climate change
- Avoid significant adverse impacts of flood behaviour on the community.

Clause 6.3 applies to land at or below the flood planning level.

Development consent must not be granted to development on land to which clause 6.3 applies unless the consent authority is satisfied that the development:

a) is compatible with the flood hazard of the land

b) is not likely to significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties

c) incorporates appropriate measures to manage risk to life from flood

d) is not likely to not significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses

e) is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding.

A word or expression used in clause 6.3 has the same meaning as it has in the NSW Government's *Floodplain Development Manual* published in 2005, unless it is otherwise defined in this clause.

In clause 6.3, *flood planning level* means the level of a 1:100 ARI flood event plus 0.5 metres freeboard.

3.4.2 Floodplain risk management plans

No floodplain risk management plans are current for Inner West Council for the catchment areas in the vicinity of the proposal site.

4. Existing environment

4.1 Site identification

The site comprises current roadways and adjoining areas surrounding Sydney Park, St Peters NSW. The particulars of the study area are identified in Table 4-1.

Table 4-1 Site details

Particulars	Description
Address	Sydney Park Road, Mitchell Road, King Street, Lord Street, Concord Street, Goodsell Street, May Street, Princes Highway, Barwon Park Road, Burrows Road in St Peters and Venice Street in Mascot.
Legal description	NA
Local government area	City of Sydney
Site dimensions	Area: 50,101 square metres Perimeter: 4,067 metres

4.2 Zoning and land use

At the time of preparing this Stage 1 contamination assessment, the site was adjacent to a combination of land uses including:

- North: High density residential premises, substation (St Peters zone substation) and railway line (T2 inner west)
- East: Sydney Park and commercial/industrial premises
- South: Sydney Park and commercial/residential premises
- West: Commercial/residential premises and railway line (T2 inner west).

Based on the Sydney LEP 2012 and Marrickville LEP 2011, the following land use zoning exist within the study area:

- SP2 – Infrastructure
- R1 – General Residential
- B5 – Business Development
- B4 – Mixed Use
- B2 – Local Centre.

4.3 Topography and drainage

Elevations in the proposal site range from 21 metres AHD at the intersection of Sydney Park Road and King Street, grading eastwards down to 8 metres AHD at the eastern end of the proposal site. Along King Street/Princes Highway, the elevations generally grade toward the south down to an elevation of 15.5 metres AHD at the intersection with Campbell Street. Refer to Figure 4-2 for the topography and drainage conditions

The topography in the study area is defined by a natural ridgeline which runs along King Street, Newtown, from the north west to the south east and intersects the corner of King Street, Sydney Park Road and the north western corner of Sydney Park. The topography in Sydney Park is an extension of this ridge, with additional man-made landforms created by former landfilling and reinstatement works. The ridge then runs in a south westerly direction roughly in line with King Street/Princes Highway. Drainage to the east of the ridge is generally eastwards towards the Alexandra Canal with the area forming part of the Alexandra Canal catchment.

To the north of Sydney Park Road is an overland flow area identified as the Munni Street – Erskineville sub-catchment and branch (Cardno, 2014), which drains in a south easterly direction and crosses Sydney Park Road at the eastern end of the proposal site. This sub-catchment includes a drainage low point at Coulson Street, 170 metres north of Sydney Park Road. Drainage to the north of Sydney Park Road is in an underground network and overland, while south of the road drainage is via a constructed concrete channel which runs through Sydney Park, crosses Euston Road and Burrows Road and discharges to the Alexandra Canal. Sydney Park Road forms a flow path for local runoff and drains to the Munni Street branch concrete channel.

King Street/Princes Highway traverses the natural ridgeline, forming two sag points in the road in the vicinity of Goodsell Street and Short Street. Both sag points mainly drain to the west to the Eastern Channel East catchment, although in large flood events they may also drain to the east to Alexandra Canal catchment. The stormwater network catering for the sag point near Goodsell Street drains to the west, while the stormwater network catering for the sag point near Short Street drains to the east.

Runoff in Sydney Park is generally directed away from the proposal site due to the terrain. In the vicinity of the Sydney Park cycle centre the ground drains north towards Sydney Park Road, although some runoff is likely to flow onto Sydney Park Road while some would be intercepted by underground drainage which discharges to a grassed swale to the east of the adjoining car park. From the car park runoff flows eastward and discharges to the Munni Street branch concrete channel.

4.4 Catchment characteristics

The proposal site consists of the road corridors of King Street/Princes Highway, Sydney Park Road and the intersections with local roads including Mitchell Street, Goodsell Street, May Street and Barwon Park Road and is virtually fully impervious. Adjacent areas include commercial and high-density residential properties with generally very high (greater than 90 per cent) levels of imperviousness. There are open space areas at Sydney Park, Camdenville Oval and Simpson Park which are mostly pervious, consisting of grassed and landscaped areas, and with some impervious areas consisting of carparks, paved footpaths and a limited number of buildings.

4.5 Review of existing studies

The proposal site and the surrounding area are covered by three separate flood studies. The catchment boundaries, flood study model domains and the proposal site are shown on these are described below.

4.5.1 Alexandra Canal Catchment Flood Study Model Conversion (BMT WBM, 2016) for City of Sydney

The Alexandra Canal Catchment has a total area of approximately 1,227 hectares which lies across the Local Government Area (LGA) of four Councils. The catchment area predominately falls within the City of Sydney LGA (approximately 93% of the total catchment) and this forms the Alexandra Canal study area. The remainder of the catchment is within the Bayside, Inner West and Randwick Council LGAs. The proposal site straddles the catchment boundary on its south western border.

The Alexandra Canal Catchment Flood Study Model Conversion was prepared for the City of Sydney to convert the existing catchment wide one-dimensional/two-dimensional SOBEK flood model (Cardno, 2014b) to a one-dimensional/two-dimensional TUFLOW model. Both models represent the pit and pipe stormwater network.

The SOBEK model was developed as part of The Alexandra Canal Flood Study, Floodplain Risk Management Study and Floodplain Risk Management Plan that were adopted by the City of Sydney in March 2014. It is noted that this project will not replace the current adopted studies and plan. However, the TUFLOW conversion has been developed to a technical standard to replace the SOBEK model in defining flood conditions across the catchment. It is understood that the developed TUFLOW model will be adopted as the tool for ongoing floodplain risk management in the catchment.

The catchment topography is modelled at a 2.2 metre model grid resolution based on LiDAR data from a variety of sources. In the vicinity of the proposal site, the topography data is dated 2008. Buildings and the stormwater drainage network are represented. Buildings pose an obstruction to flow and particularly in urban areas are highly influential on the overall flood flow patterns and behaviour. The date of the buildings layer in the model is not stated but comparison to historic aerial photography in the vicinity of the proposal site suggests that it is dated circa 2011. There have been several redevelopment of properties including replacement with new buildings at several properties along Sydney Park Road since 2011.

The developed models have been used to simulate a range of design flood conditions ranging in magnitude from the 2-year ARI event up to the Probable Maximum Flood. Design rainfall and hydrologic procedures were based on Australian Rainfall and Runoff 1987, "ARR 1987" (IEAust, 1987).

The design results have been summarised in a flood mapping series providing the peak flood level, depth and velocity and distributions across the catchment. Additional mapping has been provided for hydraulic categorisation and provisional flood hazard for relevant flood planning events. In addition to the design event mapping, the model conversion study included simulation of a number of potential climate change scenarios. These model simulations considered the change in catchment flood behaviour in response to increased rainfall intensity and sea level rise influencing water levels in the tidally influenced reaches of Alexandra Canal.

The City of Sydney Alexandra Canal TUFLOW model best defines flooding conditions for the Sydney Park Road portion of the proposal site, in addition to identified construction compound sites along Alexandra Canal.

Figure 4-1 Existing flood model extents

4.5.2 Alexandra Canal Flood Study (WMAwater, 2017) for Inner West Council

This flood study was conducted for the former Marrickville Council (now part of the amalgamated Inner West Council) for the portion of Alexandra Canal catchment which falls within that local government area. The purpose of this Flood Study is to identify local overland flow as well as mainstream flow and define existing flood liability. This objective is achieved through the development of a suitable model that can also be used as the basis for a future Floodplain Risk Management Study and Plan for the study area, and to assist Inner West Council when undertaking flood-related planning decisions for existing and future developments.

At the commencement of this flood study, the Australian and NSW State Government were in the process of undertaking design and approval for the WestConnex project. Due to the project currently being in the detail design stage at the time of the study, the St Peters Interchange and associated construction works were not included in the flood study.

The flood study developed a TUFLOW hydraulic model to define design flood behaviour for the 50% AEP, 20% AEP, 10% AEP, 5% AEP, 2% AEP and 1% AEP design storms (based on ARR 1987) and the Probable Maximum Flood (PMF) in the Alexandra Canal catchment. The catchment topography is modelled at a 2 metre model grid resolution based on LiDAR data dated 2013. Buildings and the stormwater drainage network are represented. Building outlines in the model are consistent with aerial photography dated 2018, with exception of around the WestConnex St Peters interchange site, although these would not affect modelled flood behaviour in the proposal site.

Mapping and description of flood behaviour are provided in terms of design flood levels, depths, velocities, flows and flood extents, provisional hydraulic categories and provisional hazard categories, and other outputs for flood planning and emergency management purposes. The study also assessed the sensitivity of flood behaviour to potential climate change effects such as increases in rainfall intensities and sea level rise.

This flood study best describes the flooding conditions in the southern section of the Princes Highway portion of the proposal site, to the south of Barwon Park Road.

4.5.3 EC East Subcatchment Management Plan – Flood Study (Golder, 2010) for Inner West Council

This flood study was conducted for the former Marrickville Council (now part of the amalgamated Inner West Council) for the Eastern Channel East (ECE) sub-catchment as a part of a holistic sub-catchment management plan for the catchment. In the vicinity of the proposal site the model domain extends from the Princes Highway, which straddles the catchment boundary on its south eastern border, and westwards to the sub-catchment outlet at the Sydney Water Sydenham stormwater pit. The overall sub-catchment area is 131 hectares.

The flood study developed a TUFLOW hydraulic model to define design flood behaviour for the 39.35% AEP (2 year ARI), 18.93% AEP (5 year ARI), 10% AEP and 1% AEP design storms (based on ARR 1987) and the Probable Maximum Flood (PMF). The catchment topography is modelled at a 2 metre model grid resolution based on LiDAR data dated 2007. Buildings and the stormwater drainage network are represented. Buildings are presumed to be based on information circa 2008 – 2010, which appears to be consistent with current (2020) conditions.

Mapping and description of flood behaviour is provided in terms of design flood levels, depths, velocities and flood extents and provisional hazard categories. The study also assessed the sensitivity of flood behaviour to potential climate change effects such as increases in rainfall intensities and sea level rise.

This flood study best describes the flooding conditions in the northern section of the Princes Highway portion of the proposal site, to the north of Barwon Park Road.

4.5.4 Erskineville Flood Safe Concept Design Report – Draft (ENsure, 2020)

The ENsure design joint venture (consisting of Jacobs and GHD) is in the process of developing a concept design for the Erskineville Flood Safe project, which has the objective of reducing the existing and future flood risk and to facilitate urban redevelopment of the Ashmore Precinct, in the vicinity of Ashmore Street and Mitchell Road, Erskineville. This would be achieved by developing a concept design that improves conveyance of stormwater from the Ashmore Precinct and surrounding area into the existing trunk main and ultimately discharges into the Alexandra Canal. This drainage upgrade project is essentially a further development of the flood risk mitigation measure FM6 recommended in the Alexandra Canal Floodplain Risk Management Study and Plan (Cardno, 2014) discussed in Section 3.3.2.

As a part of the concept design development, WMAwater (2019) were engaged to undertaken flood hydraulic modelling to optimise the design option. The modelling was generally based on the Alexandra Canal Catchment Flood Study Model Conversion (BMT WBM, 2016) (refer Section 4.5.1) and updated including to ARR 2019 design rainfall and procedures. The flood modelling indicated that ARR 2019 flood levels were over 0.3 metres lower in the Coulson Street low point, and around 0.1 metres lower in Sydney Park Road, in the 1% AEP event.

The preferred concept design option is "Option 6" which consists of new hydraulic transition structures at Coulson Street and Euston Road to improve hydraulic efficiency and enable new pipe drainage junctions, and a new inlet structure in Coulson Street. Option 6 initially included new trunk drainage lines in Mitchell Street and Sydney Park Road, crossing the proposal site, but these were ultimately excluded due to constraints assessment.

The modelling by WMAwater (2019) indicated Option 6 would reduce flood levels in the Ashmore Precinct by 0.3 metres and Coulson Road low point by about 0.1 metres. There were not reductions in flood levels in Sydney Park Road. Flood modelling data was not available for this King Street Gateway flooding assessment.

4.6 Flooding conditions

The flood depths for existing conditions, as defined by the existing flood studies described in Section 4.4, are mapped on Figure 4-3 for the 1% AEP event and Figure 4-4 for the probable maximum flood event. The City of Sydney flood model results are presented on the flood maps. The Erskineville Flood Safe project, which would provide improvements to flooding around the proposal site, has not yet been implemented and therefore is not presented for existing conditions.

While the flood modelling undertaken for those studies in some cases reflects previous development conditions (old building footprints), the flood behaviour shown by the models is expected to be indicative of the flood behaviour with current development conditions. Similarly, although the previous flood studies were based on ARR 1987, the flood behaviour is also expected to be indicative and similar to design flooding conditions if these were defined using the current ARR 2019 design rainfall and guidelines.

Flooding in the proposal site is considered to be minor, although there are areas of more significant flooding adjacent to the proposal site. These are discussed below in three separate sections of the proposal site, subdivided based on the catchment boundaries and flood model domains.

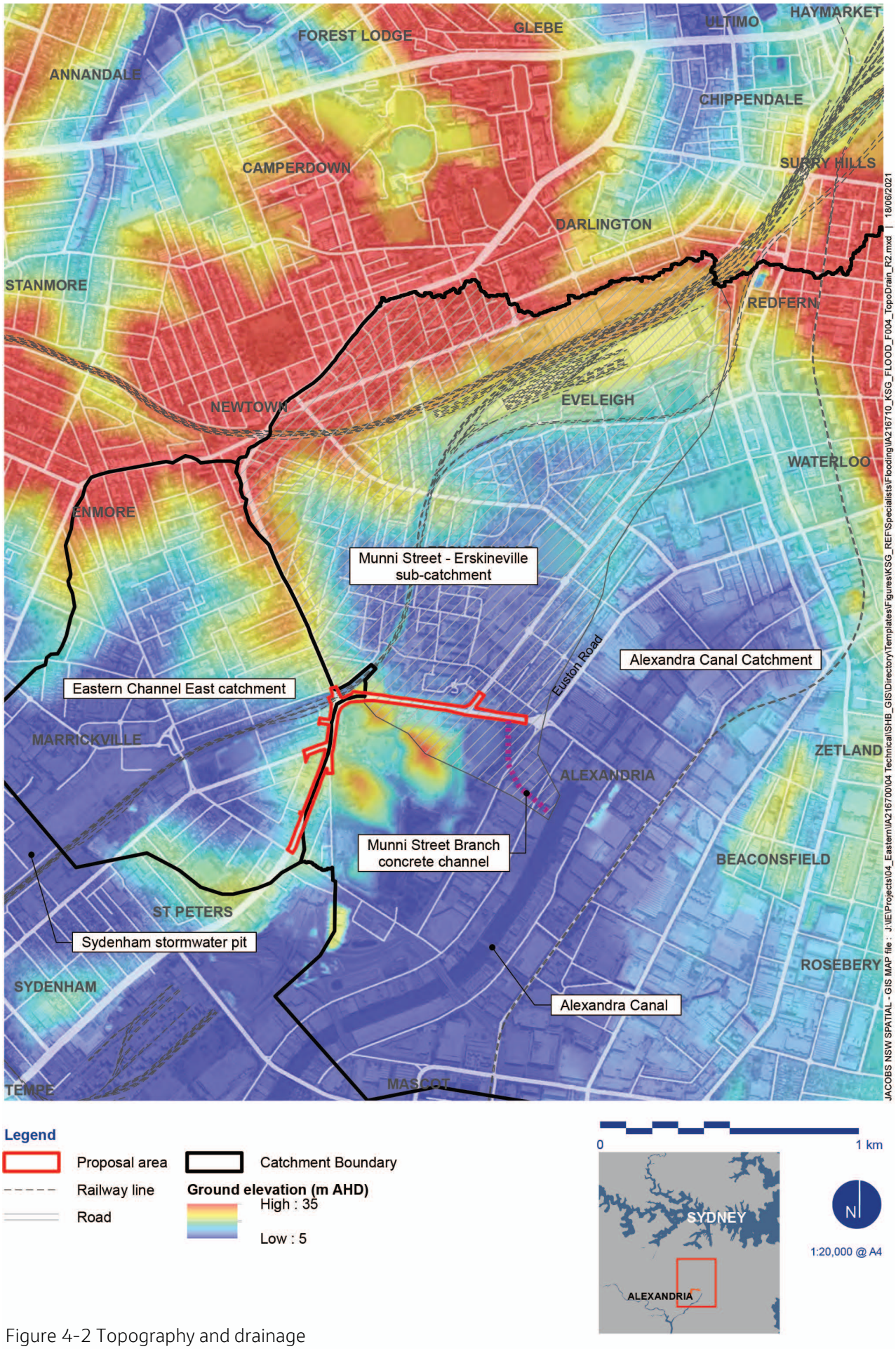

Figure 4-2 Topography and drainage

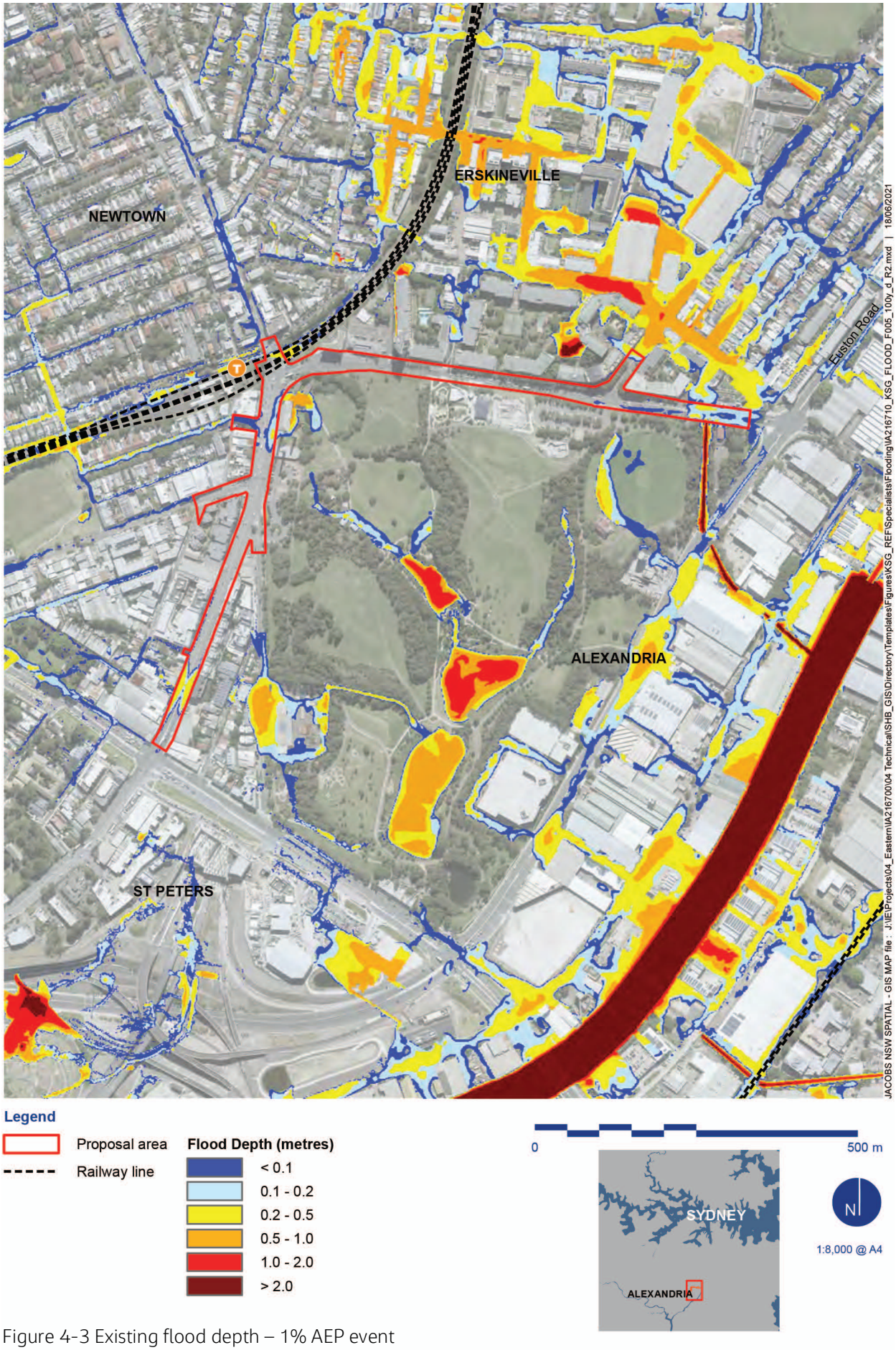

Figure 4-3 Existing flood depth – 1% AEP event

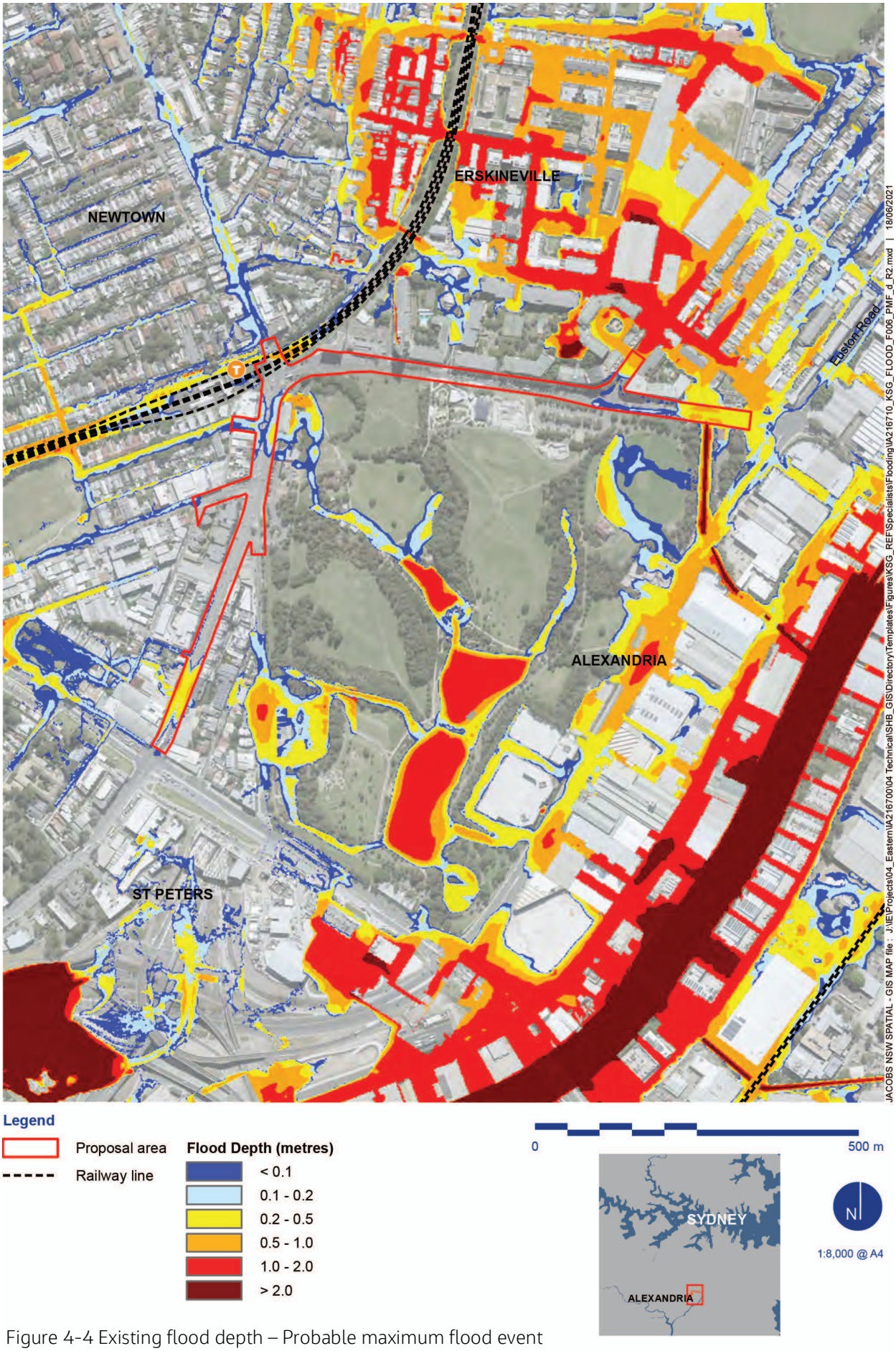

Figure 4-4 Existing flood depth – Probable maximum flood event

4.6.1 Sydney Park Road

Most of Sydney Park Road is within the Munni Street branch sub-catchment of the Alexandra Canal catchment. Flood depths reach 0.4 metres in the 1% AEP event and 0.6 metres in the probable maximum flood in the Sydney Park Road sag point at the Munni Street branch crossing, caused by ponding floodwaters which are low velocity. The property on the northern side of the road has recently been redeveloped and floor levels appear to be raised above the 1% AEP flood level.

To the west, the flood mapping indicates runoff generated in Sydney Park flow onto Sydney Park Road, with depths of flow in the road to 0.1 metres in the 1% AEP event and 0.15 metres in the probable maximum flood. While the rest of Sydney Park Road is not shown as flood-affected, it is expected that there would be flows in the road gutters which are comprised mainly of runoff from the road surface and adjoining areas. The road drainage system runs east and drains to the Munni Street branch concrete channel.

Adjacent to the sag point, flood depths reach up to 1.3 metres in the 1% AEP event and two metres in the probable maximum flood in Coulson Street (about 170 metres north of Sydney Park Road), due to a low point in the topography. Flood flows have low velocity in this area. The floodwaters flow over Sydney Park Road at the sag point to the area to the south.

To the south, floodwaters in the PMF are generally confined to the Munni Street branch concrete channel with depths of over two metres and high velocities of two metres per second in the channel. There are shallow depths of flooding on the eastern bank of the concrete channel in the probable maximum flood to depths of 0.2 metres.

4.6.2 Princes Highway/King Street north of Barwon Park Road

This northern section of the Princes Highway/King Street section of the proposal site falls within the Eastern Channel East catchment. Runoff to the sag point near Goodsell Street is generated mainly in the roadways, including the far western end of Sydney Park Road, King Street south of the railway bridge and Princes Highway/King Street north of Barwon Park Road, in addition to the north western corner of Sydney Park.

Floodwaters pond to depths of 0.2 metres in the 1% AEP event and 0.3 metres in the probable maximum flood on both sides of the highway. On the eastern side of the highway the buildings on the Sydney Park former brickworks heritage site are affected by flooding up to depths of 0.8 metres in the 1% AEP event and up to one metre in the probable maximum flood, particularly on the eastern side of the buildings. Most of the floodwater is from runoff from the park, which overflows into the sag near Goodsell Street. On the western side of the buildings, flood depths are up to 0.15 metres in the 1% AEP event and 0.2 metres in the probable maximum flood.

On the western side of the highway, the sag overflows into Goodsell Street. Shallow floodwaters of up to 0.1 metres 1% AEP event affects commercial buildings on the corner of the western side of the highway and Goodsell Street, with possible shallow (less than 0.1 metres depth) above-floor flooding in the 1% AEP event. Depths are up to 0.25 metres in the probable maximum flood.

Goodsell Street forms an active overland flow path with reports by residents of flows to depths of up to 0.2 metres in the road, footpath and yards of properties in historic storm events. This flood behaviour is confirmed with Council's flood modelling and mapping with depths of up to 0.3 metres in the 1% AEP event. There is no underground drainage system in Goodsell Street. The existing Princes Highway pipe drainage system discharges via a headwall into the gutter at the eastern end of Goodsell Street, with the pipe flows combining with road surface flows to form the overland flooding in Goodsell Street. King Street also contributes to minor overland flows to May Street, although the flows and flood depths are less than in Goodsell Street. The overland flows from Goodsell Street and May Street collect in Council Street, before flowing along the railway line towards the Eastern Channel East catchment outlet at Sydenham Pit.

Flooding is also shown within the portion of the proposal site which overlaps the railway corridor, although the floodwaters are on the railway itself and not on the King Street road bridge above.

4.6.3 Princes Highway south of Barwon Park Road

This southern section of the Princes Highway falls on the boundary of the Alexandra Canal catchment and Eastern Channel East catchment. Flooding in the sag near Short Street is generated in the Princes Highway roadway between Barwon Park Road and Campbell Street in addition to roof runoff from adjacent commercial buildings. The floodwaters build up to depths of 0.5 metres in the 1% AEP event in the sag. Adjacent commercial properties are likely to be affected by above-floor flooding on the ground floor. Overflows from the sag occur to depths of 0.2 metres through the yards of commercial properties towards the west into the Eastern Channel East catchment. The sag is drained by a stormwater pit and pipe network, which runs southward to Campbell Street and then east along Campbell Street, discharging to the Alexandra Canal.

The flood mapping indicates flooding to depths of 0.9 metres in the 1% AEP event and 1.1 metres in the probable maximum flood in the sag point in Barwon Park Road, 120 metres east of the proposal site. This sag point receives runoff from the Barwon Park Road corridor up to the Princes Highway intersection to the north and up to the Campbell Street intersection to the south, and from the commercial and residential properties between Princes Highway and Barwon Park Road to the west, and parts of Sydney Park Road to the east. The sag is drained by pit and pipe towards Campbell Street, and overland through Sydney Park.

5. Potential impacts

5.1 Assessment of operational phase impacts

5.1.1 Features of design with potential flood effects

Key aspects of the proposed design which have the potential to affect flooding conditions include:

- Changes to road profiles due to reduction in carriageway width, modifications to road intersections and other traffic arrangements and widening of footpaths
- Modifications to road drainage infrastructure.

The potential for flood impacts relating to these aspects are discussed below.

5.1.2 Potential flood impacts due to road profile changes

The road profiles in Sydney Park Road and King Street/Princes Highway are expected to change from changed alignments of kerbs, gutters and central medians, in addition to minor changes in road and footpath finished levels (typically less than 0.1 metres). These modified road profiles are expected to result in negligible changes in flood levels and depths in the roadways due to the minor nature of the road changes and the magnitude of overland flows in general. Flood impacts resulting from the proposal to properties adjoining the proposal site are expected to be negligible.

Overland flows cross the proposal site, from the Coulson Street low point over Sydney Park Road and into Sydney Park and Munni Street concrete channel, particularly in large flood events including the 1% AEP event and up to the probable maximum flood. Changed road profiles, including raising of road surfaces and medians, have the potential to increase the overflow level and hence raise upstream flood levels. The design road cross section at the sag point is shown on Figure 5-1, which indicates that the high point in the cross section, which controls the overflow level in all floods, rises by 25 millimetres from 7.807 metres AHD to 7.832 metres AHD. This is considered a minor increase in levels and hence the flooding impact is expected to be negligible. Note that the recent residential development adjacent to the sag point, which was not represented in the City of Sydney flood modelling, impedes flows across this sag point and reduces the potential flood impact borne by the proposal.

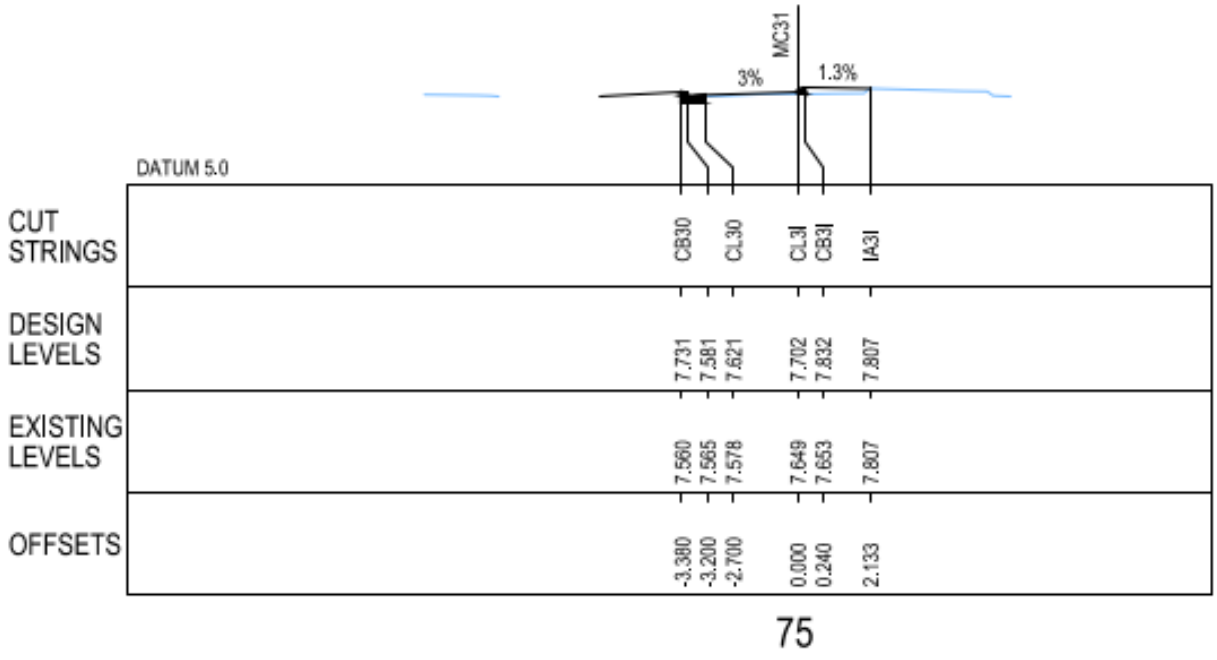

Figure 5-1 Existing and proposed road cross section at Sydney Park Road sag (Munni Street branch crossing)

Construction of the proposal itself including roadworks and drainage works is not expected to have worse influence on flooding conditions than expected in the operational phase, during which impacts of the proposal on existing flooding conditions are considered negligible.

5.2 Cumulative impacts

An assessment of the cumulative impacts to flooding from the combination of the proposal and other developments was undertaken. The catchments in which the proposal site is situated are fully urbanised. Any new or proposed developments including the Ashmore Precinct urban redevelopment in Erskineville would not increase the catchment imperviousness from the existing fully developed condition and hence are not expected to result in any flooding impacts due to increased levels of development and resultant increased runoff.

Improvements to flooding in the Munni Street sub-catchment, including the Coulson Street low point, are expected from the proposed Erskineville Flood Safe project. The minor nature of drainage changes from the King Street Gateway proposal are not expected to affect the flooding improvements from the Erskineville Flood Safe project.

The WestConnex project and associated surface road upgrade projects including Euston Road and Campbell Street are located downstream of the King Street Gateway proposal site. Given the minor nature of drainage changes and individual flooding impacts from the King Street Gateway proposal it is expected that the proposal will not materially contribute to any cumulative impacts in combination with WestConnex.

5.3 Consideration of climate change impacts

Future climate change may have impacts on flooding conditions due to increased rainfall intensity during storm events and due to sea level rise. The resultant increased flooding may change the impacts on flooding borne by the proposal.

Interim climate change factors from ARR 2019 indicate that by the year 2090, storm rainfall intensities are projected to increase by approximately 20%. The generally shallow flooding in and around the proposal site is expected to increase by a minor increment in depth only. Flood depths in significant flood problem areas in the vicinity of the proposal site, including the Coulson Street low point and the Barwon Road Park low point may increase by a similar proportion to the rainfall intensity increase, that is, by about 20% or by up to 0.2 metres in the 1% AEP event. This is confirmed by sensitivity testing undertaken by BMT WBM (2016) for Alexandra Canal for the 1% AEP event as shown on Figure 5-2.

Given the proposed minor changes in road profiles and drainage arrangements, it is not expected that the negligible flooding impacts resulting from the proposal in the existing climate conditions would be significantly worsened in a future climate change scenario.

Sea levels are projected to rise by 0.9 metres by the year 2100 based on research by the Intergovernmental Panel on Climate Change (IPCC) and as refined for the Australian region. The proposal site has a minimum elevation of 8 metres AHD and flooding in the immediate vicinity of the site is expected to be insensitive to the effects of sea level rise. Sensitivity testing by BMT WBM (2016) for the Alexandra Canal for the 1% AEP flood event, as shown on Figure 5-3, indicates that while flood levels increase within the Alexandra Canal waterway by over 0.3 metres in response to future sea level rise, these impacts do not affect the proposal site and hence would not worsen the negligible flooding impacts resulting from the proposal in the existing climate conditions.

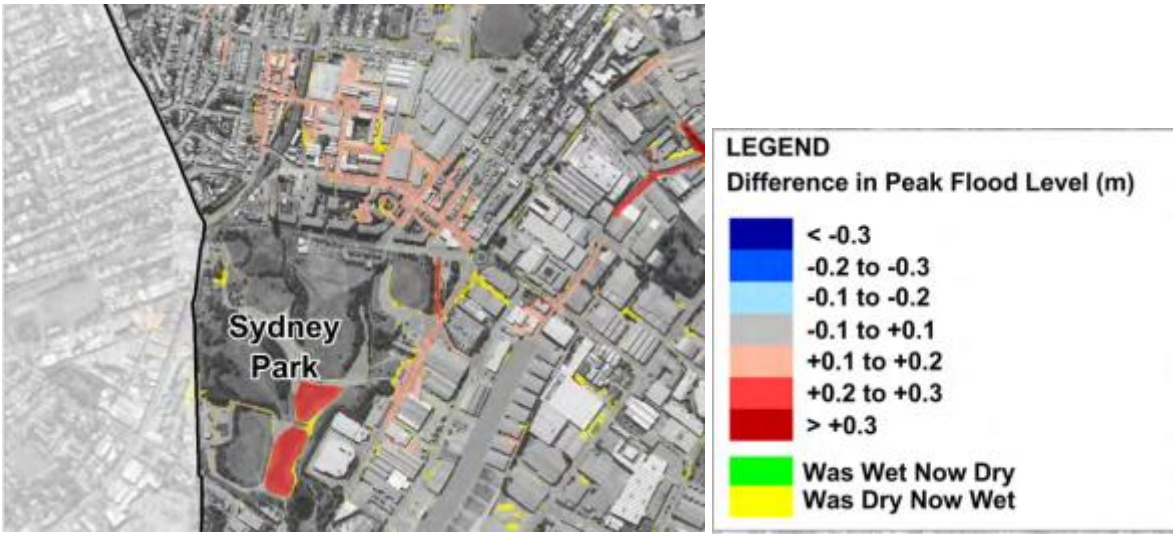

Figure 5-2 Change in 1% AEP flood levels with climate change (20% increase in rainfall intensity).

Source: Figure B-2 in BMT WBM, 2016.

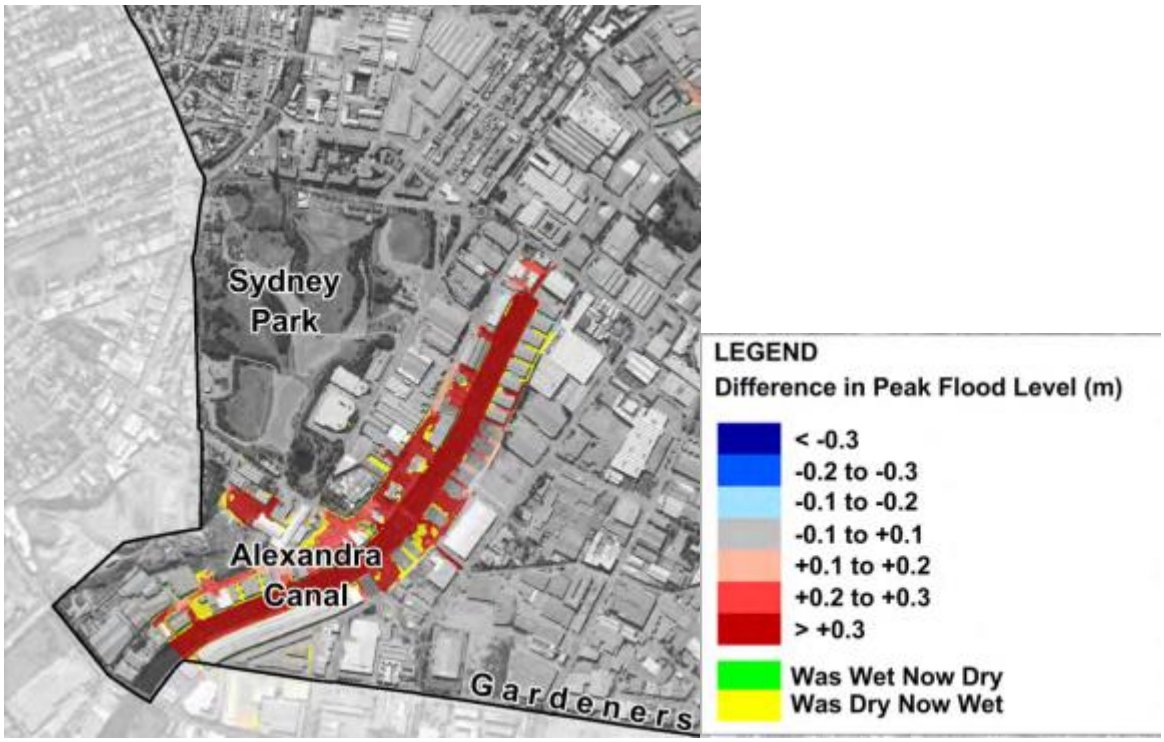

Figure 5-3 Change in 1% AEP flood levels with climate change (0.9 metre sea level rise).

Source: Figure B-2 in BMT WBM, 2016.

6. Mitigation and management measures

6.1 Management of flood impacts from the proposal

Based on the detailed design of the proposed King Street Gateway upgrade and assessment of the potential operational and construction phase impacts to flooding, it is expected that the flooding impacts resulting from the proposal would be negligible. This is due to the generally minor changes in road profiles and geometry and to drainage infrastructure, in relation to the drainage patterns and overland flooding behaviour in and around the proposal site. Existing overland flow patterns would be maintained.

While several flood problem areas are present in the vicinity of the proposal site, it is anticipated that there would not be significant changes to existing flood behaviour. Therefore, no mitigation measures are proposed to manage the effects on existing flooding resulting from the proposal.

The proposed construction compound sites at 12-18 Burrows Road, St Peters, and 1 – 3 Venice Street, Mascot have a minimum flood immunity (i.e. remains flood free) of a 2% AEP event. The St Peters site is partly affected by the 1% AEP flood on its lower portion of the site. Temporary stockpiles, which have potential to cause obstruction to flow or reduce floodplain storage, should be placed at the higher portions of the sites, if possible, to minimise the risk of potential impacts on flooding.

Should further design development result in more substantial changes to road and drainage design, it is recommended the potential for flooding impacts be reassessed and confirmed.

6.2 Management of existing flooding

While the proposal is not expected to result in any significant impacts to existing flooding conditions, in some areas the existing flooding is being contributed to by the current road drainage patterns. It is recommended that, where practical, Transport for NSW coordinate with City of Sydney Council and Inner West Council to make provisions for upgrading of drainage infrastructure to alleviate the existing flooding issues.

7. Conclusions and recommendations

7.1 Conclusions

A flooding assessment of the proposed King Street Gateway project has been undertaken, involving desktop review of existing flood studies covering the proposal site and surrounding catchment areas, in conjunction with review of the detailed design of the proposal. The assessment characterises the existing catchment and drainage conditions, considers the existing flooding issues in and around the proposal site including the occurrence of historic flooding problems, and provides a qualitative assessment of likely flooding impacts resulting from the proposal.

The assessment finds that there are not expected to be any significant impacts to existing flooding conditions resulting from the proposal, due to the generally minor nature of overland flooding in the proposal site and the minor changes to road profiles and drainage conditions. It is not expected that the proposed changes to the road will result in material impacts to flood flows which are currently conveyed to existing flood problem areas, nor will the proposal result in increased runoff rates or create obstruction to existing overland flows. Construction phase and cumulative impacts to flooding in combination with other development in the catchment areas are not expected to be significant. In relation to construction compounds, temporary material stockpiles, which have potential to cause obstruction to flow or reduce floodplain storage, should be placed at the higher portions of the sites, if possible, to minimise the risk of potential impacts on flooding. Any flooding impacts resulting from the proposal are not expected to be worsened as a result future climate change effects of increased rainfall intensity or sea level rise.

Given the assessment that there are expected to be only negligible impacts to flooding, no specific mitigation measures are proposed to manage the flood impacts resulting from the proposal.

7.2 Recommendations

1) Should further design development result in more substantial changes to road and drainage design, it is recommended the potential for flooding impacts be reassessed and confirmed.
2) While the proposal is not expected to result in any significant impacts to existing flooding conditions, in some areas the existing flooding is being contributed to by the current road drainage patterns. It is recommended that, where practical, Transport for NSW coordinate with City of Sydney Council and Inner West Council to make provisions for upgrading of drainage infrastructure to alleviate the existing flooding issues.
3) For temporary use of the ancillary sites provision of appropriate site drainage requirements to convey overland flows around the sites should be implemented. Sites should be graded (or facilities erected) to a minimum ground level of 2.7m AHD, which includes an appropriate freeboard (0.5m).

8. References

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