Kulcher Pty Ltd

Concord West - Stormwater and flood management strategy
Flooding and Water Sensitive Urban Design Report

Item 3 - Attachment E - Stormwater and Flood Management Strategy

March 2021

Executive summary

Kulcher have engaged GHD to undertake flooding investigations and provide engineering advice for the incorporation of flood mitigation measures and water sensitive urban design features into the Concord West North Precinct Plan, also referred to as Victoria Avenue Precinct or “Parkside” in marketing material for the proposal. The proposed precinct plan is discussed in detail in the Parkside Urban Design Report, prepared by Dickson Rothschild.

This report forms part of the documentation submitted to the City of Canada Bay Council to support the proposal to rezone land within the Concord West North Precinct

This report provides a review of the existing flood behaviour across the Concord West North Precinct based on flood modelling undertaken by others for Council. Potential flood impacts of the redevelopment of the Precinct and concept flood mitigation options have been identified. This report outlines mitigation measures, primarily through an increase in the capacity of the existing drainage network, that will reduce these potential impacts on flood levels and flows within the Precinct and surrounding areas, decreasing overall flood risk.

Flood evacuation planning for the precinct will involve evacuation to flood free areas within the precinct, with flooding during longer term events requiring taking mapped routes to the regional flood evacuation centre within the Homebush precinct.

The management of stormwater, through integration of water sensitive urban design measures into the development, is discussed in this report. The use of rainwater tanks to harvest stormwater, and street trees throughout the precinct, watered by passive irrigation and harvested rainwater, will manage the impact of increased development density. These measures have been developed in consultation and collaboration with landscape and architectural measures proposed for the precinct. The management of water is key in the incorporation of vegetation within the precinct, which is driven by liveability and urban heat island reduction outcomes.

The developed scenario water quality modelling indicates that the precinct layout shown on the Urban Design Report will incorporate water cycle management features able to meet pollutant removal targets.

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1. Introduction

1.1 Concord West North Precinct

1.1.1 Background

Kulcher have engaged GHD to undertake flooding investigations and provide engineering advice for the incorporation of water sensitive urban design features into the Concord West North Precinct Plan, also referred to as Victoria Avenue Precinct or “Parkside” in marketing material for the proposal. The proposed precinct plan is discussed in detail in the Parkside Urban Design Report, prepared by Dickson Rothschild.

This report forms part of the documentation submitted to the City of Canada Bay Council to support the proposal to rezone land within the Concord West North Precinct from R2 Low Density Residential and IN1 General Industrial to R4 High Density Residential and B1 Neighbourhood Centre with a revised Height of Building and Floor Space Ratio (FSR).

The Concord West North Precinct (referred to as the Precinct) proposed for rezoning and the subject of this report is shown in Figure 1-1. The Concord West North Precinct is part of the overall Concord West Precinct, which is the subject of separate investigations. The site is located within the City of Canada Bay (Council) Local Government Area.

The precinct drains predominantly from east to west, with flow crossing the elevated embankment of Homebush Bay Drive through culverts. The main flowpath is the vehicular underpass on Victoria Avenue, draining to Powells Creek approximately 150 metres to the west of Homebush Bay Drive. Powells Creek discharges to Homebush Bay approximately 800 metres to the north of the site.

The rezoning and redevelopment of the Precinct will impact on flood behaviour by:

- Increasing the building footprint area, reducing floodplain storage of areas inundated by floodplain storage and blocking existing overland flow paths.
- Increasing the percentage imperviousness of the area.
- Raising ground levels and floor levels, required to mitigate flood risk.

This report provides a review of the existing flood behaviour across the Concord West North Precinct based on flood modelling undertaken by others for Council. Potential flood impacts of the redevelopment of the Precinct and concept flood mitigation options have been identified. This report outlines mitigation measures that will reduce these potential impacts on flood levels and flows within the Precinct and surrounding areas, decreasing overall flood risk.

These flood impacts will be managed, along with management of stormwater runoff generated by the development of the Precinct, in order to provide beneficial development outcomes.

The management of stormwater, through integration of water sensitive urban design measures into the development, is discussed in this report. The use of rainwater tanks to harvest stormwater, and street trees throughout the precinct, watered by passive irrigation and harvested rainwater, will manage the impact of increased development density. These measures have been developed in consultation and collaboration with landscape and architectural measures proposed for the precinct. The management of water is key in the incorporation of vegetation within the precinct, which is driven by liveability and urban heat island reduction outcomes.

Data Disclaimer

** Insert text as required by data custodian **
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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Kulcher Pty Ltd
Concord West North Precint
Flooding and Water Sensetive Urban Design Report

Concord West North Precinct
Location

Project No. 22-12534237
Revision No. -
Date 25/02/2021

FIGURE 1-1

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Data source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: hkosari

1.1.2 Previous investigations

There have been two investigations into flood behaviour for the Concord West Precinct, a study by Jacobs in 2015, with an update to this investigation by Arcadis in 2018.

Concord West Precinct Master Plan Flood Study by Jacobs in 2015

The Concord West Precinct Master Plan Flood Study prepared for Council by Jacobs in 2015 involved a flood study and development of a concept design for flood mitigation measures based on Council's 2014 Draft Concord West Precinct Master Plan.

The Jacobs Flood Study utilised existing hydrologic and hydraulic models of the area as well as additional information to build a TUFLOW flood model of the Concord West Precinct. The model includes the entire catchment of the Concord West North Precinct and incorporated the pit and pipe drainage network. This model has been utilised for the preparation of this report and is discussed in Section 4.

Concord West Precinct Flood Report by Arcadis in 2018

The report by Arcadis in 2018 provided a review of the existing flood behaviour across the Concord West Precinct based on the current publicly available information, comprising almost entirely of information in the Jacobs investigation.

Potential flood impacts of the rezoning and concept flood mitigation options were identified by Arcadis, based on the Jacobs report. Flood related development controls from the City of Canada Bay were discussed, along with recommendations for further investigations of flood mitigation options.

The Arcadis report did not undertake any modelling or provide additional technical guidance on flooding in the Concord West Precinct, other than by references to the Jacobs study.

Powells Creek investigations

Several investigations into flooding within Powells Creek catchment have also been assessed for this investigation, including:

- DRAINS hydrologic model for local catchments on the eastern side of Powells Creek, developed for the North Strathfield Rail Underpass (NSRU) flood impact assessment and drainage design (SKM/Jacobs, 2012).
- TUFLOW flood hydraulic model of Powells Creek and Saleyards Creek downstream of Parramatta Road, developed for the NSRU flood impact assessment and drainage design (developed by SKM/Jacobs and WMAwater, 2012).
- *Parramatta River Estuary Data Compilation and Review Study* (2008) by Cardno Lawson Treloar.
- Powells Creek ILSAX hydrologic model from the *Powells Creek and Saleyards Creek Flood Study* (Webb McKeown & Associates, 1998), prepared for Strathfield Municipal Council.

1.2 Purpose of this report

The purpose of this report is to provide technical support for the flooding, drainage and water sensitive urban design aspects of the proposal to rezone land within the Concord West North Precinct. This report outlines measures to be incorporated into the masterplan and development controls.

1.3 Scope and limitations

This report has been prepared by GHD for Kulcher Pty Ltd and may only be used and relied on by Kulcher Pty Ltd for the purpose agreed between GHD and the Kulcher Pty Ltd as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Kulcher Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the date of preparation of the Report. GHD has no responsibility or obligation to update this Report to account for events or changes occurring subsequent to the date that the Report was prepared. Specifically, this Report does not take into account the effects, implications and consequences of or responses to COVID-19, which is a highly dynamic situation and rapidly changing. These effects, implications, consequences of and responses to COVID-19 may have a material effect on the opinions, conclusions, recommendations, assumptions, qualifications and limitations in this Report, and the entire Report must be re-examined and revisited in light of COVID-19. Where this Report is relied on or used without obtaining this further advice from GHD, to the maximum extent permitted by law, GHD disclaims all liability and responsibility to any person in connection with, arising from or in respect of this Report whether such liability arises in contract, tort (including negligence) or under statute.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Kulcher Pty Ltd and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.4 Assumptions

This investigation has been prepared on the assumption that the TUFLOW model and data files provided by Kulcher from the Jacobs 2015 flood modelling are correct and appropriate for use.

2. Precinct details

2.1 Location

The Concord West North Precinct (referred to as the Precinct or “Parkside” in marketing material for the proposal) which is subject to rezoning and the subject of this report is shown in Figure 1-1.

The Concord West North Precinct is part of the overall Concord West Precinct, which is the subject of separate investigations. The site is located within the City of Canada Bay (Council) Local Government Area.

The Precinct is bound by Concord Avenue to the north, the Strathfield to Epping rail line to the east, the bend in George Street to the south, and Homebush Bay Drive to the west, which is located on an elevated embankment.

2.2 Existing land use

The existing land use within the Concord West North Precinct is predominately residential properties and Council roadways. The existing land use within the Precinct area is primarily low density residential, with a single industrial development located at the western end of Station Avenue.

There are significant street trees within the precinct, in particular several large paperbark (*Melaleuca Quinquinervia*) located along King Street.

2.3 Existing topography and drainage

The Concord West North Precinct, shown on Figure 2-1, generally grades from east to west, with grades of approximately 3% in the higher, eastern areas of the site, adjacent to the Main North Rail Line embankment, to between 0–0.5% in the lower areas on the western edge, adjacent to the Homebush Bay Drive road embankment.

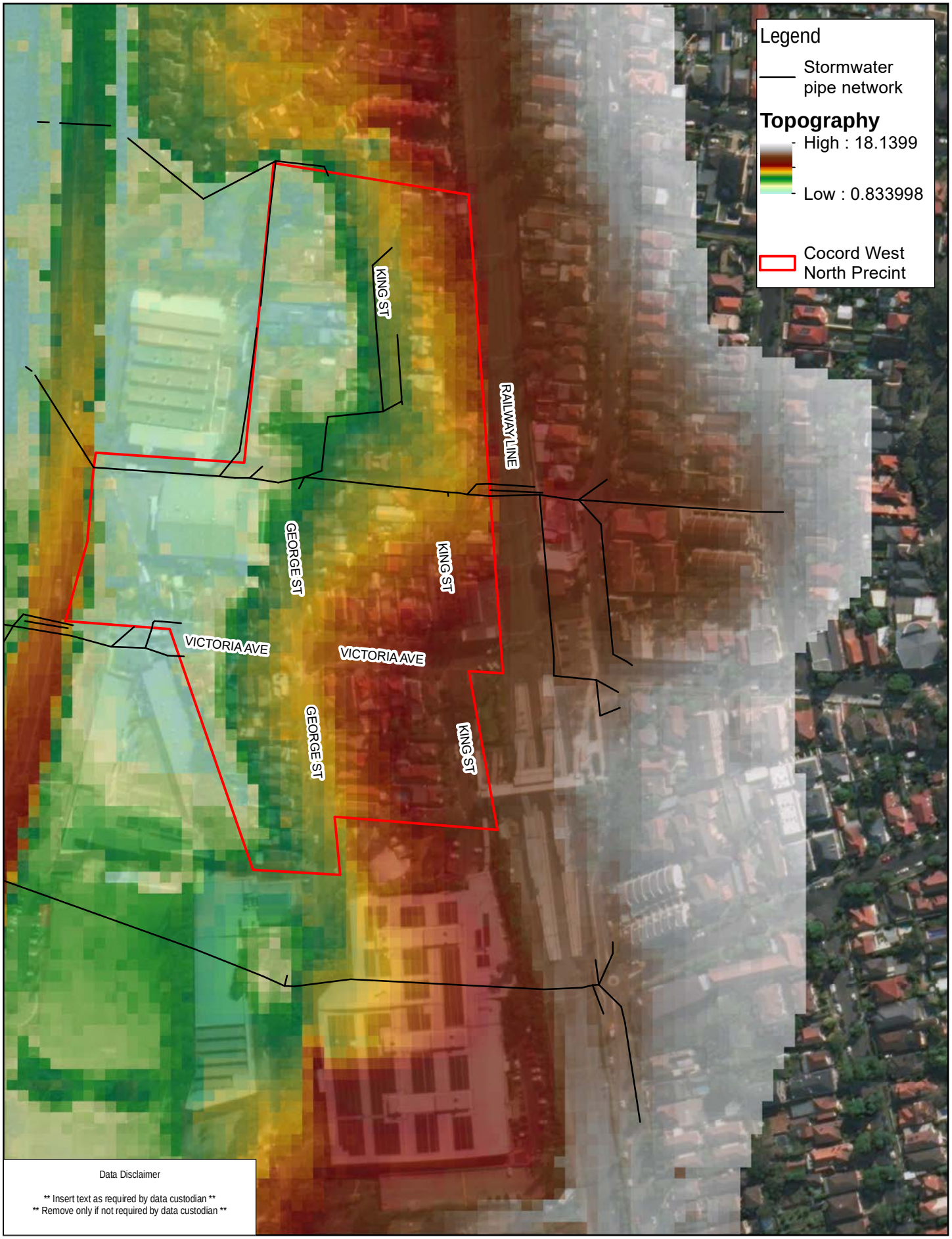
The Main North Rail Line embankment forms the eastern boundary of the site. Homebush Bay Drive forms an embankment along the western boundary of the Concord West North Precinct and is elevated several meters higher than the surrounding areas on both sides.

A small catchment upstream, to the east of the Main North Rail Line embankment, drains through the pipe network and overland by the pedestrian tunnel on Station Avenue.

Stormwater runoff from the local and upstream catchment area drains to the pit and pipe drainage network and overland to several crossings of the Homebush Bay Drive embankment.

Overland flow is typically confined to roads in the southern areas of the Concord West North Precinct, with an existing flooding situation from the trapped low point on King Street north of Station Avenue, with ponding in excess of the capacity of the piped drainage network flowing through low-lying properties along King Street. Ponding at the road sag along Victoria Avenue (immediately east of Homebush Bay Drive in front of the Community Precinct) also occurs, which is a result of overland flows from the Precinct and flood flows from Powells Creek.

The piped drainage network drains through the Homebush Bay Drive embankment, with stormwater outlets discharging to open channels and mangroves which convey flow to Powell’s Creek. Powell’s Creek drains north approximately 1.5 kilometres to Homebush Bay.



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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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GHD

Kulcher Pty Ltd
Concord West North Precinct
Flooding and Water Sensitive Urban Design Report

Topography and draingae network
EXISTING
100yr ARI

Project No. 22-12534237
Revision No. -
Date 25/02/2021

FIGURE 2-1

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Data source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: hkosari

2.4 Existing flood behaviour

Existing flood behaviour for the Concord West North Precinct is discussed in detail in Section 4.2 of this report, including a discussion of detailed flood modelling.

Development within the Concord West North Precinct is constrained by several factors relating to flooding and drainage. The downstream Homebush Bay Road embankment and associated drainage infrastructure taking flows through the embankment constrains free drainage from the Precinct. Flood evacuation routes are constrained by flooding, including routes across the Homebush Bay Drive embankment and to the south along George Street.

Discharge to Powells Creek is constrained by inundation levels within Powells Creek and Homebush Bay. Discharges to Homebush Bay, one of the most polluted waterways in Sydney, and Powells Creek are required to meet pollutant removal targets for Council, discussed in Section 5.1.

Existing street trees within the precinct are to be retained in order to meet tree canopy targets set by the proponent, Kulcher.

2.5 Proposed Concord West North Precinct development

The proponent, Kulcher, is seeking to create a new, more holistic vision for Concord West to create a healthy transit-oriented neighbourhood known as ‘Parkside’. The proposed precinct plan is discussed in detail in the Parkside Urban Design Report, prepared by Dickson Rothschild.

The rezoning proposal seeks to increase residential densities and introduce a mixed-use hub. The Concord West North Precinct is identified as a strategically important part of the Sydney metropolitan area, given its high level of public transport accessibility and its proximity to jobs, recreation, significant open space, goods and services. The proposed development of the Concord West North Precinct shown on Figure 2-2.

Figure 2-2 Concord West North Precinct proposed development (artist impression)

The rezoning of the Concord West Precinct is unlocked by a traffic solution at the intersection of Pomeroy Street and George Street, North Strathfield to the south of the precinct. The proposed upgrade improves congestion at the intersection and provides opportunities for increased housing density within Concord West.

It is estimated that the proposed redevelopment could deliver:

- Building Heights of 6-12 storeys
- Floor Space Ratios of 2:1-3.6:1
- Approximately 1,500 dwellings
- 2,300-3,000 m^2 of retail floor space with active frontages
- 4% affordable housing
- Significant public domain upgrades
- Approximately 3,000 m^2 of public open spaces in a series of pocket parks and town squares
- Improvement of overland flow and flooding impacts
- Sustainable water management by incorporation of water sensitive urban design measures
- An increase in the urban Tree Canopy from 18% to 30%

The overall suburb of Concord West, of which the Concord West North Precinct forms part, is dominated by impervious cover, with established trees providing an overall tree canopy coverage of 21.35%. The subject precinct has an existing urban canopy of approximately 18%. The tree planning strategy outlined in the proposed rezoing has been prepared to achieve a tree canopy index of at least 30%, exceeding Council's city-wide target of 25%.

This strategy involves each site contributing to the neighbourhood's tree canopy, through planting in the public domain, street trees, and in private lots. This will enhance the existing precinct while contributing to the wider locality, meeting council benchmarks. The canopy can be achieved through a combination of an integrated canopy street tree planting regime and a tree canopy target for each individual development site.

The proposed street tree planting regime at maturity should be capable of achieving a canopy cover for approximately 75% of the existing street and open space network. The private sites are to contribute 3%-15% of canopy cover depending on the site's location and role within the precinct. Most of the canopy trees should be capable of being planted in deep soil zones, but given the urban character of the precinct, tree planting on structure can also be considered in meeting the canopy index.

The Water Sensitive Urban Design (WSUD) strategy involves passive and active irrigation of street trees and trees located within private lots through irrigation of harvested rainwater. Passive irrigation of street trees, by use of tree pits and measures to direct street runoff to landscapes areas is integral to the WSUD strategy.

Street tree planting is integral to the Concord West North Precinct plan. The street tree planting strategy is to integrate streetscape improvements with WSUD and use street trees to contribute to the precinct's sense of place. Important existing trees that are to be retained in the precinct include the mature stand of Melaleuca along the northern stretch of King Street and the Casurinas around Homebush Bay Drive in the lower lying, swampier part of the area.

The proposal is to build on these existing landscape elements and introduce other natives including Spotted Gum and Boxbrush to create a mixture of street tree regimes that define the street to enhance the street tree canopy.

Street tree planting and public domain landscape are developed along the principles of WSUD. The WSUD strategy outlined in this report has been developed to make best use of the site's location, geology and flooding to develop a precinct plan that achieves the desired outcomes for liveability, and urban cooling through increased tree cover.

3. Development framework

3.1 Legislative framework

This section outlines the relevant State and Commonwealth legislation that is applicable to the planning, design and construction of the stormwater management infrastructure.

3.1.1 NSW Environmental Planning and Assessment Act 1979

This Act is the primary piece of land use and planning legislation in New South Wales. It allows for the creation, at various levels of government, of environmental planning instruments to control land use and planning. State environmental planning policies (SEPPs), regional environmental plans, Local Environment Plans (LEPs), development control plans (DCPs), and council codes and policies can all be established under Part 3 the Act.

This proposal will be assessed under Part 3 of this Act. Determination of an application for planning approval is undertaken by a 'determining authority', as the development is undertaken by the consent authority. Under Section 110 of the EP&A Act, a determining authority can be a public authority such as Council. It is possible to have more than one determining authority for an activity.

Under the EP&A Act a determining authority has a duty to consider the environmental impacts of an activity and is required to 'examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment' as a result of the activity.

3.1.2 Water Act 1912 / Water Management Act 2000

The objects of the Acts aim to provide for the sustainable and integrated management of the water sources and to apply the principles of ecologically sustainable development. The Acts set guides for the preparation of water management plans and direct the relevant water regulator in decision making. DPIE Water is a separate office within the NSW Department of Primary Industries. It is responsible for the management of the State's surface water and groundwater resources. The Office reports to the NSW Government for water policy and the administration of key water management legislation, including the Water Act 1912 and Water Management Act 2000.

3.1.3 Water Management Amendment (Controlled Activities) Regulation 2008

This Regulation of the Water Management Act 2000 replaces the Rivers and Foreshores Improvement Act 1948 from 4 Feb 2008. Under this Regulation a Controlled Activity Approval (CAA) is required from the water regulator for works within 40 metres of top of bank. This permit application is developed at the detailed design stage of these proposals and needs to outline:

- A map of the area depicting the site to be affected by the works in relation to the waterway.
- Plans indicating works to be undertaken including elevations.
- Existing condition and values of the adjoining intertidal and aquatic environment (such as seagrass, rock platforms, and sandy beaches).
- Recent photographs of the site (preferably from the water).
- Details of excavations, earthworks and/or filling, including the type of materials to be affected, i.e. soil and rock.
- The potential for disturbance of acid sulfate soils.

- The potential for disturbance of contaminated material.
- Stability assessment.
- Location of existing drainage and any alteration to drainage.
- A description of the construction methods to be used (including plant and equipment) and methods to be used to access the site.
- Vegetation and landscape plans (including details of vegetation to be retained, removed and/or planted, numbers of each species to be planted, general indication of the location of plantings).
- Methods to be employed to manage potential environmental impacts such as erosion and sediment control plans, and remedial action plans.

A controlled activity permit will be required under this regulation for works being undertaken by private developers. Works being undertaken by Council, such as mitigation measures for flooding, will not require approval under Clause 39A of which provides exemption for public authorities and local councils.

3.1.4 Fisheries Management Act 1994

This Act deals with matters related to the dredging of waterways and the reclamation of land and provides guidelines for assessing barriers to aquatic fauna movement. The Fisheries Management Act is administered by the NSW Department of Primary Industries, now part of the Department of Planning, Industry and Environment (DPIE), with the objective to 'conserve key fish habitats'.

3.1.5 Local Land Services Act 2013

This Act establish a statutory corporation, Local Land Services, with responsibility for management and delivery of local land services in the social, economic and environmental interests of the State in accordance with State priorities. The Act establishes local boards for the purpose of devolving operational management and planning functions to regional levels to facilitate targeted local delivery of programs and services. This Act commenced on 1 January 2014 and replaced the Catchment Management Authorities Act 2003 which established catchment management authorities and committees to achieve coordinated, sustainable management of natural resources on a water catchment basis.

3.1.6 Local Government Act 1993

Creates local governments and grants them the power necessary to perform their functions, among which are the management, development, protection, restoration, enhancement and conservation of the environment of the area the local government is responsible for, in a manner that is consistent with and promotes the principles of ecologically sustainable development. The Local Government (Ecologically Sustainable Development) Act 1997 amended the Local Government Act so that ecologically sustainable development, including the sustainable use of resources, is now a guiding operational principle.

The NSW Floodplain Development Manual: the management of flood liable land relates to the management of flood liable land in accordance with Section 733 of the Local Government Act.

3.1.7 Sydney Water Act 1994

The Sydney Water Act 1994 establishes a State owned corporation in relation to the supply of water, the provision of sewerage and stormwater drainage systems and the disposal of waste water in Sydney and other regions. A Section 73 Compliance Certificate is issued under Section 73 of the Act to demonstrate that a development has satisfied Sydney Water's requirements.

Powells Creek, which receives flow from the Precinct, is an asset of Sydney Water.

3.2 Flood planning context

The NSW Floodplain Development Manual: the management of flood liable land relates to the management of flood liable land in accordance with Section 733 of the Local Government Act.

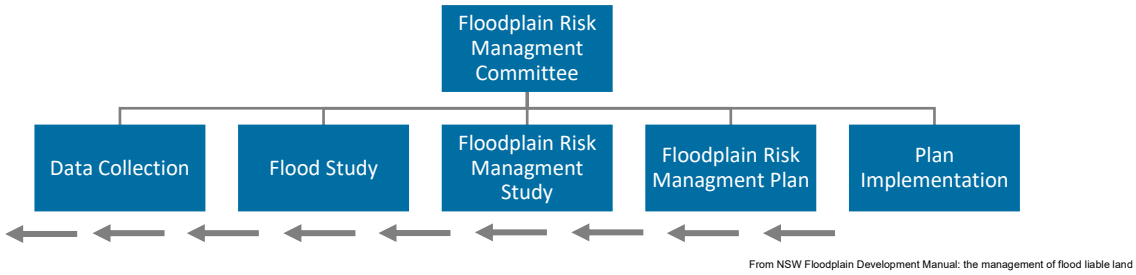


Figure 3-1 The floodplain risk management process

Data Collection: Compilation of existing data and collection of additional data.

Flood Study: Defines the nature and extent of the flood problem, in technical rather than map form.

Floodplain Risk Management Study: Determines options in consideration of social, ecological and economic factors relating to flood risk.

Floodplain Risk Management Plan: Council publicly exhibits the preferred options from the studies. The Floodplain Risk Management Plan is subject to responses and subsequent revision. Council formally approves the Plan after public exhibition.

Plan Implementation: Council undertakes measures including mitigation works, planning controls, flood warnings, flood readiness and response plans, environmental rehabilitation along with ongoing data collection and monitoring.

Drainage and flood mitigation works in the Concord West North Precinct were considered by Jacobs in the 2015 investigation, which considered flooding issues in the wider Concord West Precinct and Powells Creek. Flooding in the Concord West North Precinct results from overland flows from local catchments, along with flooding from Powells Creek.

The proposed drainage upgrade works within the Concord West North Precinct are intended to limit the impact of more frequent, local flooding on the development of the Concord West North Precinct and will not directly impact on flood planning within Powells Creek.

The objective of this design is to be consistent with the principles of Floodplain Risk Management, adopted flood policies and associated guidelines, i.e. to not result in adverse flooding impacts during flood events.

3.3 Planning context

The planning context of the Concord West North Precinct is discussed in detail in Section 2 of the Parkside Urban Design Report, prepared by Dickson Rothschild.

This section outlines the specific planning tools relating to stormwater and flooding and how they relate to this proposed Concord West North Precinct.

3.3.1 City of Canada Bay Development Control Plan

The sections of the City of Canada Bay Development Control Plan relating to flooding and drainage are listed below.

Section C7 Flooding Control

This Section establishes Council's approach to flood related development controls for the City of Canada Bay Local Government Area. Council's approach to flooding is based on the requirements of the New South Wales Government's Flood Prone Land Policy and Floodplain Development Manual discussed in Section 3.2.

Section C7 lists objectives, design principles and development controls for development for different development types within areas of varying flood risk.

Control C1 Flood Affectation states that *An Engineer's report is required to demonstrate how and certify that the development will not increase flood affectation elsewhere*. This control has been addressed by the preparation of this study.

Appendix A2 Sections

The following Stormwater Management sections of the City of Canada Bay Development Control Plan have been addressed as part of this document, including:

- Street trees A27-A32
- Stormwater Management SWM1-SWM9
- On site stormwater detention OSD1-OSD91
- Scouring, Erosion and Water Quality Control SC1-SC14
- Rainwater Re-use RR1- RR11
- Stormwater Drainage Design SW1-SW84
- Stormwater Pollution and Erosion Control SPE1-SPE7
- Water Sensitive Urban Design WSUD1-WSUD5

3.3.2 Concord West Precinct Master Plan

JBA produced a Master Plan for Canada Bay Council in 2014 for the isolated industrial sites in the Concord West Precinct.

The Master Plan was supported by the Concord West Precinct Master Plan Flood Study by Jacobs introduced in Section 1.1.2. Council outlined a piecemeal approach to development within the precinct, with individual land owners to submit planning proposals for the isolated industrial sites. Several rezoning applications have been submitted, with development underway.

4. Flooding investigations and recommendations

4.1 Objectives

The objective of the flood investigation and proposed flooding and drainage measures to be incorporated into the Concord West North Precinct is to address the requirements in the City of Canada Bay Development Control Plan, Special Precincts, Section Concord West Precinct, Section 2.15.5, Flooding which states:

Objective O19 *To mitigate potential flood impacts on new and existing development*

The control associated with this objective (C30) states that:

New development is to be consistent with the findings, conclusions and recommendations of the Concord West Precinct Master Plan Flood Study.

The proposed development is discussed in terms of these flooding objectives in Sections 4.2–4.8.

4.2 Existing flood conditions

Existing flood conditions were developed utilising the flood model developed for Council by Jacobs in 2015 as part of the Concord West Precinct Master Plan Flood Study.

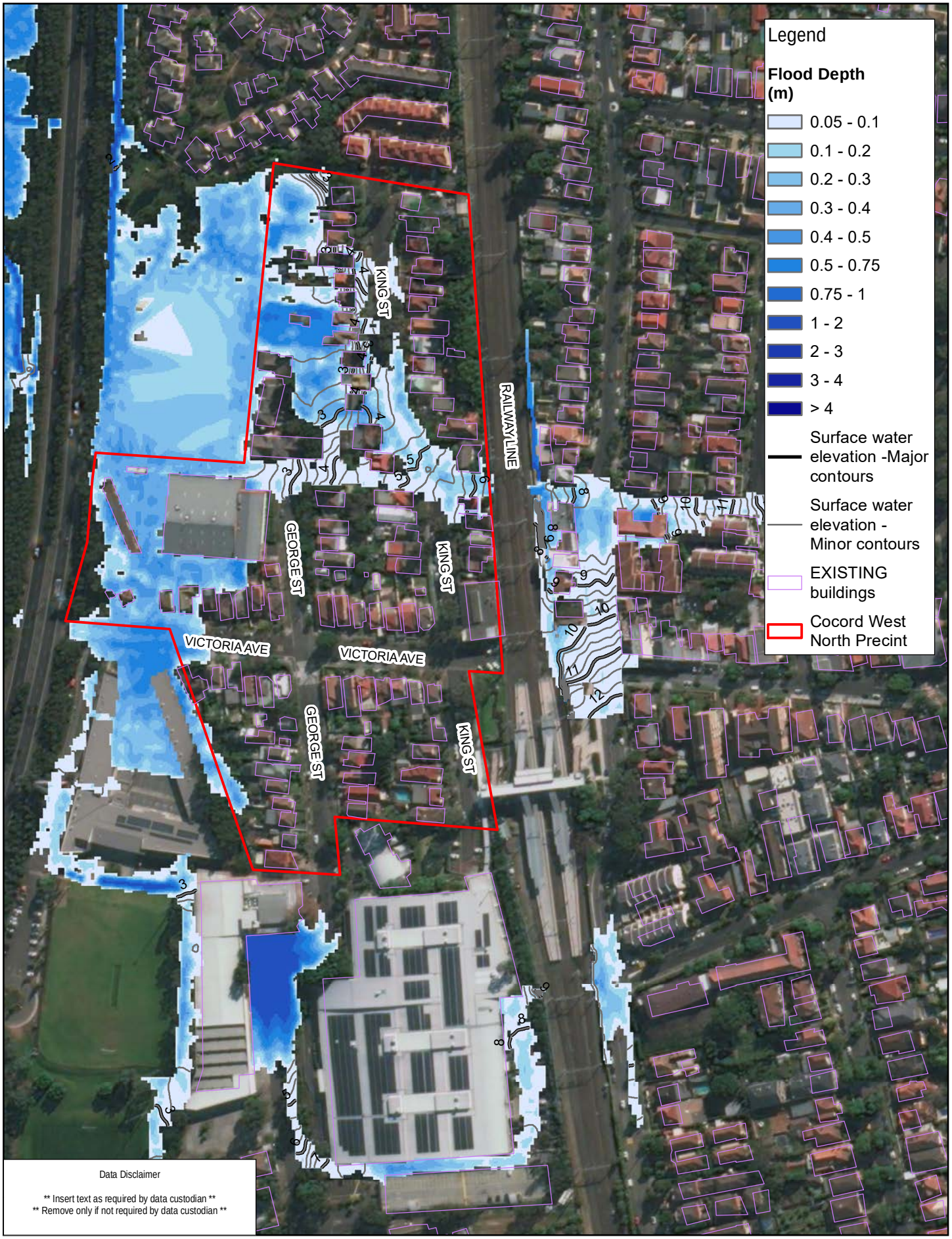
The Jacobs Flood Study utilised existing hydrologic and hydraulic models of the area as well as additional information to build a TUFLOW flood model of the Concord West Precinct. The model includes the entire catchment of the Concord West North Precinct and incorporated the pit and pipe drainage network.

This model has been utilised for the preparation of this report. The modelling for this investigation was carried out utilising the same version of the TUFLOW modelling software (Build: 2013-12-AD-iDP-w64) that was used for the Jacobs 2015 study. This approach was taken in order to achieve consistent results to the Jacobs 2015 mapping.

The modelling for this investigation utilised the same peak storm events, which are developed using the methodologies outlined in Australian Rainfall and Runoff 1987 and have not been updated to the contemporary Australian Rainfall and Runoff 2019 in order to achieve consistent results to the Jacobs 2015 mapping.

The results of the existing condition flood modelling for the 100 year Average Recurrence Interval (ARI) were modelled as the maximum peak flood levels calculated during the 25 minute and 2 hour peak storm events. The peak flood depth and elevations are presented in Figure 4-1, with flood hazard presented on Figure 4-2.

These results in Figure 4-1 and Figure 4-2 are consistent with the mapping in the Jacobs 2015 study.



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Kilometers

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Grid: GDA 1994 MGA Zone 56

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FIGURE 4-1

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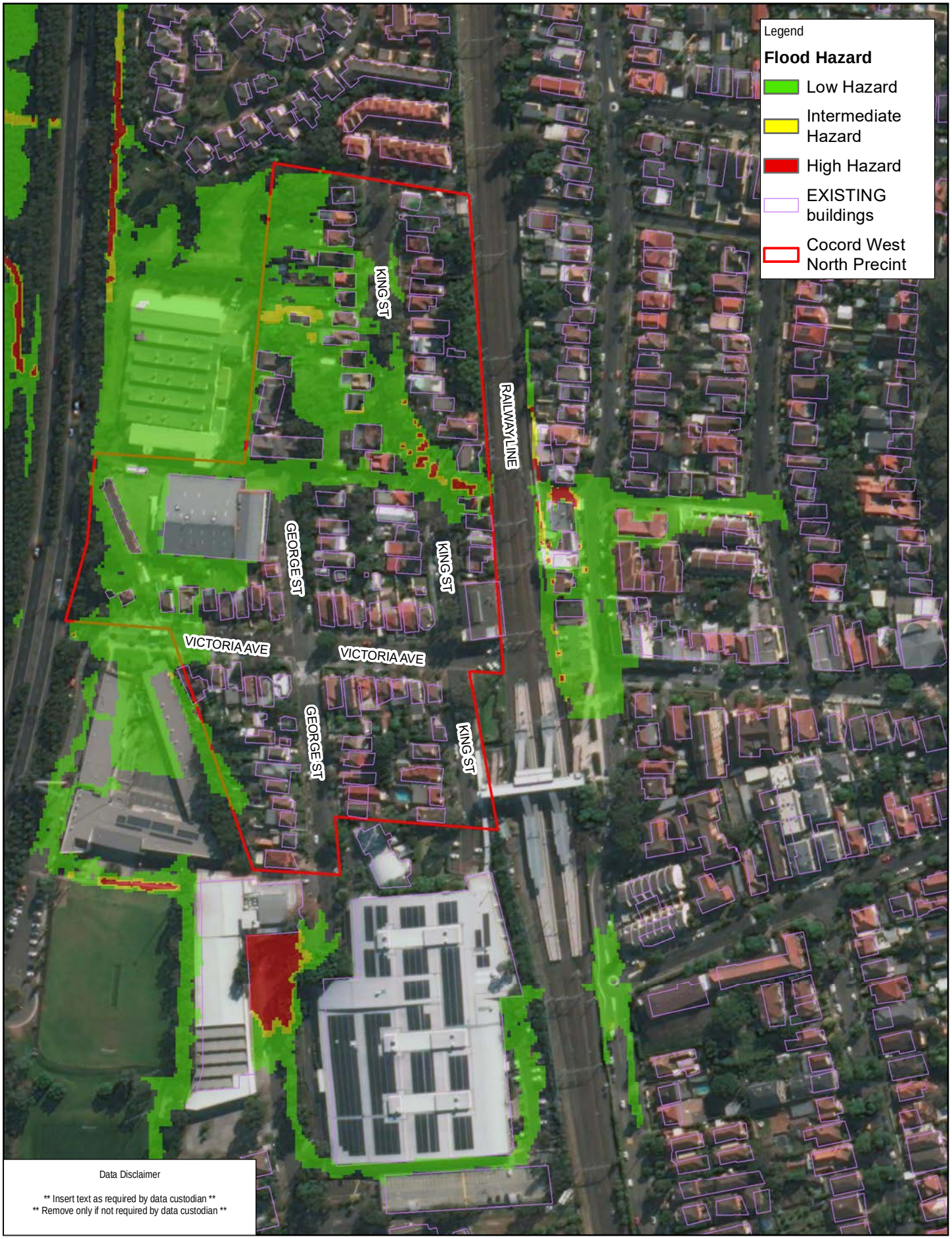

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EXISTING
100yr ARI

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FIGURE 4-2

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Data source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: hkosari

The main flooding mechanisms present in the Concord West North Precinct are summarised in Sections 4.2.1 to 4.2.3.

4.2.1 King Street north of Station Avenue

As discussed in Section 2.3, an existing overland flooding situation occurs at the trapped low point on King Street north of Station Avenue, resulting from stormwater flows draining to the Concord West North Precinct from the catchment east of the rail line. Overland flows drain to the Concord West North Precinct via the Station Avenue pedestrian underpass within the Main North Line embankment.

Along with local catchment flows, this overland flow continues to drain west along Station Avenue, flowing north along King Street, ponding at the trapped low point on King Street. Ponding in excess of the capacity of the piped drainage network flows through low-lying properties along King Street and north-west through numerous residential properties, primarily through 28A and 30 King Street. Flow through these properties on King Street ponds within the low-lying area to the east of the Homebush Bay Drive embankment.

Ponded water in this area drains out via an existing open drain to the west of the site along the Homebush Bay Drive embankment to a 2.1H x 0.9W metre box culvert under the embankment, which discharges into the mangroves to the west of Homebush Bay Drive.

4.2.2 Low lying ponding (western side of Concord West North Precinct)

Ponding occurs at the road sag along Victoria Avenue (immediately east of the Homebush Bay Drive embankment in front of the Community Precinct). This ponding is a result of overland flows from the precinct and flood flows from Powells Creek.

The low-lying area immediately east of Homebush Bay Drive is a trapped depression extending from Victoria Avenue to Concord Avenue. Stormwater runoff ponds in the area given the insufficient capacity of the existing stormwater drainage network and lack of overland flow path downstream to Powells Creek.

4.2.3 Flooding in George Street, south of the Concord West North Precinct

A sag is located along George Street immediately south of the Concord West North Precinct at the bend in the road, between Victoria Avenue and Rothwell Avenue. Ponding occurs at this location which is of interest as it is currently the only vehicle evacuation route for the Concord West North Precinct. An existing industrial building at 174-184 George Street prevents overland flows draining west. Vehicle access to and evacuation from the Concord West North Precinct could potentially be blocked by this ponding during flood events at this location.

4.3 Existing flood conditions – mitigation measures proposed in Jacobs 2015

Jacobs, as part of the 2015 investigations for Council, prepared a flood study and concept designs for flood mitigation measures. The results of the mitigation measures on flooding during the 100 year ARI event are presented in Figure 4-3.

These measures are based on Council's 2014 Draft Concord West Precinct Master Plan and included a 10 metre wide floodway channel conveying flows from the existing overland flow path on 28A and 30 King Street to an open drain along the Homebush Bay Drive embankment, discharging to the south of the Concord West North Precinct.

The Jacobs study did not consider upgrading the culverts through the Homebush Bay Drive embankment, stating that they were not considered practical due to the flat grades and minimal available cover.

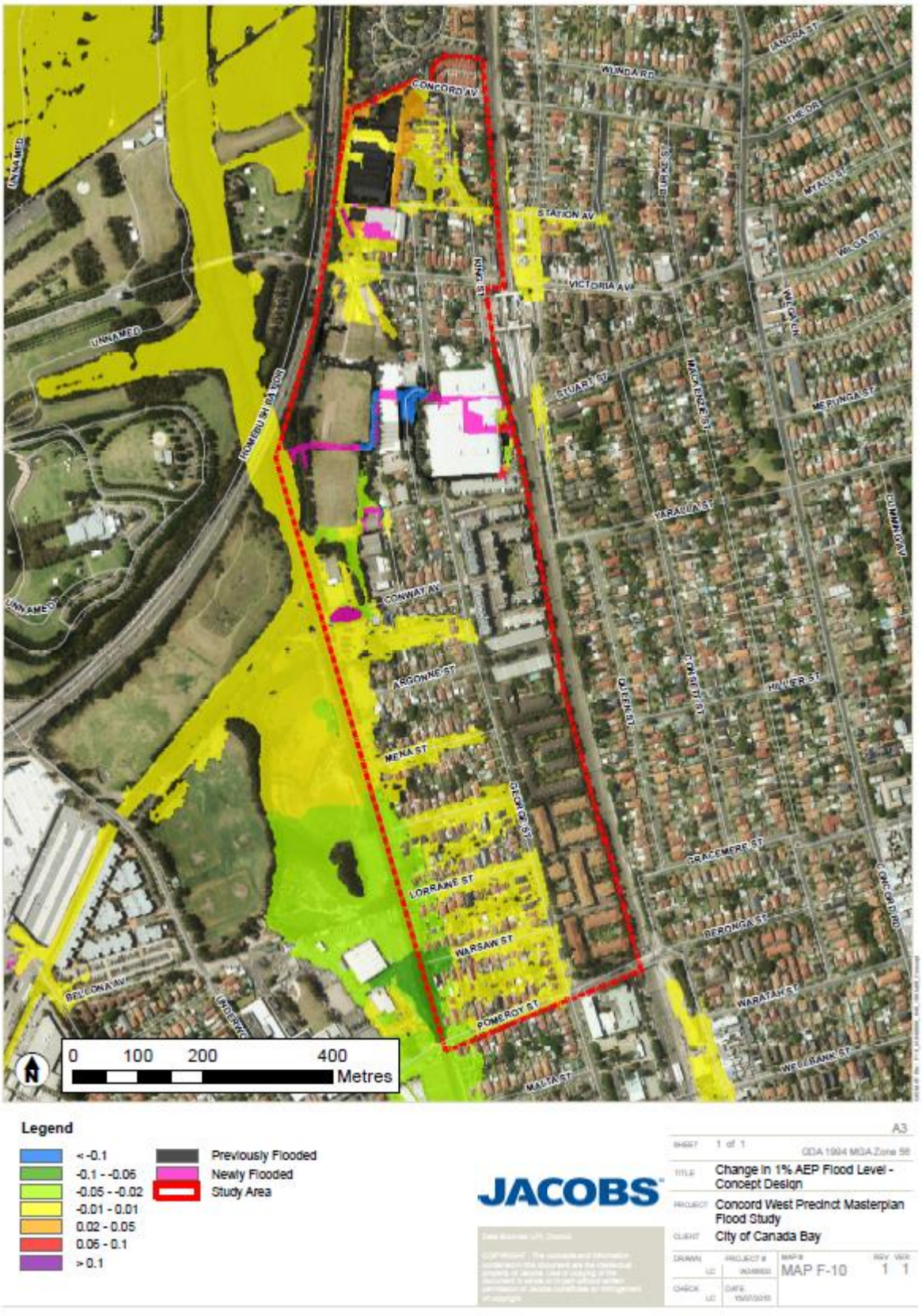


Figure 4-3 Concord West Precinct flood mitigation measures – Jacobs 2015 (100 year ARI)

The results in Figure 4-3 indicate that the measures recommended by Jacobs increase flood levels in the area of the Concord West North Precinct and do not resolve the flooding issues identified in Section 4.2, resulting in an exacerbation of flood issues at King Street and low lying areas. Measures to address these issues are discussed in Section 4.5.

4.4 Developed flood conditions – no mitigation

Developed flood conditions were modelled by modification of the flood model developed for Council by Jacobs in 2015 as part of the Concord West Precinct Master Plan Flood Study.

The model was adjusted to include the buildings proposed as part of the Concord West North Precinct and incorporated the existing pit and pipe drainage network. No mitigation measures were included in the model in order to determine potential flood impacts that would result from development of the precinct.

The results of flood modelling of the developed condition, with no mitigation measures, for the 100 year Average Recurrence Interval (ARI) were modelled as the maximum peak flood levels calculated during the 25 minute and 2 hour peak storm events. The peak flood depth and elevations are presented in Figure 4-5.

The results of the modelling, shown in Figure 4-5, with flood hazard mapping in Figure 4-6, indicate that the proposed buildings block flows through the King Street sag, reducing flooding through numerous residential properties, including 28A and 30 King Street. There is significant ponding within the low-lying area to the east of the Homebush Bay Drive embankment, along with ponding at Victoria Ave and George Street, to the south of the precinct.

4.4.1 Flood difference mapping – no mitigation

Flood difference (afflux) mapping for the proposed Concord West North Precinct, with no mitigation measures, shown on Figure 4-7 indicates an increase in flooding at the sag in King Street, and at the low lying downstream areas and in Victoria Ave. There are modelled increases in existing flooded areas along with flooding of the proposed pocket park at the corner of King Street and Station Avenue.

The results of the flood modelling of the proposed Concord West North Precinct with no flood mitigation measures demonstrates an increase in flooding in several locations and would likely increase flood risk within the precinct.

4.5 Developed flood conditions – flood mitigation recommendations

Flood mitigation has been assessed as part of this investigation. These options include upgrades to the existing pipe network in Station Street, draining through the Homebush Bay Drive Embankment, shown in yellow on Figure 4-4.

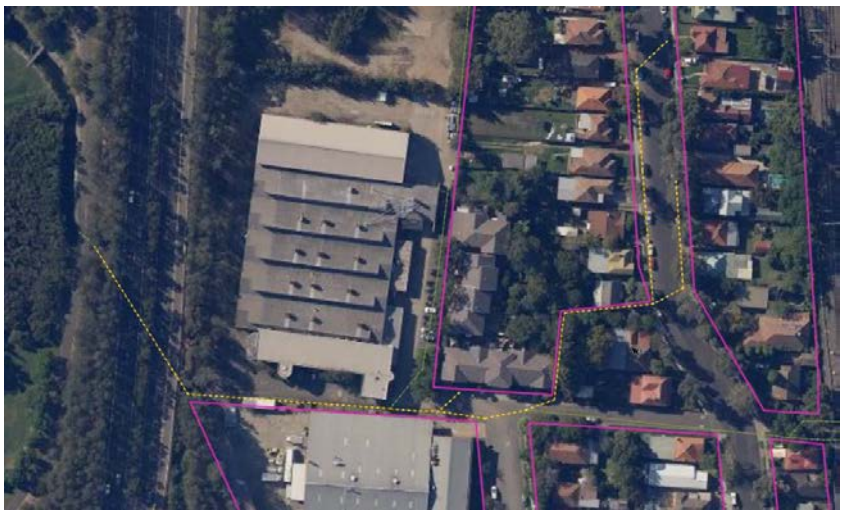


Figure 4-4 Proposed upgrades to drainage network

The proposed upgrade involves increasing the capacity of the drainage pits at the sag within King Street, along with upgrades to the existing drainage easement and 1050 millimetre diameter pipe in the proposed pocket park and along Station Street to accommodate flows. These upgrades are proposed to be constructed within existing drainage easements and the roadway of Station Avenue and do not require additional purchase of land or easements from neighbouring properties and do not impact on development of these sites. These upgrades to the capacity of the existing drainage network will require upgrades of the pipe network downstream of the Concord West North Precinct, most notably through the Homebush Bay West embankment, which will require negotiations with Transport for NSW.

These upgrades were modelled as a duplication of the existing network, i.e. a doubling of capacity. This will be refined at later development and design stages of the proposal.

The results of flood modelling of the developed condition, incorporating upgrades to the drainage network, for the 100 year Average Recurrence Interval (ARI) were modelled as the maximum peak flood levels calculated during the 25 minute and 2 hour peak storm events. The peak flood depth and elevations are presented in Figure 4-8.

The results of the modelling, shown in Figure 4-8, with hazard mapping in Figure 4-9 indicate that the proposed upgrades to the drainage network reduce ponding at the King Street sag, reducing flooding through numerous residential properties, including 28A and 30 King Street.

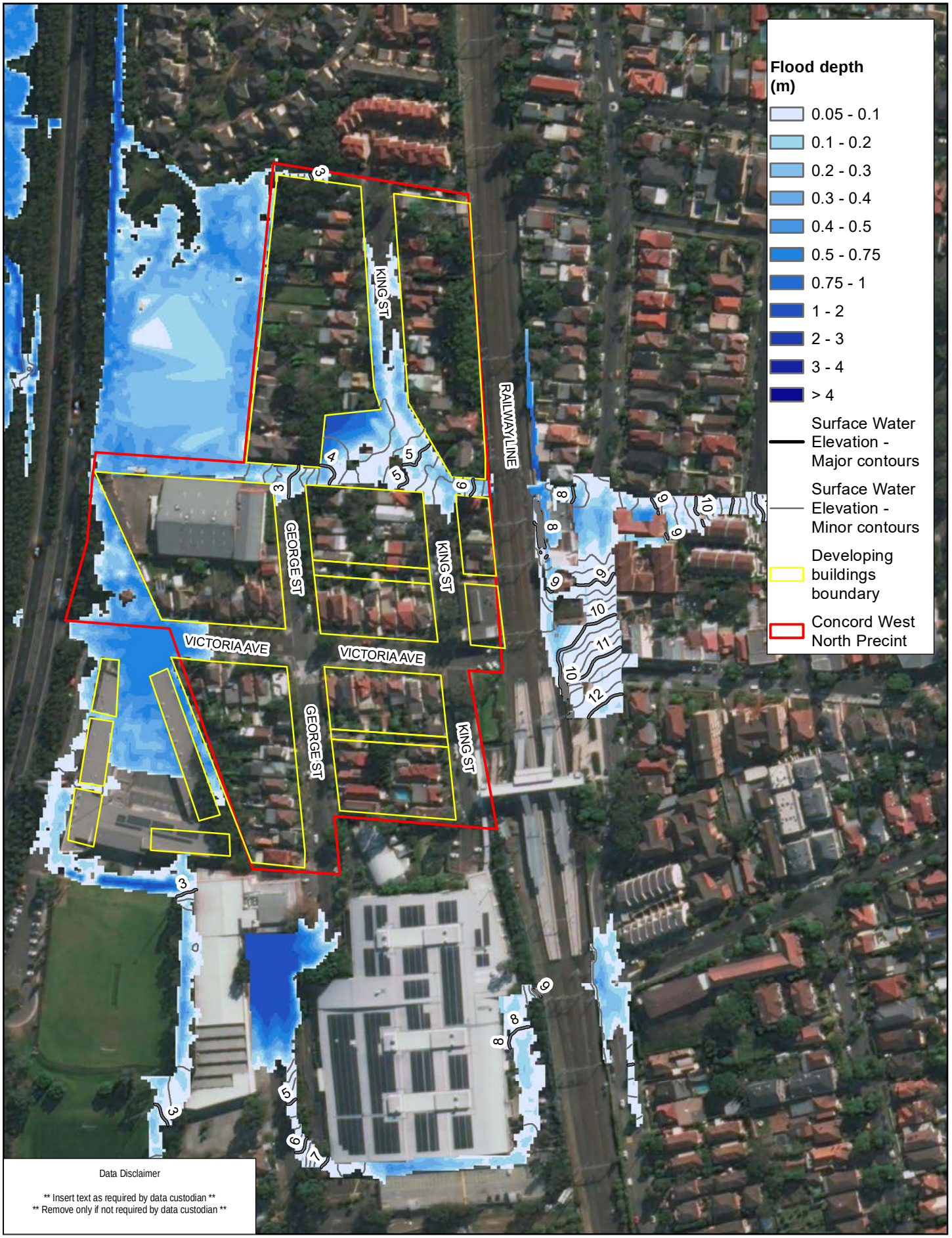
4.5.1 Flood difference mapping – with pipe upgrades

Flood difference (afflux) mapping for the proposed Concord West North Precinct, incorporating upgrades to the drainage network, shown on Figure 4-10, indicates a decrease in flooding at the sag in King Street, and at the low lying downstream areas and in Victoria Ave. There is a small localised increase in the proposed pocket park at the corner of King Street and Station Avenue.

The results of the flood modelling of the proposed Concord West North Precinct with an increase in the capacity of the existing drainage network that drains the King Street sag indicate that a decrease in flooding would result at several locations within the precinct. These results indicate that including upgrades to the piped drainage network, as part of the development of the Concord West North Precinct would decrease the flood risk, with an increase in development density.

A small increase as a result of the proposed Concord West North Precinct development, with an increase in flooding of between 0.01 and 0.02 metres, is modelled within the existing flooded low lying areas to the south west of the precinct. This is in the location of existing significant ponding within the low-lying area to the east of the Homebush Bay Drive embankment. In addition to this increase, there is also significant flooding during developed conditions with ponding at Victoria Ave and George Street, to the south of the precinct.

It is recommended that Council re-visit the recommendations of the 2015 investigations by Jacobs to alleviate the impact of flooding at these locations of existing risk. By incorporation of the measures outlined in this report, primarily the increase in the capacity of the culvert under the Homebush Bay Drive embankment, the modelling in this report indicates that improved outcomes, relative to the concept design put forward by the Jacobs 2015 study, are possible for the Concord West Precinct.



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Kilometers

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Grid: GDA 1994 MGA Zone 56

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FIGURE 4-5

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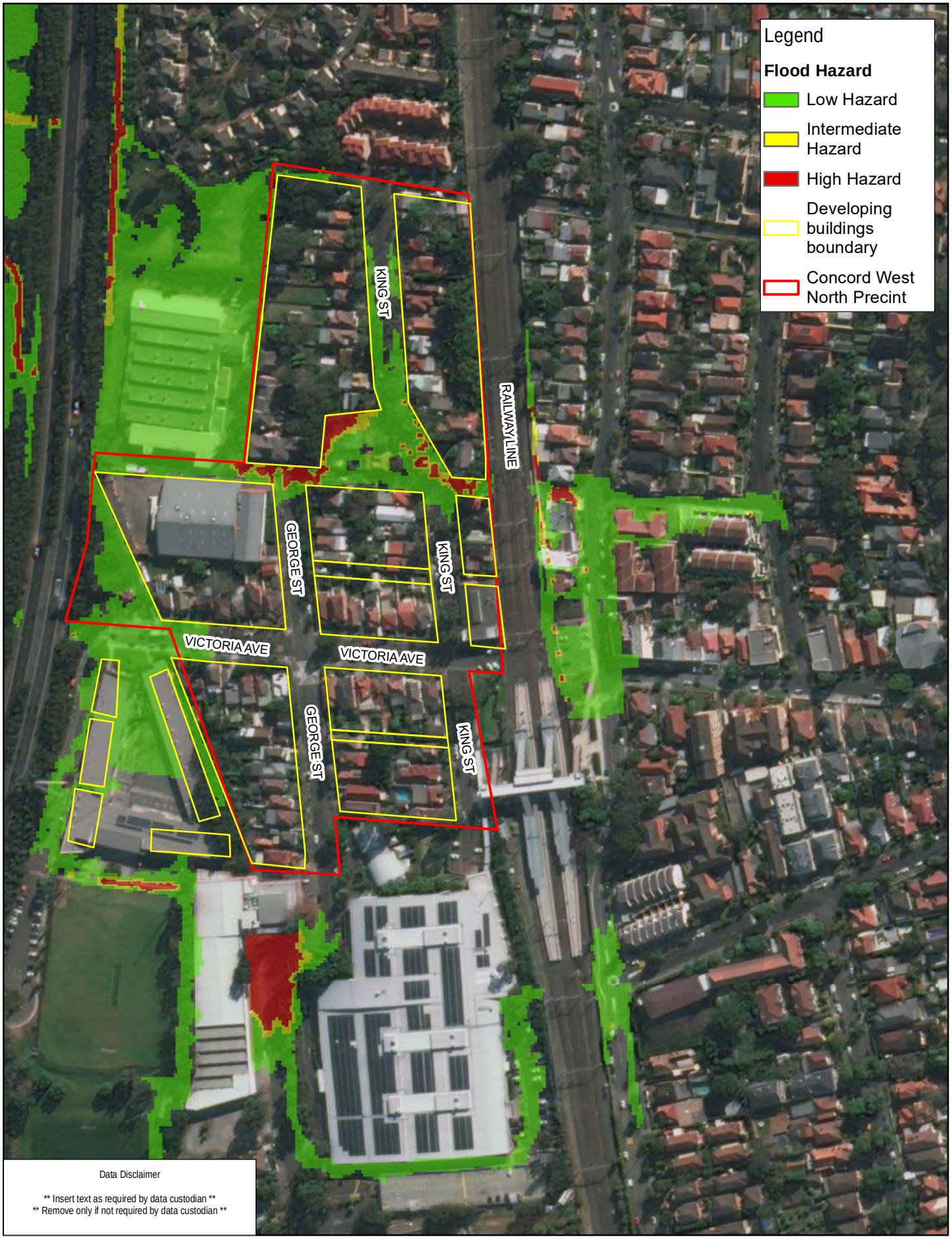

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FIGURE 4-6

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FIGURE 4-7

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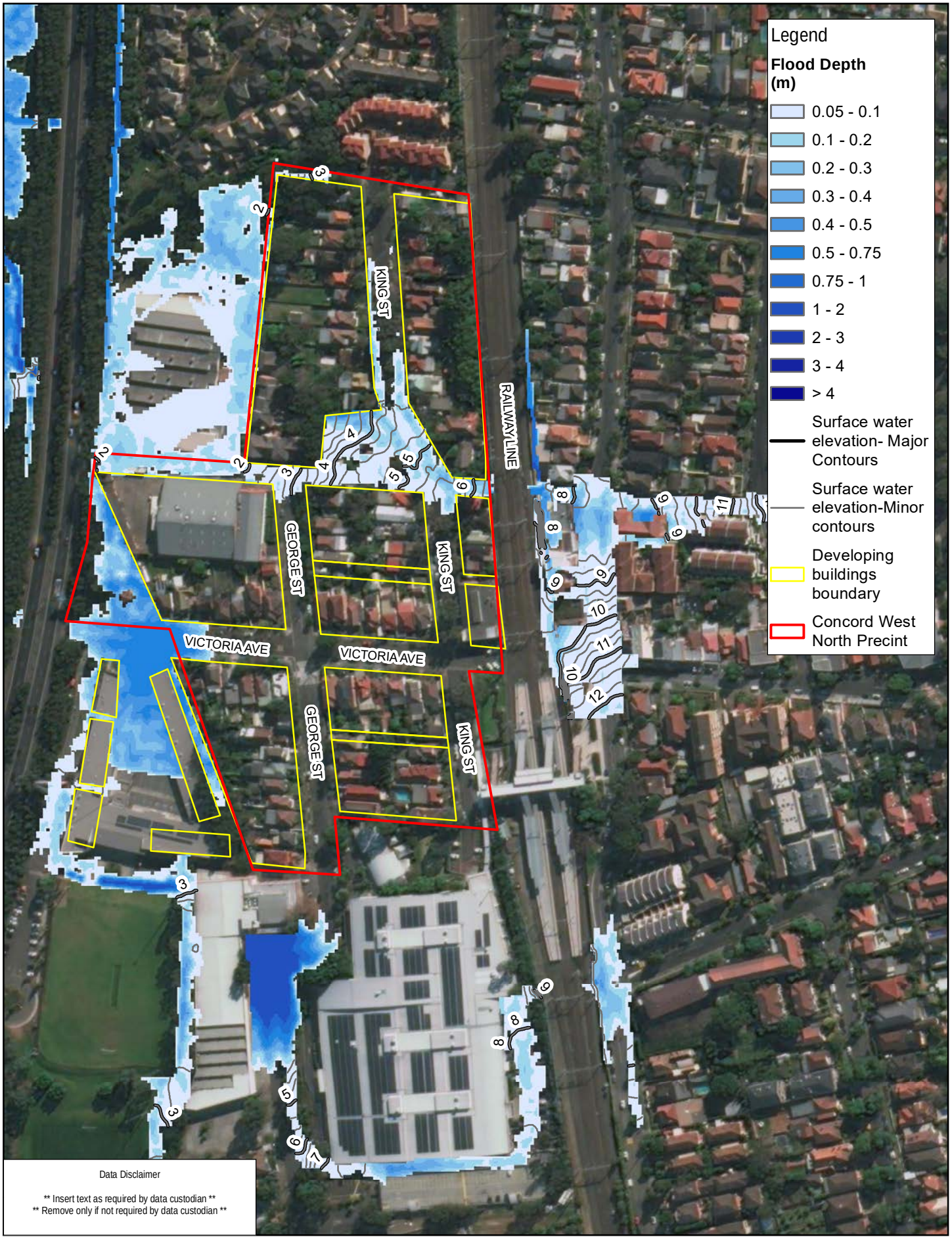

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Grid: GDA 1994 MGA Zone 56

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FIGURE 4-8

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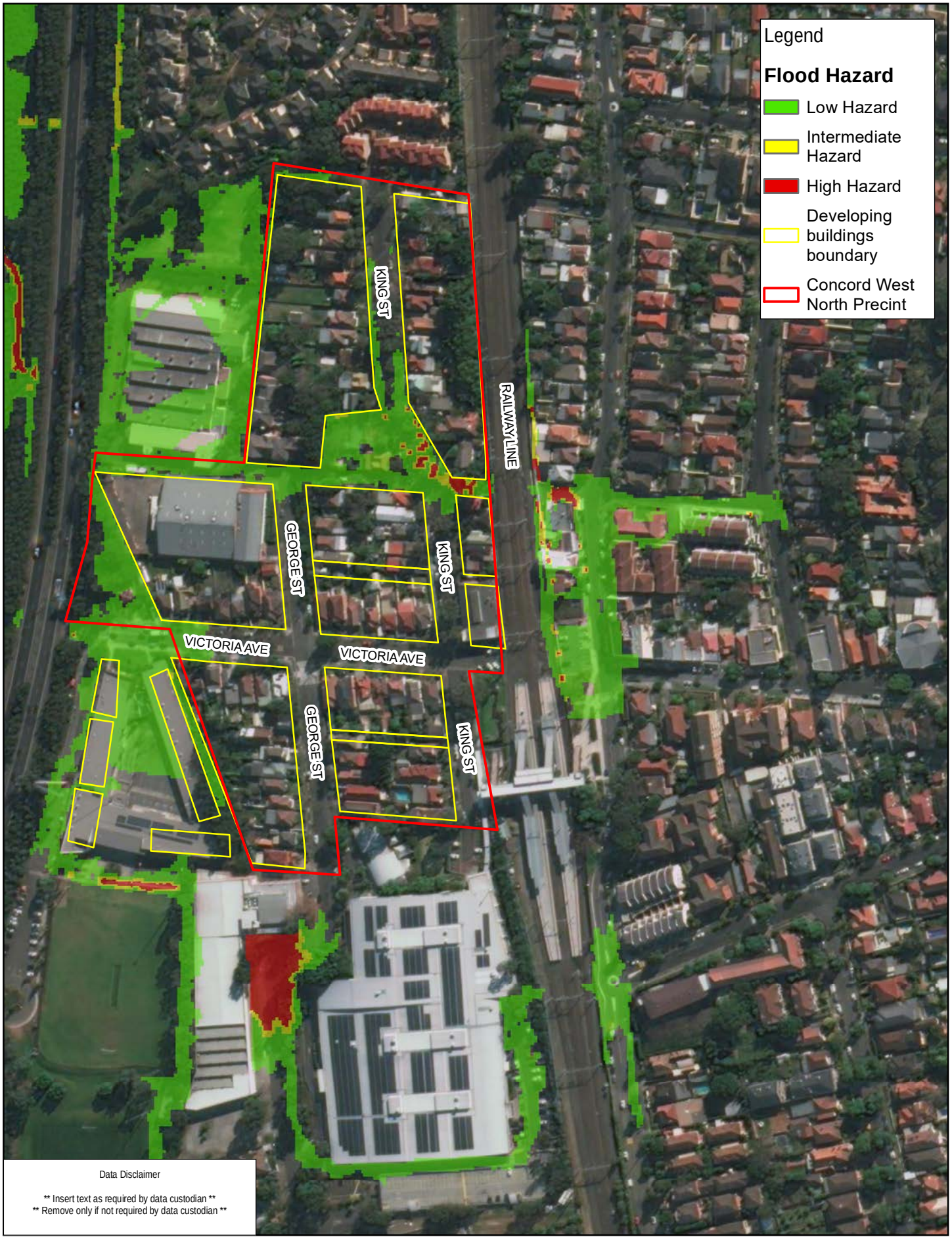

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Flooding and Water Sensitive Urban Design Report

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FIGURE 4-9

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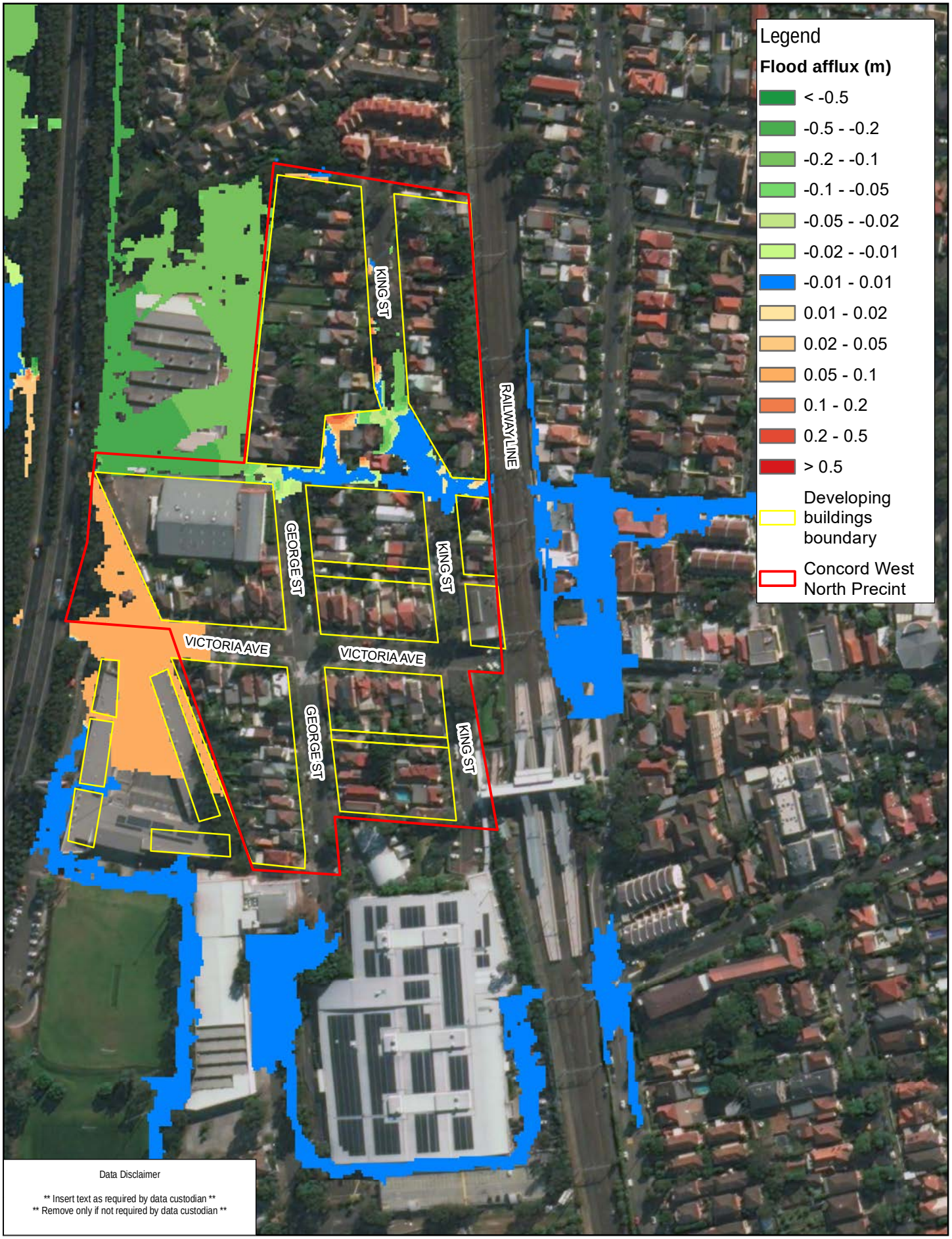

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FIGURE 4-10

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Data source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: hkosari

4.6 Flood planning levels

Flood planning levels within the Concord West North Precinct will be developed in accordance with Section C7 of the City of Canada Bay Development Control Plan. Flood planning levels will be set above the 100 year flood level plus freeboard (defined in Appendix A2, condition SW25 of the DCP), with the impact of the development on flooding elsewhere to be considered.

Garage floor entrance ramps are to be above the Probable Maximum Flood level, in accordance with Car Parking and Driveway Access Control C8 of the City of Canada Bay DCP.

The results of the flood modelling of the developed Concord West North Precinct plan, shown on Figure 4-8 and Figure 4-9, indicate that all buildings have access to a flood free street frontage and are in areas of low flood hazard. Flood planning levels are at most approximately 0.7 metres above existing street levels, with maximum flood depths of 0.2 metres and maximum freeboard requirements of 0.5 metres.

4.7 Flood evacuation planning

The results of the flood modelling of the developed Concord West North Precinct plan, shown on Figure 4-8, indicate that all buildings have access to a flood free street frontage, facilitating an evacuation route. Buildings will need to incorporate this evacuation point into the design and to allow for egress in accordance with Australian Standard 1428.

The existing road layout allows movement of people and vehicles from lower lying areas on the western edges of the Concord West North Precinct to evacuate to higher ground on the eastern side of the precinct. The higher ground within the precinct is located above the Probable Maximum Flood level (shown from the 2015 Jacobs study on Figure 4-11), allowing safe refuge at the Concord West Railway Station in accordance with Evacuation Control C2 of the City of Canada Bay DCP.

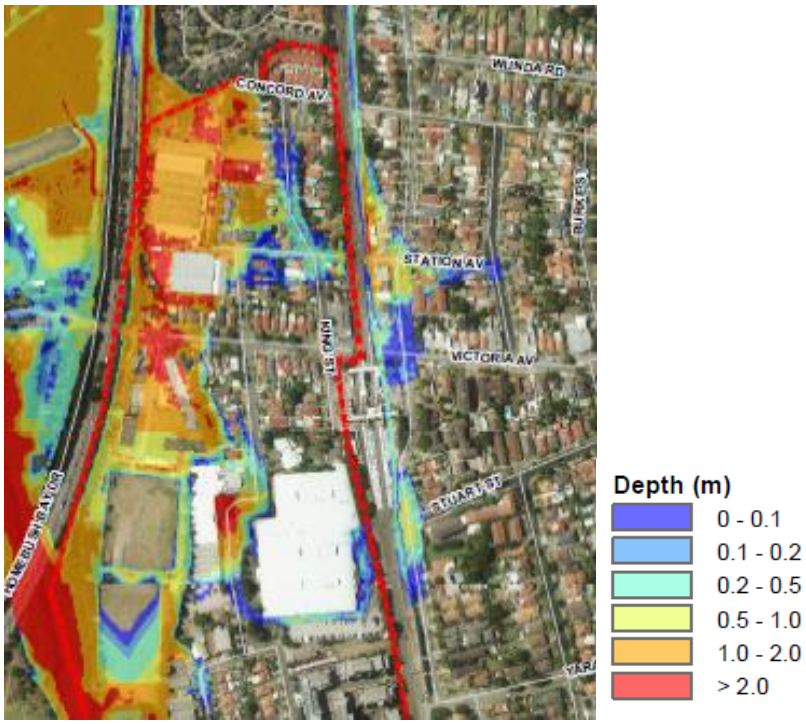

Figure 4-11 Concord West Probable Maximum Flood levels

Evacuation procedures for areas north of Station Avenue will require adequate shelter in place for facilities. During periods of prolonged inundation, where refuge within the precinct may not be suitable, an evacuation route from the precinct to the regional evacuation centre at the Homebush Precinct has been mapped and is presented on Figure 4-12. This evacuation route relies on roads that are currently constructed.

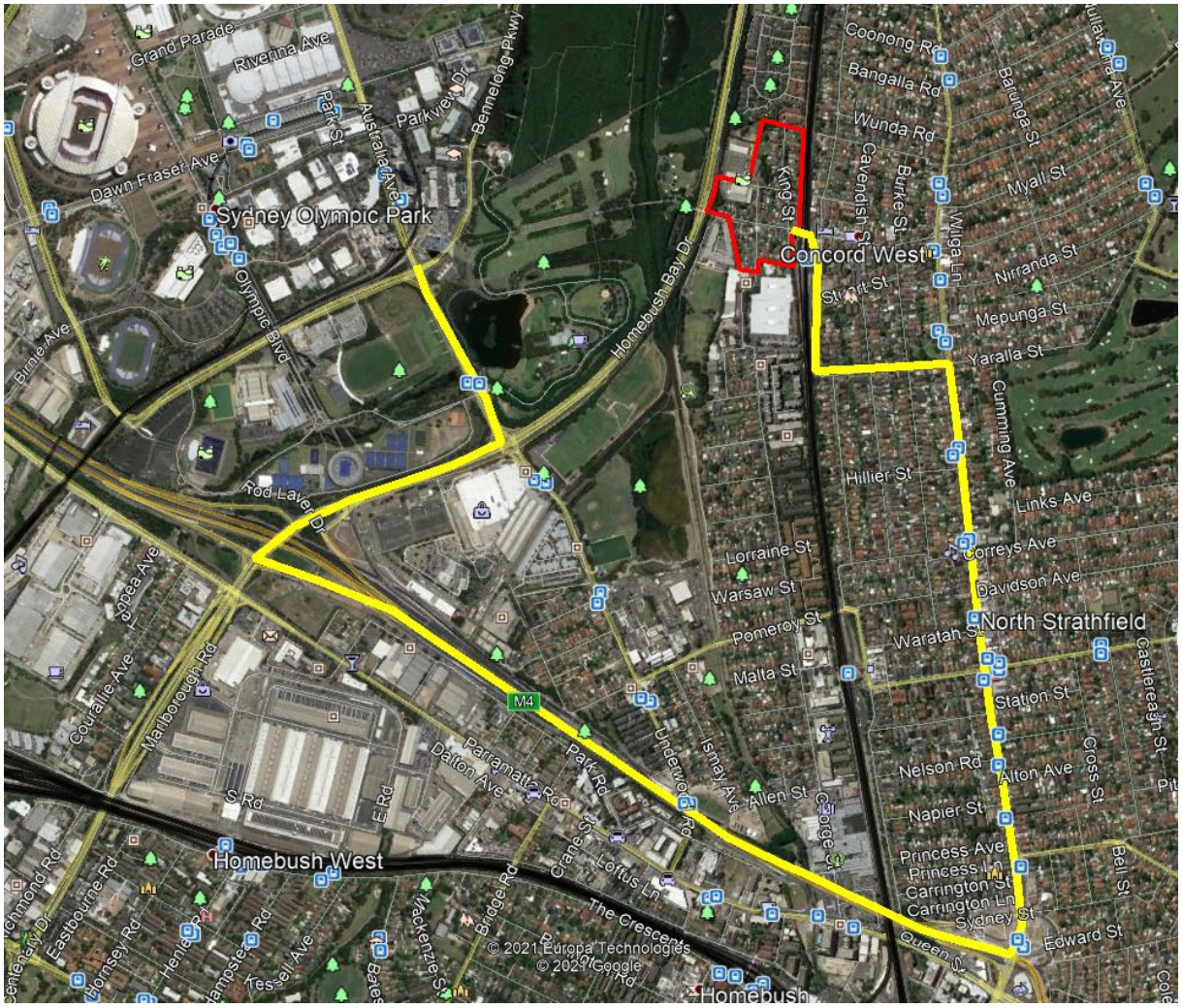

Figure 4-12 Concord West North Precinct potential flood evacuation route

This study has not been prepared for submission to the SES but has been prepared as a preliminary study to guide further investigations.

This evacuation route on Figure 4-12 has been mapped in accordance with requirements discussed between Infrastructure NSW and the Department of Planning, Industry and Environment. This preliminary evacuation plan avoids using any of the more direct, potential routes to the west or south of the Concord West North Precinct. This is to avoid using evacuation routes that are already flooded.

4.8 Flood precinct design outcomes and recommendations

The modelling undertaken as part of the flood investigations for the Concord West North Precinct Minor indicates that by incorporation of minor upgrades to pit and pipe network to address existing flood issues, along with an increase in building levels for lots, will result in a decrease flood risk with an increase in population density.

Flood evacuation planning for the precinct will involve evacuation to flood free areas within the precinct, with flooding during longer term events requiring taking mapped routes to the regional flood evacuation centre within the Homebush precinct.

5. Water Sensitive Urban Design

The WSUD strategy shall be integrated through precincts by creating a clear network of open spaces and landscaped corridors. Public domain design is proposed to capture, slow and use runoff to improve water management in the precinct, providing a low maintenance public domain and address the precinct wide water management issues.

5.1 Canada Bay Council requirements

The City of Canada Bay Development Control Plan (DCP) includes five controls for Water Sensitive Urban Design WSUD1-WSUD5, which list the objectives, aims, design principles, application and requirements for modelling of development.

All developments are encouraged to implement the principles of WSUD in order to minimise the impact of the development on the water cycle and achieve more sustainable forms of urban development.

Control SC4 of the City of Canada Bay DCP, within the Scouring, Erosion and Water Quality Section of Appendix A2, lists the Pollutant Load to be Retained for water quality treatment systems or pollution control devices.

These pollutant removal rates are:

- Total suspended solids (TSS) 80%
- Total phosphorus (TP) 45%
- Total nitrogen (TN) 45%
- Gross litter all litter - 70%
- Gross Pollutant Material (>50mm) - 70%

Discussion of the pollutant removal rates for the Concord West North Precinct is included in Section 5.5.

5.2 Water management objective of the precinct

The management of stormwater, through integration of WSUD measures into the development is a key objective of the Concord West North Precinct proposal.

The management of water is key in the incorporation of vegetation within the precinct, which is driven by liveability and urban heat island reduction outcomes.

The water sensitive urban design strategy of the precinct plan is to manage improved tree canopy, as discussed in Section 2.5.

These measures have been developed in consultation and collaboration with landscape and architectural measures proposed for the precinct. This strategy involves each site contributing to the neighbourhood's tree canopy, through planting in the public domain, street trees, and in private lots. The canopy can be achieved through a combination of an integrated canopy street tree planting regime and a tree canopy target for each individual development site.

5.3 WSUD strategy of the precinct

The WSUD strategy involves passive and active irrigation of street trees and trees located within private lots through irrigation of harvested rainwater. Passive irrigation of street trees, by use of tree pits and measures to direct street runoff to landscapes areas, is integral to the WSUD strategy.

Street tree planting is integral to the Concord West North Precinct plan. The street tree planting strategy is to integrate streetscape improvements with WSUD and use street trees to contribute to the precinct's sense of place. Important existing trees that are to be retained in the precinct include the mature stand of Melaleuca along the northern stretch of King Street and the Casurinas around Homebush Bay Drive in the lower lying, swampier part of the area.

The proposal is to build on these existing landscape elements and introduce other natives including Spotted Gum and Boxbrush to create a mixture of street tree regimes that define the street to enhance the street tree canopy.

Street tree planting and public domain landscape are developed along the principles of WSUD. The WSUD strategy outlined in this report has been developed to make best use of the site's location, geology and flooding to develop a precinct plan that achieves the desired outcomes for liveability, and urban cooling through increased tree cover.

5.4 WSUD measures

5.4.1 Rainwater tanks

Harvesting of stormwater falling on the buildings will be captured for use in landscaping.

The use of rainwater tanks to harvest stormwater, and street trees throughout the precinct, watered by passive irrigation and harvested rainwater, will manage the impact of increased development density.

Rainwater tanks will be included in the development of each building within the precinct, with a dual tank system. Rainwater harvested from the higher, tower buildings will be used for toilet flushing. Runoff captured from the podium level will be used for irrigation of plants, both landscaping on the podium level and within private space at street level. This arrangement is shown in Figure 5-1.

Figure 5-1 Rainwater harvesting arrangement

This dual tank system, shown in Figure 5-1, will minimise the risk of contamination from foot trafficked areas on the podium level.

Water balance calculations will be carried out at the concept design phase to determine water demand requirements for on lot landscaping and for the maintenance of street trees adjacent to individual lots.

5.4.2 Private lot drainage and on-site detention

Stormwater runoff from lots in excess of the capacity of the rainwater tanks will be directed to a trunk drainage system for minor storm events in the conventional pit and pipe system.

The provision of on-site detention as additional storage within the rainwater tanks will address the requirements within the City of Canada Bay DCP, noting that this requirement may also be provided as an above ground system within the podium level landscaping. The calculated basic OSD storage volume can be reduced by a maximum of fifty percent (50%) portion of the rainwater re-use volume in accordance with Control RR8 of the City of Canada Bay DCP, Appendix A2.

5.4.3 Gross pollutant traps

Gross pollutant traps will be incorporated into the proposed drainage network, at locations where the proposed pipes from lots join the existing network, as well as at the locations of discharge points to wetlands on Powells Creek.

The pollutant capture efficiency of various traps is variable; as a conservative measure gross pollutant traps have been ignored in the development of the water quality models for this assessment.

5.4.4 Street trees

Water quality treatment to manage runoff has been incorporated at source by the use of street trees within the road and in private space at street level.

Street trees will be incorporated into the road design, as shown on Figure 5-2, with details included from the landscape drawing provided in Section 6.11 of the Parkside Urban Design Report, prepared by Dickson Rothschild.

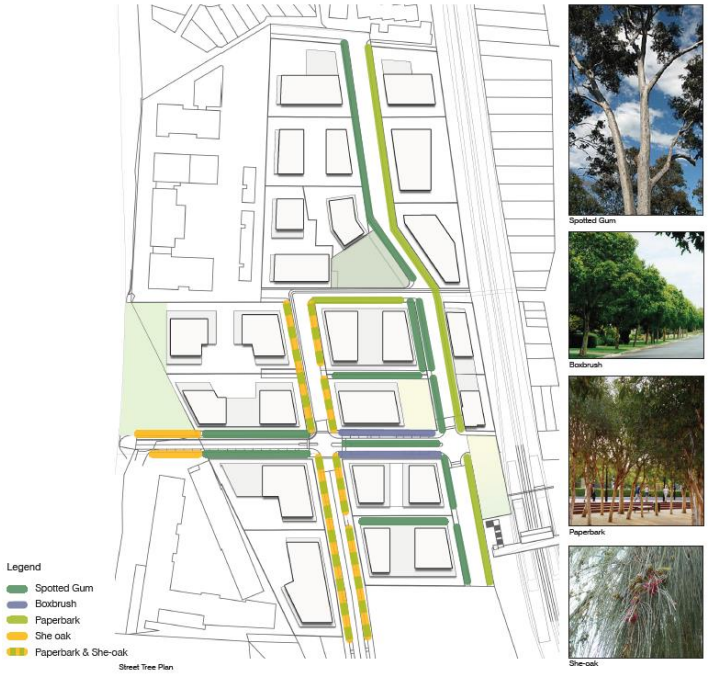

Figure 5-2 Street trees

The street trees shown on Figure 5-2 have been selected from local species and those listed by Council of Canada Bay as suitable species, listed in the DCP Section C5.3, Table CH.

Street trees will be irrigated passively by allowing for breaks in kerbs, appropriate set-down paths graded to drain to landscaped areas and scour protection at the edge of the landscaped bed, as shown in Figure 5-3.

Figure 5-3 Kerbing to allow irrigation of street trees

Street trees have been modelled as media filters within the MUSIC modelling, discussed in Section 5.5, each having a treatment area equivalent to the width of the road section and a depth of 1 metre. The street sections are discussed in detail below.

Street Section 1 – Victoria Ave East (High Street)

The section of Victoria Avenue, shown in Figure 5-4 involves widening of the existing 20 metre roadway to a 26 metre wide pedestrian priority, slow speed active village centre.

Figure 5-4 Victoria Ave East (High Street) Street trees

The streetscape incorporates a narrowed carriageway, widened footpaths, street trees and new public open space.

Treatment for runoff will be provided by the landscaped median areas and street trees, including tree pits to be located under parking lanes and footpaths. A total of 13.6 metres of the 26 metre wide street would be capable of providing treatment.

For the purposes of MUSIC modelling in Section 5.5, a treatment area width of 2.6 metres was adopted, with filter media incorporated into half of the treatment width, for a filter media of 150 m^2 for the approximately 115 metres of road.

Street Section 2 – Victoria Ave West (Schoolside)

The section of Victoria Avenue, shown in Figure 5-5, involves widening of the existing 20 metre roadway to a 26 metre wide into pedestrian priority urban environment with new dedicated cycleway on the north side of the street and widened footpath on the south side of the street.

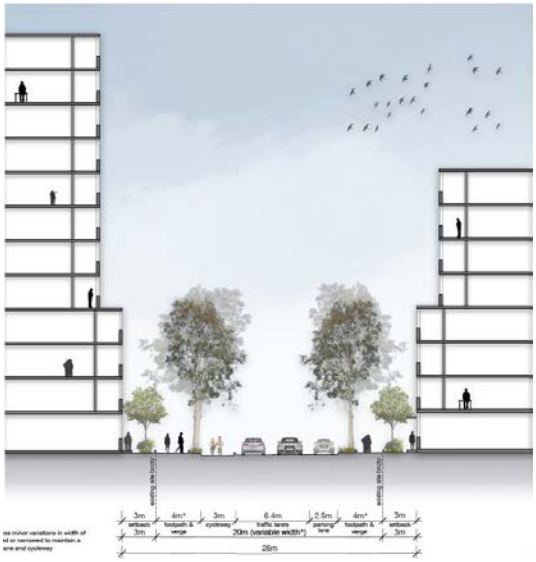

Figure 5-5 Victoria Ave East (Schoolside) Street trees

Spotted gum trees lead visitors towards the Park and verges are used for WSUD adding to the character and function of the street

Treatment for runoff will be provided by the street trees, including tree pits to be located under parking lanes, verge and footpaths. A total of 16.5 metres of the 26 metre wide street would be capable of providing treatment.

For the purposes of MUSIC modelling in Section 5.5, a treatment area width of 4 metres was adopted, with filter media incorporated into half of the treatment width, for a filter media of 290 m^2 for the approximately 145 metres of road.

Street Section 3 – George Street

The section of George Street, shown in Figure 5-6, involves incorporation of street trees into the existing 20 metre roadway.

Figure 5-6 George Street trees

A soft landscape setback of 4.5 m is used for soft landscape and residential courtyards. Street tree planting shall alternate between Paperbark and Sheoak, emphasising the importance of native planting in the precinct. On street parking bays are interspersed with street tree planting, limiting the visual impact of on street parking.

Treatment for runoff will be provided by the landscaped areas and street trees, including tree pits to be located under parking lanes and footpaths. A total of 13.6 metres of the 20 metre wide street would be capable of providing treatment.

For the purposes of MUSIC modelling in Section 5.5, a treatment area width of 2.3 metres was adopted, with filter media incorporated into half of the treatment width, for a filter media of 270 m^2 for the approximately 240 metres of road.

Street Section 4 – King Street (near railway station)

The section of King Street, shown in Figure 5-7, involves incorporation of street trees into the existing 23 metre roadway.

Figure 5-7 King Street (near railway station) trees

New Spotted Gum street tree planting are to be interspersed with existing street tree planting introducing the Spotted Gum as the feature tree for the Victoria Avenue spine, the neighbourhood's main link to Bicentennial Park.

Treatment for runoff will be provided by the street trees, including tree pits to be located under parking lanes and footpaths. A total of 8.76 metres of the 23 metre wide street would be capable of providing treatment.

For the purposes of MUSIC modelling in Section 5.5, a treatment area width of 1.7 metres was adopted, with filter media incorporated into half of the treatment width, for a filter media of 180 m^2 for the approximately 210 metres of road.

Street Section 5 – new laneways

The new laneways to be incorporated into the Concord West North Precinct, shown in Figure 5-8, will incorporate of street trees into the proposed 12 metre wide laneway.

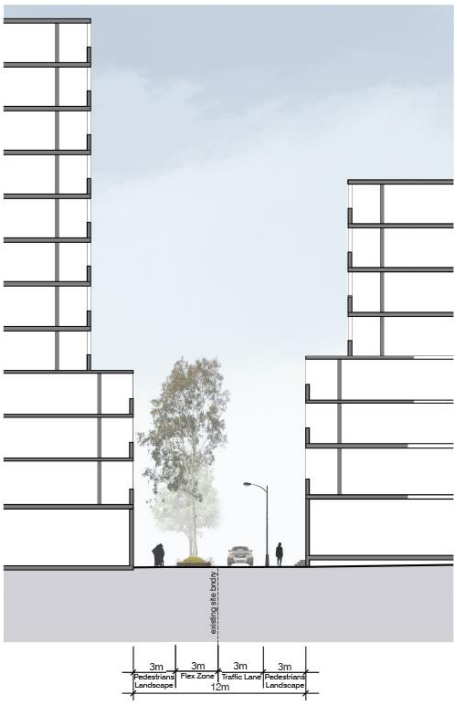

Figure 5-8 New laneway trees

The laneways are one-way vehicular carriageways with a flexible lane with loading bays, soft landscape planting, trees and pedestrian zones.

Treatment for runoff will be provided by the street trees, including tree pits to be located in the flex zone. A total of 3 metres of the 12 metre wide lane would be capable of providing treatment.

For the purposes of MUSIC modelling in Section 5.5, a treatment area width of 3 metres was adopted, with filter media incorporated into half of the treatment width, for a filter media of 240 m^2 for the approximately 160 metres of road.

Street Section 6 – King Street (north)

The section of King Street, shown in Figure 5-9, involves widening of the existing 20 metre roadway to a 32 metre wide pedestrian priority urban environment with incorporation of street trees into the existing roadway and a front courtyard within the setbacks of private lots.

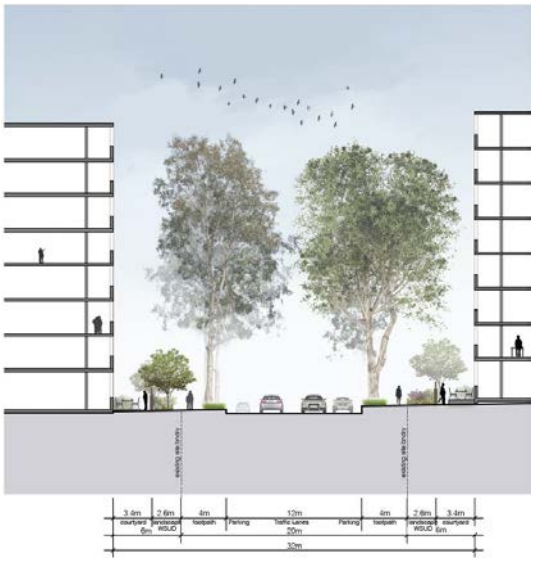

Figure 5-9 King Street (north) trees

Trees shall be required in the deep soil front setbacks to contribute to the tree canopy and the leafy character of the northern part of the neighbourhood.

Building upon the existing mature Paperbark trees on the eastern side of the street, additional Paperbarks will enhance their visual impact. On the west side of the street where there are relatively few existing street trees, Spotted Gums are proposed along the full length of King Street.

Treatment for runoff will be provided by the street trees, including tree pits to be located under parking lanes and footpaths, along with courtyard areas. A total of 5.2 metres of the 32 metre wide street would be capable of providing treatment, noting that this does not include the private courtyards.

For the purposes of MUSIC modelling in Section 5.5, a treatment area width of 5.2 metres was adopted, with filter media incorporated into half of the treatment width, for a filter media of 500 m^2 for the approximately 200 metres of road.

5.4.5 Pit, pipe and overland flow drainage system

The existing pit, pipe and overland flow drainage system will be largely retained as part of the Concord West North Precinct Plan.

The upgrade of the pipe network to take flows from the King Street sag, discussed in Section 4.5, along with potential modifications resulting from the installation of street tree pits will be refined at later development and design stages of the Concord West North Precinct.

5.5 Water quality modelling

Preliminary water quality modelling of the precinct water management measures, including rainwater tanks and street trees, discussed in Section 5.4, has been undertaken during the preparation of the Concord West North Precinct plan.

For the purposes of modelling, the roofed areas of the proposed buildings have been modelled as ‘Urban – Roof”, with podiums modelled as ‘Urban – Residential’, as podium levels are anticipated to include facilities and will be trafficked by pedestrians.

Water usage from the rainwater tanks was modelled as 20 litres per dwelling per day for roof water tanks, equivalent to approximately two toilet flushes per residence. Use of harvested rainwater from the podium level was determined by the evaporation deficit for the landscaped elements.

This modelling of the preliminary design, undertaken using the MUSIC-X water quality modelling software (Version 1.0.0) has been prepared in accordance with City of Canada Bay guidelines and is used to determine the performance of the system, in terms of the pollutant removal targets presented in Section 5.1. The results of the preliminary MUSIC modelling are presented in Table 5-1.

Table 5-1 MUSIC water quality modelling results

Pollutant	Target Removal Rate (%)	Sources (kg/year)	Residual Load (kg/year)	% Reduction
Total suspended solids (TSS)	80%	20,140	125	99.4%
Total phosphorus (TP)	45%	33.51	3.39	89.9%
Total nitrogen (TN)	45%	189.3	20.33	89.3%
Gross Pollutant	70%	2171	0	100%

The MUSIC modelling software package does not differentiate between Gross Litter and Gross Material (>50mm) as requested in the City of Canada Bay DCP. Council targets for both are 70%.

The results of the modelling in Table 5-1 indicate that the WSUD measures to be incorporated into the Concord West North Precinct address the City of Canada Bay pollutant removal targets presented in Control SC4 of the DCP.

5.6 Water sensitive urban design outcomes

The planning outcomes resulting from the WSUD features of the Concord West North Precinct planning process have been incorporated in the development of the Parkside Urban Design Report, prepared by Dickson Rothschild. These measures include:

- Incorporation of source control features including rainwater tanks, street trees and permeable landscape features.
- Use of the existing pit, pipe and overland flow network, other than the upgrade to manage flooding at the King Street sag, discussed in Section 4.5.

The developed scenario water quality modelling indicates that the precinct layout shown on the Urban Design Report will incorporate water cycle management features able to meet pollutant removal targets.

6. Conclusion and recommendations

The Parkside Urban Design Report, prepared by Dickson Rothschild as part of the precinct planning process, has been prepared to accommodate the input from planning and specialist studies, including this flooding and water sensitive urban design report.

Key issues to note on the Urban Design Report, as they relate to this flooding and water cycle management are provided in Sections 4.8 and 5.6:

6.1 Flooding

The modelling undertaken as part of the flood investigations for the Concord West North Precinct Minor indicates that by incorporation of minor upgrades to pit and pipe network to address existing flood issues, along with an increase in building levels for lots will result in a decrease flood risk with an increase in population density.

Flood evacuation planning for the precinct will involve evacuation to flood free areas within the precinct, with flooding during longer term events requiring taking mapped routes to the regional flood evacuation centre within the Homebush precinct.

6.2 Water sensitive urban design

The planning outcomes resulting from the WSUD features of the Concord West North Precinct planning process have been incorporated in the development of the Parkside Urban Design Report, prepared by Dickson Rothschild. These measures include:

- Incorporation of source control features including rainwater tanks, street trees and permeable landscape features.
- Use of the existing pit, pipe and overland flow network, other than the upgrade to manage flooding at the King Street sag, discussed in Section 4.5.

The developed scenario water quality modelling indicates that the precinct layout shown on the Urban Design Report will incorporate water cycle management features able to meet pollutant removal targets.

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Document Status

Revision	Author	Reviewer		Approved for Issue		
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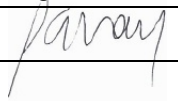
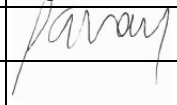
0	N Bosworth	S Gray		S Gray		25/03/21

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