KFW

INFRASTRUCTURE PROFESSIONALS

PROJECT MANAGEMENT

SURVEYING

CIVIL

STRUCTURAL

SEWER & WATER

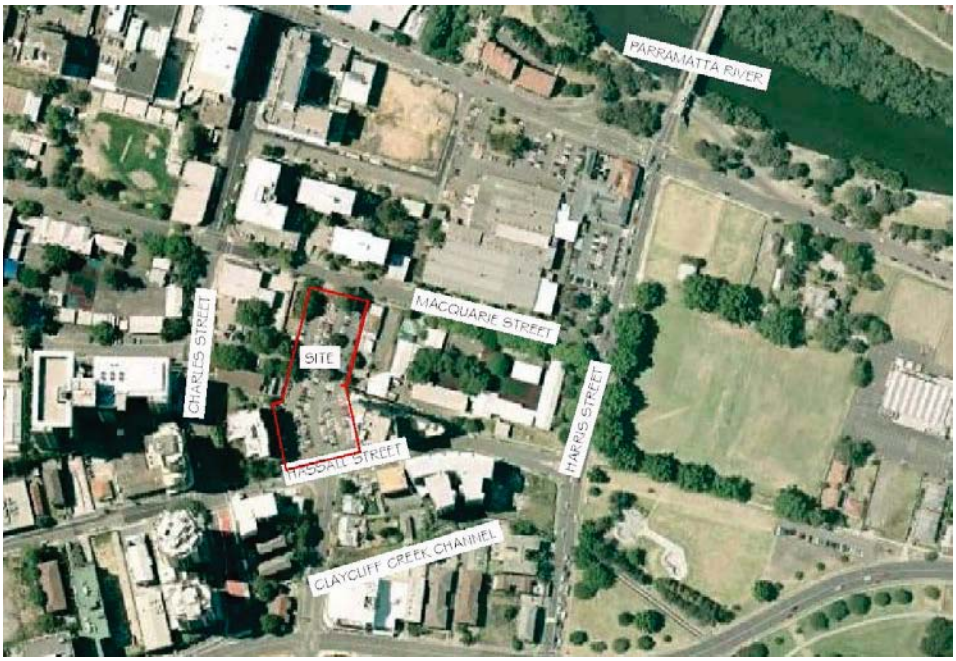
Flood Study

189 Macquarie Street

Parramatta

For Toplace

Planning Proposal



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KF Williams & Associates Pty Ltd
ABN 17 008 664 417

28 Auburn Street
Wollongong NSW 2500
PO Box 1477
Wollongong NSW 2500

p 02 4228 7044
f 02 4226 2004
e mail@kfw.net.au
www.kfw.net.au

1.0 SUMMARY

The purpose of this assessment is to investigate the impact on flooding of the possible future development resulting from the planning proposal at 189 Macquarie Street, Parramatta.

The following documents and data provided by Parramatta City Council were reviewed:

a. Lower Parramatta River Flood Study (LPRFS) (SKM May 2005)

b. Claycliff Creek Catchment Master Drainage Plan (CCCMDP) (Cardno July 2007)

c. LiDAR survey data

The 20 year ARI and 100 year ARI 6 hour rainfall burst have been modelled to determine the effect the building has on flooding in the critical storm durations. The building was modelled with and without flood storage.

Runoff was generated using the rainfall on grid method.

The pre-development catchment was modelled as the catchment currently exists. The existing conditions were modelled to estimate the existing flood behaviour.

The post-development catchment was modelled with possible future development superimposed imposed over the LiDAR data, both without and with flood storage and OSD.

A possible future building was modelled to determine flood impacts on the local catchment as a result of future development resulting from the planning proposal.

The post developed model included a flood storage plenum which sufficiently compensates for the flood storage volume lost due to the building, resulting in no increase in flood levels.

The 2D flood analysis has shown that in all cases, a flood storage plenum and OSD can sufficiently mitigate an increase in flood levels on adjacent properties and within Macquarie Street.

2.0 INTRODUCTION

K.F. Williams & Associates Pty Ltd has been commissioned by Toplace Pty Ltd to undertake a hydraulic analysis of the possible development resulting from the planning proposal at 189 Macquarie Street, Parramatta, in order to determine the impact of a building on flood levels within the local catchment.

This Flooding report has been prepared to accompany a Planning Proposal submitted to Parramatta Council for the subject site. It is understood that the Planning Proposal seeks to make the following changes:

1. *Apply a maximum height of 83m or up to 91.3m for development the result of an architectural design competition*

2. *Apply a maximum gross floor area (GFA) of 36,000m2, excluding any space used only for private balconies and communal open space for development the result of an architectural design competition.*

3. *Apply a maximum gross floor area (GFA) of 2,750m2, for the purpose of communal and private open space areas for development the result of an architectural design competition.*

The Planning Proposal does not seek to change the zoning of the land. The increase in density as a result of the Planning Proposal is marginal. The Council's own draft amendments to the comprehensive LEP would allow a FSR of 6.9:1 if the development of the land is subject to a design competition. This results in a GFA of approx. 36,000m2. The exclusion of enclosed communal open space and private open space from GFA calculations will have a minor if any impact on development density. The increased height enables the development to utilise the available floor space. Therefore from a flooding perspective the Planning Proposal does not change the flooding regime on the site. Such matters are more appropriately dealt with at the DA stage.

Notwithstanding this, this report addresses the S117 Direction relating to Flood Prone Land.

The pre development case was modelled under existing catchment conditions.

The post development case was modelled with a building on place, both without and with flood storage compensation and on-site stormwater detention (OSD).

The aim of the study is to demonstrate that sufficient site storage and OSD can be provided such as to mitigate an increase in flood levels resulting from any future development as a result of the planning proposal.

3.0 SITE CHARACTERISTICS

The site is located at 189 Macquarie Street, Parramatta with frontages to Macquarie Street and Hassall Street.

The site is located approximately 250 metres south west of Parramatta River and 85 metres north of Claycliff Creek channel.

The site locality is presented in Figure 3.1.

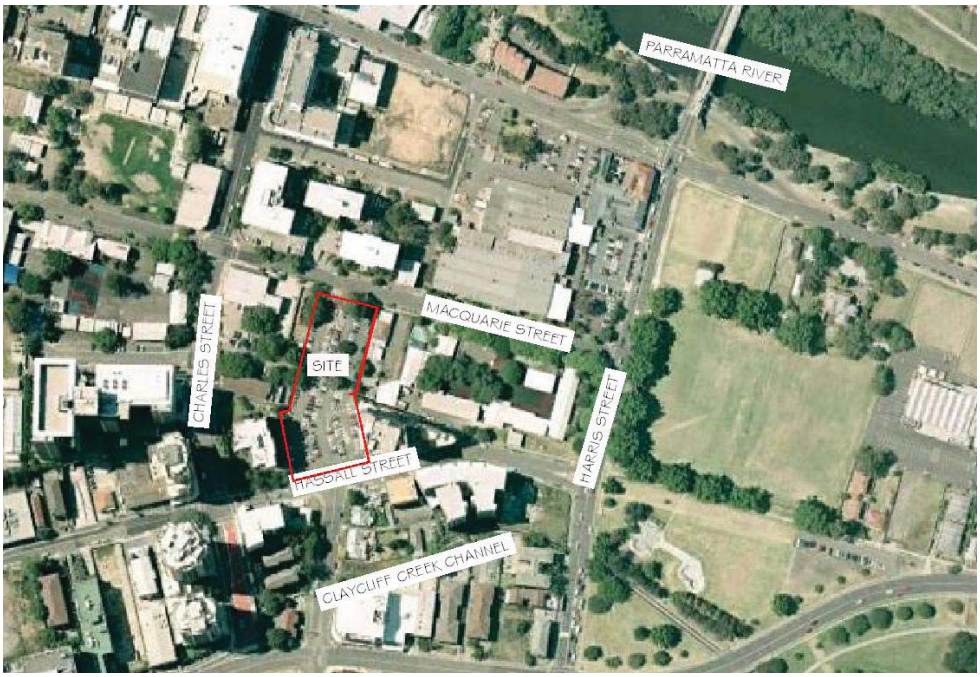


Figure 3.1 – Site Locality

Figure 3.2 shows the stormwater pipe line from the Macquarie Street frontage to the Claycliff Creek channel.

Figure 3.2 – Stormwater Drainage Layout

The local catchment area which creates a pooling effect within Macquarie Street is presented in Figure 3.3.

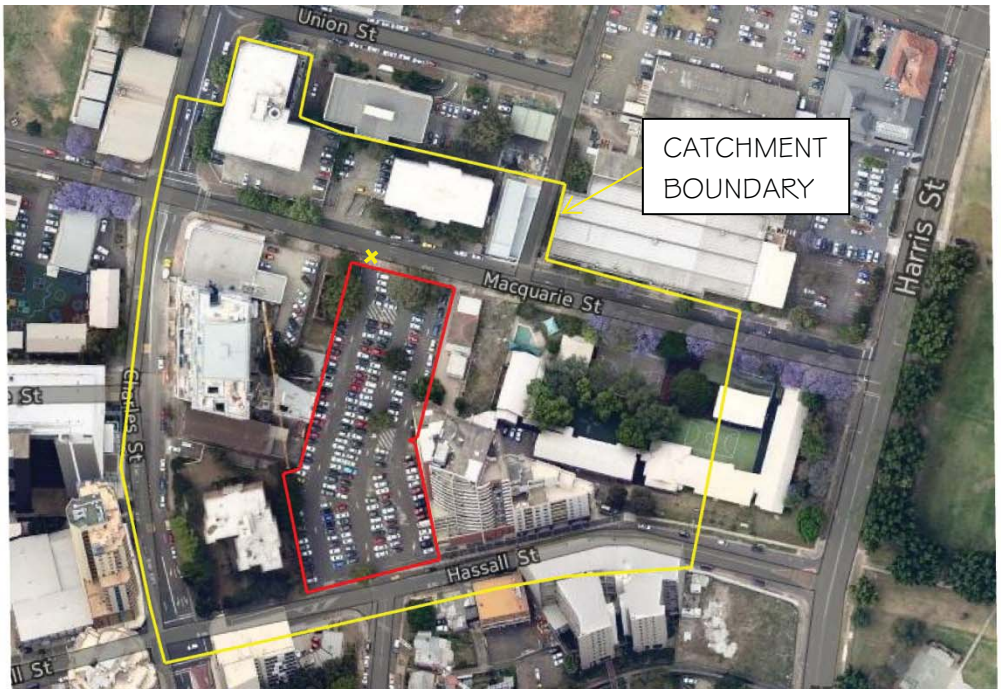


Figure 3.3 – Local Catchment Area

4.0 HYDROLOGICAL ANALYSIS

The local catchment within which a “bath tub” effect occurs is approximately 3.67 ha in area. The catchment is presented in Figure 3.3.

The site has been modelled as 100% impervious and as such the following rainfall losses have been applied.

- Initial loss = 0mm
- Continuing loss = 0mm/hr

The catchment area has been analysed for a variety of storm bursts, ranging from 1 hour to 72 hours.

Each storm burst was modelled through the 2D model to determine the critical storm duration, resulting in the greatest flood level.

Figure 4.1 presents the flood depth adjacent to the Macquarie Street frontage for varying storm burst durations. The critical storm duration for the local catchment was determined to be a 6 hour storm burst.

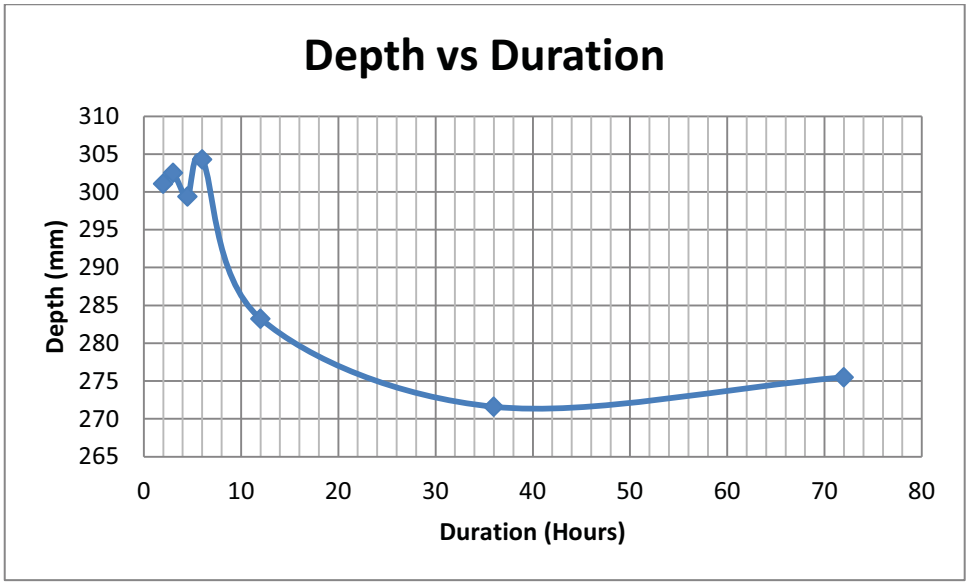


Figure 4.1 – Flood Depth vs Storm Burst Duration (Macquarie Street gutter, Point X on Figure 3.3)

Figure 4.2 and 4.3 present the 20 and 100 year ARI 6 hour storm burst hyetographs respectively. There hyetographs were used as the boundary condition for the 2D model.

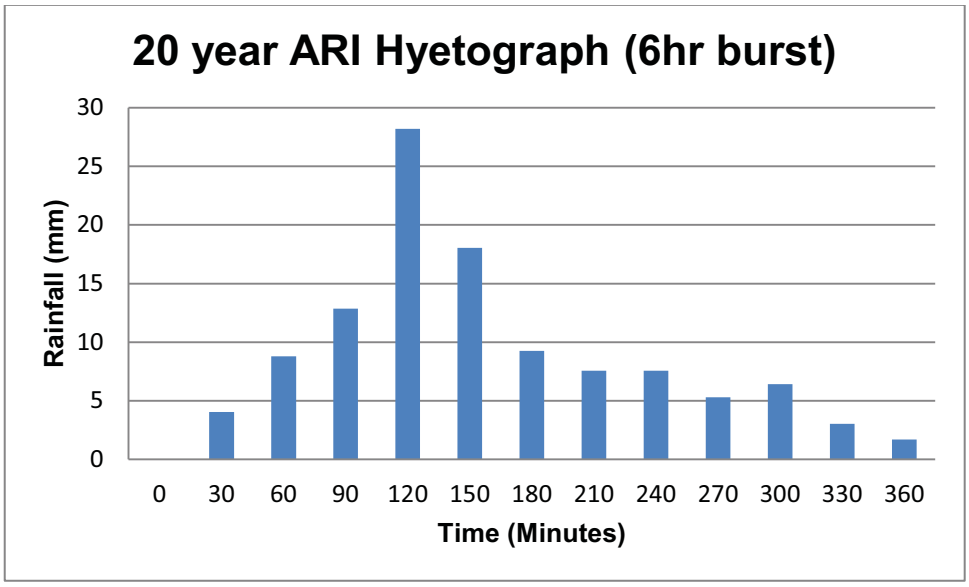


Figure 4.2 – 20 year ARI 6 hour Hyetograph

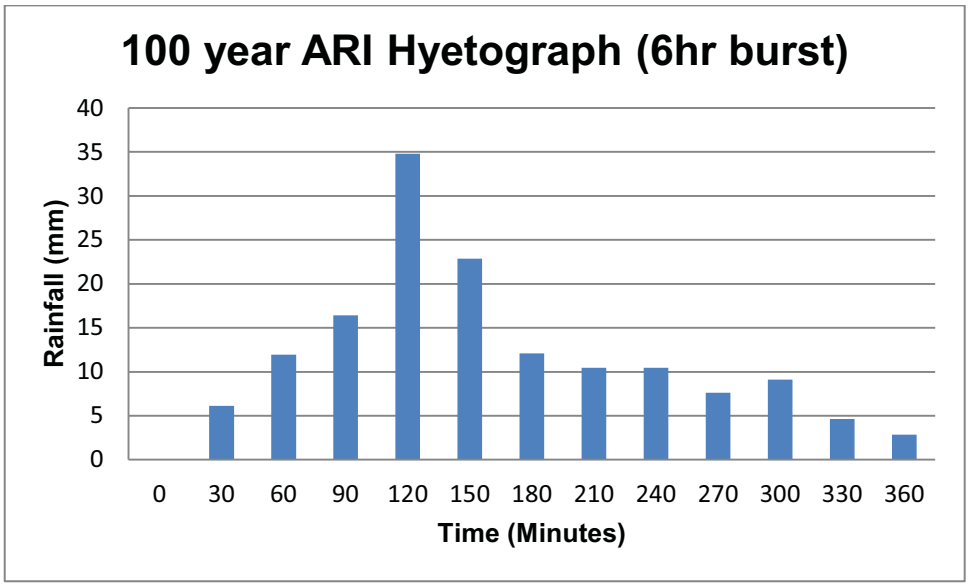


Figure 4.3 – 100 year ARI 6 hour Hyetograph

5.0 HYDRAULIC ANALYSIS

Hydraulic analysis was undertaken using a 2D hydraulic model with dynamically linked 1D elements. Modelling was undertaken using the numerical model TUFLOW.

5.1 Site Survey Details

LiDAR surface data was provided by Parramatta City Council. The LiDAR information was used to generate a 3D model of the surface.

The existing surface is shown in Figure 5.1.

The boundary of the model is shown as a green line on Figure 5.1. The TUFLOW model was developed using a 1m grid.

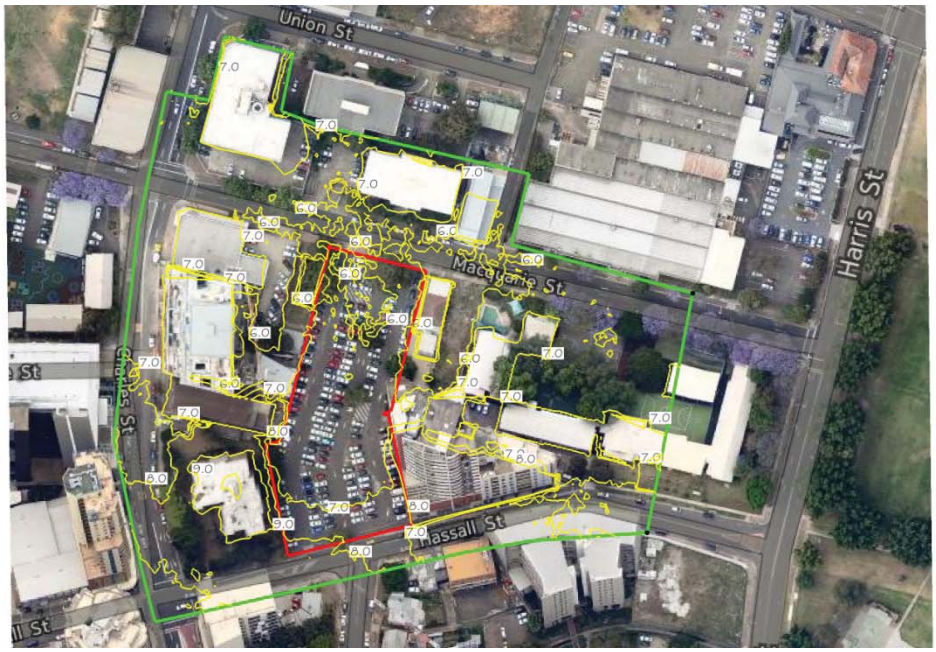


Figure 5.1 – Site Survey

The proposed building has been superimposed over the LiDAR survey information.

The existing buildings were modelled by elevating the surface. The elevated surface was shaped so as to collect the roof water to a central point which was discharged to the adjacent street. Table 5.1 presents the buildings identified in Figure 5.2.

Table 5.1 – Existing Building Details

Building	Approximate Roof Area (m^2)	Street Discharged To
A	1120	Charles St
B	687	Macquarie St
C	200	Macquarie St

C	200	Macquarie St
D	710	Macquarie St
E	1100	Charles St
F	514	Charles St
G	667	Charles St
H	111	Macquarie St
J	261	Macquarie St
K	184	Macquarie St
L	665	Macquarie St
M	522	Hassall St
N	424	Hassall St
O	1205	Hassall St
P	84	Hassall St

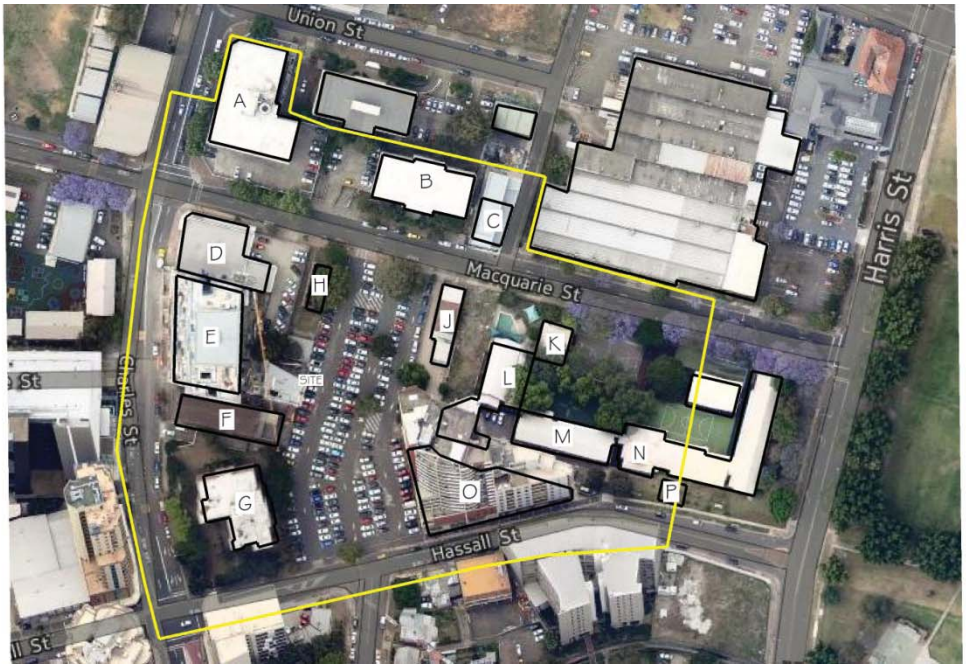


Figure 5.2 – Existing Buildings

The post developed model with no storage (OSD and flood storage) has the proposed building with a flat roof.

The post development model with storage (OSD and flood storage) has a depressed roof to collect the rainwater to a central point and direct it through the OSD system which connects to the existing drainage network.

The surface presented in Figure 5.3 has been used for the post development conditions.

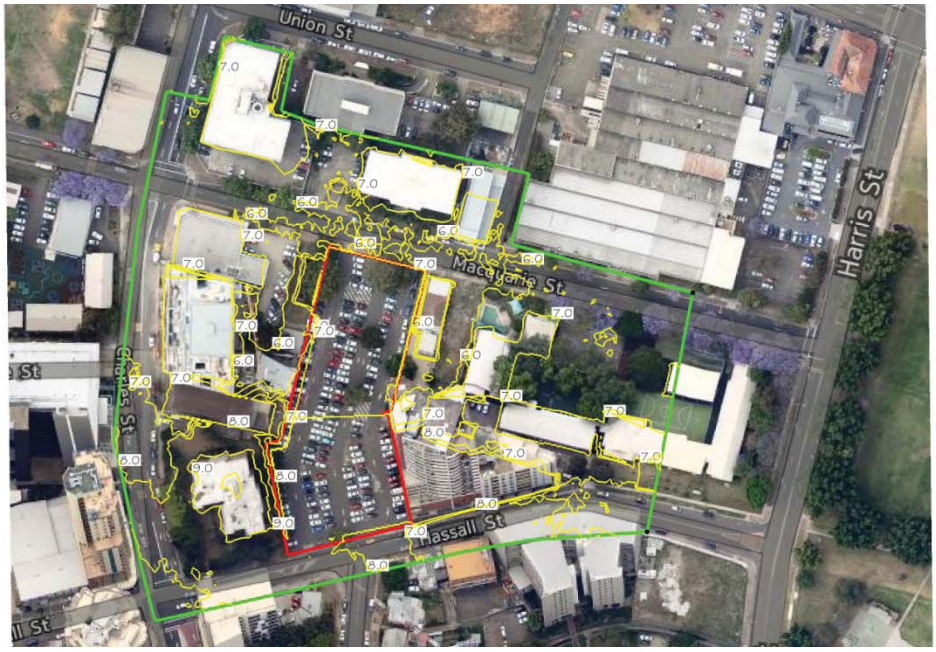


Figure 5.3 - Site Survey with Proposed Building

5.2 Roughness

The model has assumed a 100% impervious area for the catchment, which will provide a conservative estimate of runoff volume.

A roughness value of 0.015 was adopted for the catchment area.

The stormwater drainage pipes within the model have been modelled as 1D elements linked to the 2D grid and allocated a manning's value of 0.015.

5.3 1D Network

The stormwater drainage piped network has been modelled as a one dimensional network linked to the 2D domain.

A flood storage plenum was modelled using a 1D node with staged storage, modelling 535 m^3 of flood storage with twin 375 mm diameter pipe outlets to the existing drainage network.

The inflow into the flood storage plenum is through two vertical grates on the Macquarie Street frontage. The inflow details are presented in Table 5.2.

Table 5.2 - Inlet Grate Details

Vertical Grate	Opening Length (m)	Weir Flow Coefficient	Invert (m)
Grate 1	3.64	1.7	6.15
Grate 2	4.27	1.7	6.0

The opening length stated in Table 5.1 excludes the length of the vertical bars.

A 50% blockage was applied to the vertical grates.

The OSD requirement has been modelled as a 300 m^3 storage node with a 150 mm outlet.

A concept design of the proposed flood storage plenum and OSD is presented in Appendix A.

5.4 Boundary Conditions

A rainfall on grid boundary condition has been applied using the critical 6 hour storm burst hyetographs for 20 and 100 year ARIs.

It is noted that the difference in peak flood level between the 2 hour, 3 hour and 6 hour rainfall bursts was very small, being less than about 10mm.

The downstream boundary condition has been modelled as a water surface elevation and flow relationship with a 1% water surface slope.

The 1D network has been modelled as 2D/1D links at the kerb inlets and have a water surface level modelled at the downstream boundary, based on the water levels in Claycliff Creek as derived in LPRFS.

5.5 Simulations

The following scenarios have been modelled:

a) Existing site conditions

b) Future development with no storage

c) Future development with storage

The following flood frequencies have been modelled:

a) 20 year ARI

b) 100 year ARI

5.6 Results

Flood inundation maps for the 20 and 100 year ARI floods showing depth, velocity and VxD are attached in Appendix B.

A depth comparison of the pre and post development flood levels is presented for both the 20 and 100 year ARI events.

As presented in Appendix B, there is a slight increase in flood level as a result of development on the site when there is no proposed compensatory storage.

A flood plenum provides sufficient flood storage compensation so as to mitigate an increase in flood levels as a result of the proposed development for both the 20 and 100 year ARI events.

5.7 Sensitivity Analysis

The pre-developed and post-developed models have been run with mannings values of 0.025 and 0.03 to determine the effect that the roughness co-efficient has on the overall flood level within the catchment.

The following effects are noted as a result of modifying the catchment roughness.

Mannings Roughness Coefficient	Maximum Change in Flood Levels
0.025	1mm increase
0.03	2.5mm increase

Altering the mannings roughness results in negligible increases in flood levels. This is due to the catchment characteristics. Water pools within the catchment, creating a “bath tub” effect, and as a result the roughness of the surface does not cause notable effects on the flood water level.

6.0 ASSESSMENT OF SITE AGAINST FLOODPLAIN MATRIX

(a) Floor Level

The 100 year ARI flood level in Macquarie Street has been estimated to be RL 6.16 (KFW 2013).

The PMF level in Macquarie Street has been estimated to be RL 9.74 (SKM 2005).

The lowest habitable floors will be at or above RL 25.0 and will therefore be well above the PMF level.

Planning Control 1 can be satisfied.

Planning Control 5 is not applicable.

(b) Building Components

Reinforced concrete will be typically be used for floor slabs and walls. These materials widely considered to be flood compatible materials.

Planning Control 1 can be satisfied.

(c) Structural Soundness

The proposed building is a substantial and will be structurally designed to withstand an array of forces.

The depth of inundation during a 100 year ARI flood will be in the order of 0.15 m. This depth of water is clearly insufficient to result in a buoyancy force exceeding the weight of a multi storey reinforced concrete building.

The maximum velocity of flood water in Macquarie Street will be in the order of 0.2 m/s. This velocity is clearly insufficient to cause structural damage to a multi storey reinforced concrete building.

The maximum depth of inundation during a PMF will be about 3.74 m. This depth of water is clearly insufficient to result in a buoyancy force exceeding the weight of a multi storey reinforced concrete building.

Planning Control 1 is satisfied.

(d) Flood Affectation

The proposed building will not obstruct any overland flow path and will therefore have no impact on flood flows or velocities.

Full compensation for the potential loss of flood storage will be achieved by incorporating a flood storage plenum within the building. Approximately 535 m^3 of flood storage will be provided in a watertight void beneath the retail space / lobby.

As demonstrated by KFW (2013), providing compensatory flood storage on site will ensure that the proposed building does not increase flood levels. Further, the provision of flood storage provides a small reduction (up 75mm) in flood levels in Macquarie Street.

Planning Control 1 is satisfied.

(e) Car Parking & Access

The proposed building has several levels of both public and private parking.

Public Car Parking
Public car parking will be from Hassall Street.

Hassall Street is above the 100 year ARI flood in the vicinity of the point of access to the public car parking levels. The Parramatta Council Hydraulic Hazard Map indicates that the Hassall Street entry will be inundated during a PMF. The PMF level is reported to be RL9.42 AHD.

All public car parking above Level 1 will have at least 2.85 m freeboard to the 100 year ARI flood.

Inundation of Level 1 will be prevented by detailing the building to be flood proof to RL 6.66 (RL6.16 + 0.5 m).

Planning Control 1 is satisfied.

Planning Control 3 is satisfied.

Planning Control 5 is satisfied.

Planning Control 6 is not relevant because Level 1 is flood proofed for the 100 year ARI flood (plus freeboard).

Planning Control 7 is not relevant because Level 1 is flood proofed for the 100 year ARI flood (plus freeboard) and other levels are above the 100 year ARI flood level.

Private Car Parking
Private car parking is to be provided in the basement levels.

The basement car parking levels are technically below the level of the 100 year ARI flood and PMF.

Inundation of the basement car parking levels will be prevented by detailing the building to be flood proof to RL 6.66 (RL6.16 + 0.5 m). This will be achieved by specific waterproofing measures and setting the crest of the basement entry ramp from Macquarie Street to RL 6.66.

The objective of Planning Control 1 is satisfied.

The objective of Planning Control 3 is satisfied.

The depth of flood water in Macquarie Street during a 100 year ARI flood will be in the order 200mm (KFW 2013). Planning Control 5 is satisfied.

Planning Control 6 is not relevant because the basement levels are flood proofed for the 100 year ARI flood (plus freeboard).

Planning Control 7 is not relevant because the basement levels are flood proofed for the 100 year ARI flood (plus freeboard).

(f) Evacuation

All habitable floors and car parking levels above Level 2 are well above the PMF level. The proposed building will therefore offer safe refuge during a PMF.

Evacuation of the building during floods of magnitude up to and including a 100 year ARI flood will not be necessary.

Safe refuge for vehicles and personnel who may be in the vicinity during a PMF is available on Level 3, Level 4, Level 5 and Level 6.

In the event of a flood of magnitude exceeding 100 year ARI (plus 500 mm freeboard), the flood emergency strategy for persons and property (vehicles) located on and above Level 3 is to shelter in place. Residents will be safe within their place of residence. Vehicles will be safe within the car parking Level 3, Level 4, Level 5 and Level 6.

The level of risk to life and property for persons and property on or above Level 3 during a flood of magnitude exceeding 100 year ARI (plus 500 mm freeboard) is therefore low.

In the event of a flood of magnitude exceeding 100 year ARI (plus 500 mm freeboard), there is a risk that the three basement levels and Level 1 will be inundated. Level 2 will be inundated if the flood level exceeds RL 9.00 (0.74 m below PMF level).

In the event of an extreme flood, there is therefore a high – very high level of risk to persons and property (vehicles) which are located on and below Level 1. There is a low-moderate level of risk to persons and property (vehicles) located on level 2.

In order to eliminate the risk to life, and reduce damages to vehicles in the event of a flood of magnitude exceeding 100 year ARI (plus 500 mm freeboard), it will be necessary to ensure the evacuation of all personnel and as many vehicles as possible from the basement levels and from Level 1.

Evacuation of such personnel would be by the most direct vehicle or pedestrian route to Level 3 and above.

Available evacuation routes include:

- the three stairwells which provide direct connection to Level 3
- vehicle ramps which connect the basement levels to Macquarie Street
- vehicle ramps which connect level 1 to level 2 and above

Evacuation of vehicles from the basement levels and from Level 1 should occur prior to, and be completed by the time flood water reaches RL6.16.

Evacuation of personnel from the basement levels and from Level 1 should occur prior to, and be completed by the time flood water reaches RL6.66.

The first evacuation warning should therefore occur before the flood water depth has reached RL 6.16.

The following assumptions are made in relation to inundation of the basement:

a. The basement ramp crest will be set at RL 6.66 (100 year ARI flood level plus 500 mm freeboard).

b. The width of the basement ramp is 6 m.

c. Flood water will enter the basement levels and Level 1 if the flood water level exceeds RL 6.66.

d. During a PMF, flood water will rise from RL 6.65 to RL 9.74 over a 30 minute interval.

e. The maximum rate at which flood water will enter Level B1 as weir flow via the basement access ramp will be in the order of 55.4 m^3/s. This will occur when the flood level reaches RL 9.74.

f. Floodwater will enter Level 1 when flood level exceeds RL6.66. The means of entry will initially be via the Macquarie Street pedestrian entry.

g. The rate of flood water entry into Level 1 will increase significantly when flood level exceeds RL 9.40. At this point flood water will flow from Level 2 into Level 1.

The mechanism of basement inundation will generally be as follows:

- Flood water will enter Level B1 by weir flow over the crest of the basement ramp. The rate of flow over the weir will increase as flood level increases.

- Flood water will accumulate on Level B1 until sufficient depth is reached. A depth of 200 mm would commence flood water cascading into Level B2 via the access ramp at a rate of around 0.95 m^3/s. The depth of flood water in Level B1 will steadily increase, in turn increasing the rate at which flood water cascades into level B2.

- Flood water will accumulate on Level B2 until sufficient depth is reached. A depth of 200 mm would commence flood water cascading into Level B3 via the access ramp at a rate of around 0.95 m^3/s. The depth of flood water in Level B2 will steadily increase, in turn increasing the rate at which flood water cascades into level B3.

- The time taken for flood water in basement Level B3 to reach 0.9 m deep will be in the order of 22 min. At this time the depth of water in level B1 will be approximately 1.9 m deep and approximately 1.4 m deep in level B2.

- The time taken for flood water in basement Level B1 to reach 0.5 m deep will be in the order of 10 min. At this time the depth of water in level B2 will be approximately 0.14 m deep and approximately 0.005 m deep in level B3.

In the event that the Macquarie Street access ramp is overtopped (RL 6.66), it will not be possible to evacuate vehicles from the basement levels as the depth of water in Macquarie Street will prevent controlled movement of vehicles.

The evacuation plan should therefore include the following critical actions:

a. Vehicles to be evacuated from the basement prior to the flood level reaching RL 6.16.

Flood Warning 1: Residents evacuate vehicles to their allocated public car parking level.

Trigger Point: water level in Macquarie Street has reached RL 6.00 m.

The length of the evacuation route for vehicles is 330 m. The evacuation route from the basement to the public car parking levels will as follows:

i. Exit basement,
ii. Turn left into Macquarie Street,
iii. Turn left into Charles Street,
iv. Turn left into Hassall Street,
v. Turn left into car parking,

Note:
As part of the building management plan and in support of the flood evacuation plan each residence will be allocated a specific level to which they are to evacuate their vehicle in the event of an extreme flood.

The intention is therefore that residents are to evacuate their vehicle to their nominated level and park their car, then return to their dwelling unit.

If a parking space is available on the nominated level, they can use that space. Should a parking space not be available, they can double park or stack park on the nominated level.

It must be noted that the PMF is a rare flood which will prevent vehicles from entering or leaving the site. This means that double parking or stack parking will not disadvantage other persons because all vehicles must remain in the car park until the emergency has passed.

After the emergency has passed, vehicles can be moved.

Planning Control 3 can be satisfied.

b. All personnel to evacuate and be evacuated from the basement prior to the flood level reaching RL 6.66

Flood Warning 2: Evacuate basement immediately by vertical stairwell.

Trigger Point: water level in Macquarie Street has reached RL 6.50 m

c. Access to the basement be prohibited when the flood level reaches RL 6.66

Flood Warning 2: Access to basement denied. Lift service to basement to cease

Trigger Point: water level in Macquarie Street has reached RL 6.50 m

Note:
As part of the building management plan and in support of the flood evacuation plan each residence will be allocated a specific level to which they are to evacuate their vehicle in the event of an extreme flood.

The intention is therefore that residents are to evacuate their vehicle to their nominated level and park their car, then return to their dwelling unit.

If a parking space is available on the nominated level, they can use that space. Should a parking space not be available, they can double park or stack park on the nominated level.

It must be noted that the PMF is a rare flood which will prevent vehicles from entering or leaving the site. This means that double parking or stack parking will not disadvantage other persons because all vehicles must remain in the car park until the emergency has passed.

After the emergency has passed, vehicles can be moved.

A flood warning system will be installed to initiate a local audible alarm/siren and deliver SMS warning message to the resident's mobile phone.

The flood management plan for the building will be consistent and complimentary to the Parramatta CBD evacuation plan.

Planning Control 4 can be satisfied.

A satisfactory flood warning system will ensure all residents and casual visitors using the public car parking can shelter in place.

It will not be necessary for SES to allocate resources to evacuate people from the building.

Planning Control 6 can be satisfied.

(f) Management and Design

Storage of goods will be in residential units which are all above the 100 year ARI flood level.

The commercial floors will have 500 mm freeboard to the 100 year ARI flood level.

Car parking levels are for car parking only. No goods will be stored in the basement levels.

Planning Controls 2, 3 and 4 can be satisfied

7.0 PMF EVACUATION STRATEGY

7.1 General

The purpose of the PMF evacuation strategy is to:

a. ensure that residents are aware of the flood risk and are aware of the appropriate course of action in the event of an extreme flood event.

b. ensure that users of the casual car park are aware of the flood risk and aware of the appropriate course of action in the event of an extreme flood event.

c. eliminate the risk to life during a PMF

d. minimise property damages during a PMF

The flood risk exists for extreme floods with a magnitude greater than 100 year ARI flood.

It is recognised that it is probable that not all residents will be in a position to evacuate their vehicle in the event of an extreme flood. The reasons for this include but are not limited to:

- Being unaware of the situation
  (eg asleep, under the influence of intoxicating substance)

- Being incapacitated and/or incompetent to drive
  (eg intoxicated)

- Not receiving the SMS flood warning
  (eg asleep, flat battery)

- Flood rise being more rapid than reaction time

- Being away from the building
  (eg at work via public transport, on holidays, visiting others, overseas)

Based on the Lower Parramatta River Flood Study (SKM May 2005), the PMF level in the Parramatta CBD will be between RL 9.42 and RL 9.74.

All habitable floors and the car parking levels above Level 3 will be above the PMF and will therefore offer safe refuge for residents and others in the vicinity.

Level 2 will be partially inundated by a PMF.

Level 1 and the basement car parking levels will be inundated by a PMF.

7.2 Flood Initial Action Plan

In the unlikely event of an extreme flood, residents will receive early warning from the Bureau of Meteorology and local NSW State Emergency Services (SES).

7.2.1 Initial Action Plan Trigger

The trigger for the initial action plan will be a warning of Extreme Flood from Bureau of Meteorology, ABC Radio or SES.

7.2.2 Initial Action Plan: Residents

As the flood approaches the initial flood risk minimisation actions for residents/occupants on Level 1 include the following:

a. Remain aware of the situation and listen for updates and warnings from the Bureau of Meteorology and ABC radio.

b. If safe to do so, relocate your vehicle to your allocated public car parking level. The vehicle evacuation route from the basement to the public car parking levels will as follows:
   - Exit basement,
   - Turn left into Macquarie Street,
   - Turn left into Charles Street,
   - Turn left into Hassall Street,
   - Turn left into car parking entry
   - Drive to your allocated parking space
   - Return to you residence
   - When the emergency has passed, return to your vehicle and ensure that it is not causing an obstruction to others

   Observe flood warning signs.

   Do not enter the basement if flood alarm is sounding.

   Do not enter the basement if flood water is flowing into the basement.

   You must immediately evacuate the basement if flood water is flowing into the basement.

   Do not drive, ride or walk in flood water.

c. Continue to listen for updates from the Bureau of Meteorology and ABC radio.

Note:
As part of the building management plan and in support of the flood evacuation plan each residence will be allocated a specific level to which they are to evacuate their vehicle in the event of an extreme flood.

The intention is therefore that residents are to evacuate their vehicle to their nominated level and park their car, then return to their dwelling unit.

If a parking space is available on the nominated level, they can use that space. Should a parking space not be available, they can double park or stack park on the nominated level.

It must be noted that the PMF is a rare flood which will prevent vehicles from entering or leaving the site. This means that double parking or stack parking will not disadvantage other persons because all vehicles must remain in the car park until the emergency has passed.

After the emergency has passed, vehicles can be moved.

A flood warning system will be installed to initiate a local audible alarm/siren and deliver SMS warning message to the resident's mobile phone.

The flood management plan for the building will be consistent will and complimentary to the Parramatta CBD evacuation plan.

7.2.3 Initial Action Plan: Casual Car Park users

For casual car park users on Level 1 and Level 2

a. Be aware of the situation and listen for updates and warnings from the Bureau of Meteorology and ABC radio.

b. If safe to do so, return to your vehicle and move it to Level 3 or higher. Alternatively drive to high ground or drive home .

   Observe flood warning signs.

   Do not enter attempt to leave the building or enter Level 1 or Level 2 if flood water has entered.

   Do not drive, ride or walk in flood water.

c. Continue to listen for updates from the Bureau of Meteorology and ABC radio.

7.3 **Vehicle Evacuation Action Plan**

7.3.1 Basement Levels – Vehicle Evacuation Action Trigger

The trigger for the evacuation of vehicles in levels B1, B2, B3 and Level 1 will be either of the following:

a. A direction to do so from the Police or SES, or

b. Flood water reaching RL 6.00. This flood level is indicated by the footpath in Macquarie Street being just covered by flood water.

7.3.2 Vehicle Evacuation Action Plan:

Vehicles on Level 1 should be driven directly to Level 3 or higher by the internal vehicle circulating aisles and ramps.

Vehicles on level B1, B2 and B3 should be driven to the allocated level via Macquarie Street, Charles Street and Hassall Street.

7.4 **Personnel Evacuation Action Plan**

7.4.1 Basement Levels – Personnell Evacuation Action Trigger

The trigger for the evacuation of personnel in levels B1, B2, B3 and Level 1 will be either of the following:

a. A direction to do so from the Police or SES, or

b. Flood water reaching RL 6.50. This flood level will indicated by a prominent marker at the Macquarie Street frontage and a water level sensor set to detect a water level of RL 6.50.

   An audible alarm and flashing red light will be initiated in the affected basement levels to indicate that these levels must be evacuated immediately.

7.4.2 Personnel Evacuation Action Plan:

Personnel on the PMF affected levels must immediately move to Level 3 or higher using the three basement stairwells or vehicle ramps.

Residents should return to their residence.

8.0 RESPONSE TO DIRECTION 4.3 – Flood Prone Land

The following table provides a response to the relevant requirements of Direction 4.3 Flood Prone Land:

Relevant consideration	Response
(1) A planning proposal must include provisions that give effect to and are consistent with the NSW Flood Prone Land Policy and the principles of the *Floodplain Development Manual 2005* (including the *Guideline on Development Controls on Low Flood Risk Areas*).	This Flood Study was prepared in order to determine the potential flood impacts of proposed development that results from the revised controls sought under this Planning Proposal. The report has been subsequently reviewed by an independent consultant, Cardno Pty Ltd, engaged by Council. This report incorporates comments submitted to Parramatta Council by Brett Phillips (Cardno) The Flooding report is consistent with the NSW Flood Prone Land Policy and the principles of the Floodplain Development Manual 2005 (including the Guideline on Development Controls on Low Flood Risk Areas).
(2) A planning proposal must not rezone land within the flood planning areas from Special Use, Special Purpose, Recreation, Rural or Environmental Protection Zones to a Residential, Business, Industrial, Special Use or Special Purpose Zone.	This does not apply to this Planning Proposal.
(3) A planning proposal must not contain provisions that apply to the flood planning areas which:	
(a) permit development in floodway areas,	No change is proposed to development permitted on the site.
(b) permit development that will result in significant flood impacts to other properties,	The flooding report has clearly demonstrated that the development of the site will have no adverse impact on flood flows or velocities. Adjacent properties will not be subject to flood impact nor subject to increased flood risk.
(c) permit a significant increase in the development of that land,	The Planning Proposal seeks to increase the height of building to enable the utilisation of the permitted GFA on the site inclusive of the bonus for design excellence. (15% as

Relevant consideration	Response
	proposed by Council's Planning Proposal). The Planning Proposal does not increase development of the land, instead it permits a more appropriate building form to utilise the permitted floor space.
(d) are likely to result in a substantially increased requirement for government spending on flood mitigation measures, infrastructure or services, or	As demonstrated in the Flooding report, the development of the site will have no adverse impact on flood flows or velocities. Additional flood mitigation works will not be required. Development of the site will in fact provide a place of safe refuge in the event of an extreme flood.
(e) permit development to be carried out without development consent except for the purposes of agriculture (not including dams, drainage canals, levees, buildings or structures in floodways or high hazard areas), roads or exempt development.	This is not sought by this Planning Proposal.
(4) A planning proposal must not impose flood related development controls above the residential flood planning level for residential development on land, unless a relevant planning authority provides adequate justification for those controls to the satisfaction of the Director-General (or an officer of the Department nominated by the Director-General).	The Planning Proposal does not propose flood related controls.
(5) For the purposes of a planning proposal, a relevant planning authority must not determine a flood planning level that is inconsistent with the Floodplain Development Manual 2005 (including the *Guideline on Development Controls on Low Flood Risk Areas*) unless a relevant planning authority provides adequate justification for the proposed departure from that Manual to the satisfaction of the Director-General (or an officer of the Department nominated by the Director-General).	The flood study is consistent with the FPDM. This proposal does not seek to vary the flood planning level.

9.0 CONCLUSION

The hydraulic analysis has shown that the proposed building has minimal effects on surrounding flood levels.

The proposed flood storage plenum provides sufficient volumetric storage to mitigate an increase in flooding, by storing the lost flood storage volume and discharging through the existing stormwater drainage network.

The proposed plenum also has the capacity to accommodate for the OSD required on the site.

A flood warning and awareness system can be easily installed.

Report prepared by:

Nathan Gundlach ……
Date: 16 December 2013

Reviewed by:

Wal Mullany ……
BE Grad Dip LGE, ME(Hons), MIE Aust CPEng, NPER
Date: 16 December 2013

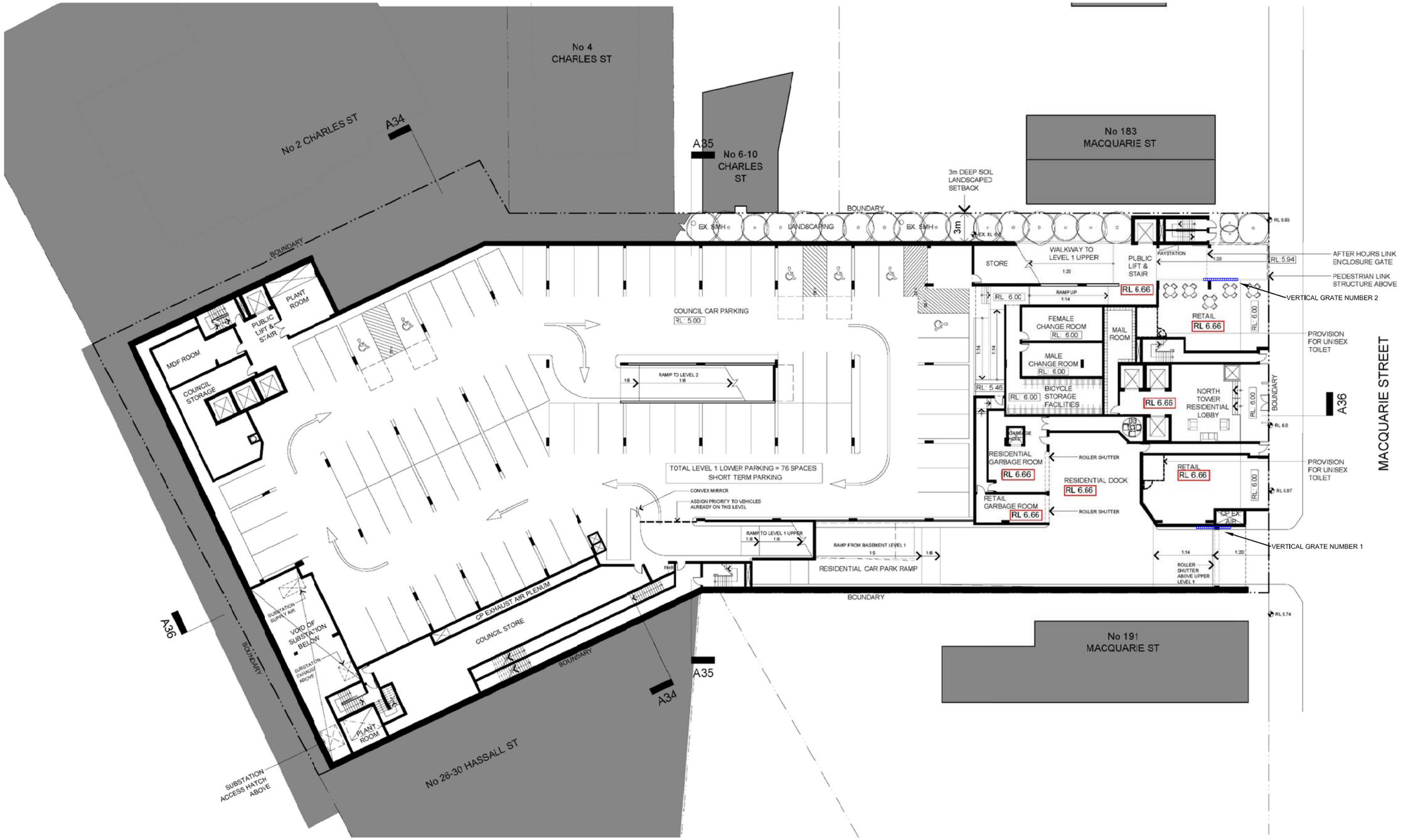
Appendices:

Appendix A – Flood Plenum Design

Appendix B – Flood Inundation Maps

APPENDIX A

Flood Plenum Design



MACQUARIE STREET CARPARK REDEVELOPMENT

189 MACQUARIE ST PARRAMATTA, NSW, 2150

LOWER LEVEL 1 FLOOR PLAN (COUNCIL CAR PARK)

PRELIMINARY

DATE 13/12/2013
SCALE 1 : 200 @A1

0 2 4 8 12 16

PROJECT NO. 3212 | DRAWING NO. A13 | ISSUE C

A1

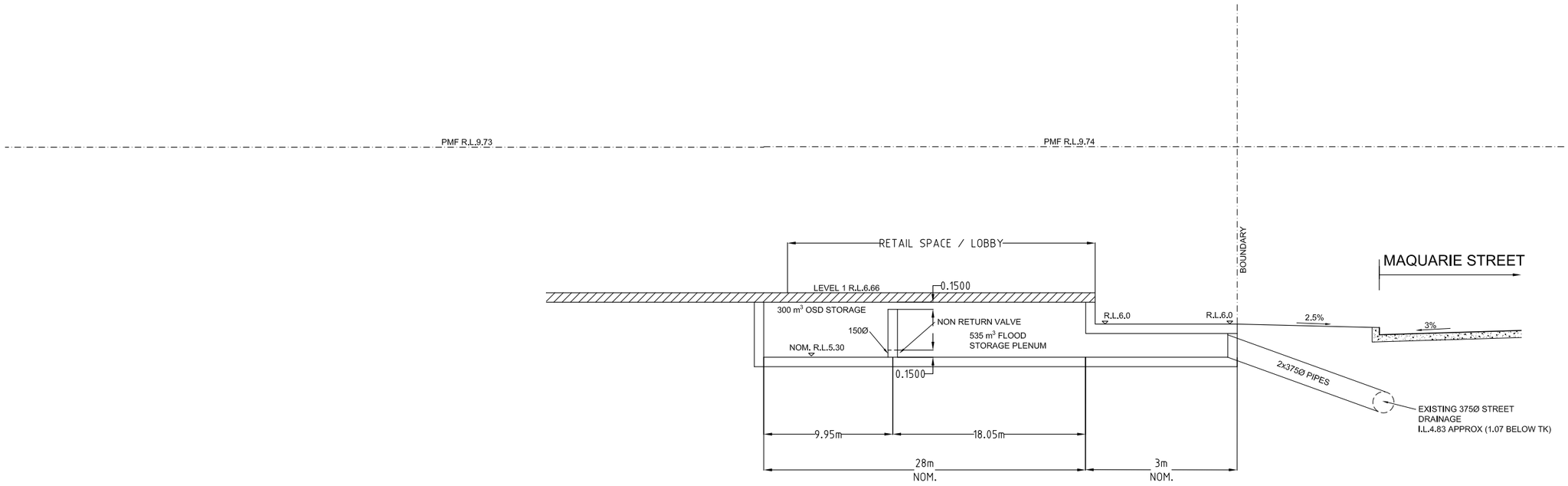
DO NOT SCALE DRAWINGS.
VERIFY ALL DIMENSIONS ON SITE.
REFER ANY DISCREPANCIES TO THE SUPERINTENDENT BEFORE PROCEEDING WITH THE WORK.

nick tayler chartered architect no 5596

PROPRIETOR
TOPLACE PTY LTD
SHOP 3, 143-147 Parramatta Rd
Concord NSW 2137
TEL 02 9747 0947 FAX 02 9747 0540

ARCHITECT
krikis tayler architects
alevel 7 97 pacific highway
north sydney nsw 2060
mpo box 726 north sydney nsw 2059
p+61(0)2 9900 6000 f +61(0)2 99006001
www.krikistayler.com.au

100mm 200mm 300mm ON ORIGINAL



FLOOD LEVEL DETAIL & FLOOD STORAGE PLENUM

SCALE NTS

Revision	Amendment or reason for issue	Issue date	Drawn by	Authorised
I	LEVELS ADJUSTED	17/12/2013	N.G	
H	WEIR ADDED	15/04/2013	B.P	
G	AMENDED FOOD STORAGE PLENUM	17/01/2013	B.P	
F	FLOOD STORAGE PLENUM AMENDED	15/01/2013	B.P	
E	SECTION AMENDED	18/12/2012	B.P	
D	FLOOR LEVELS AMENDED	17/12/2012	B.P	
C	VOID UNDER RETAIL/LOBBY	23-11-2012	B.P	
B	VOID AND DRAINAGE ADDED, FLOOR LEVELS LIFTED 100mm	23-11-2012	A.P.	WM
A	LEVEL 1 LIFTED 100mm	16-11-2012	WM	WM

INFRASTRUCTURE PROFESSIONALS

K.F. Williams & Associates Pty Ltd
28 Auburn Street
Wollongong NSW 2500
A.C.N 008 664 417
Project Management, Surveying,
Civil, Structural, Water & Sewer

p (02) 4228 7044
f (02) 4226 2004
e mail@kfw.net.au
www.kfw.net.au

Surveyor		Date	26 Oct 2012
Date of Survey		Drawn	BP
Height Datum		Designed	
Origin		Checked	
Horiz. Datum		Approved	

Drawing Title: MACQUARIE STREET CARPARK REDEVELOPMENT
ATTACHMENT 2
INDICATIVE SECTION

Scale: NTS @ A1, NTS @ A3

Drawing Status: ISSUED FOR INFORMATION

Project No.	Drawing No.	Sheet	Revision
KF111027	ATT3	1 Of 1	I

APPENDIX B

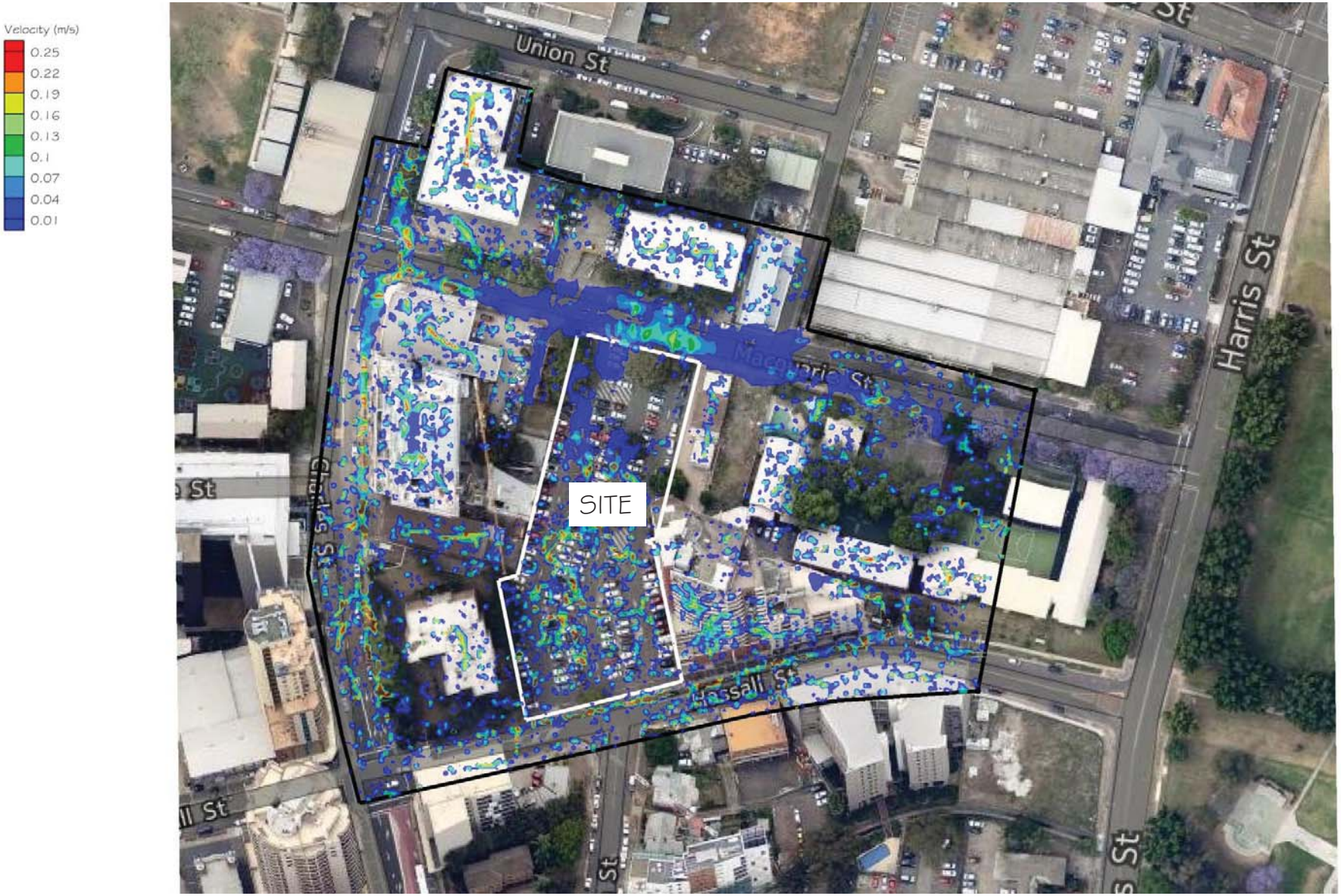
Flood Inundation Maps

FLOOD MAPPING, 189 MACQUARIE ST, PARRAMATTA					
Conditions	Flood Event	Storm Burst Duration	Coverage	Revision	Job
Existing	20yr	6hrs	Depth	-	KF111027

FLOOD MAPPING, 189 MACQUARIE ST, PARRAMATTA					
Conditions	Flood Event	Storm Burst Duration	Coverage	Revision	Job
Proposed (No Storage)	20yr	6hrs	Depth	-	KF111027

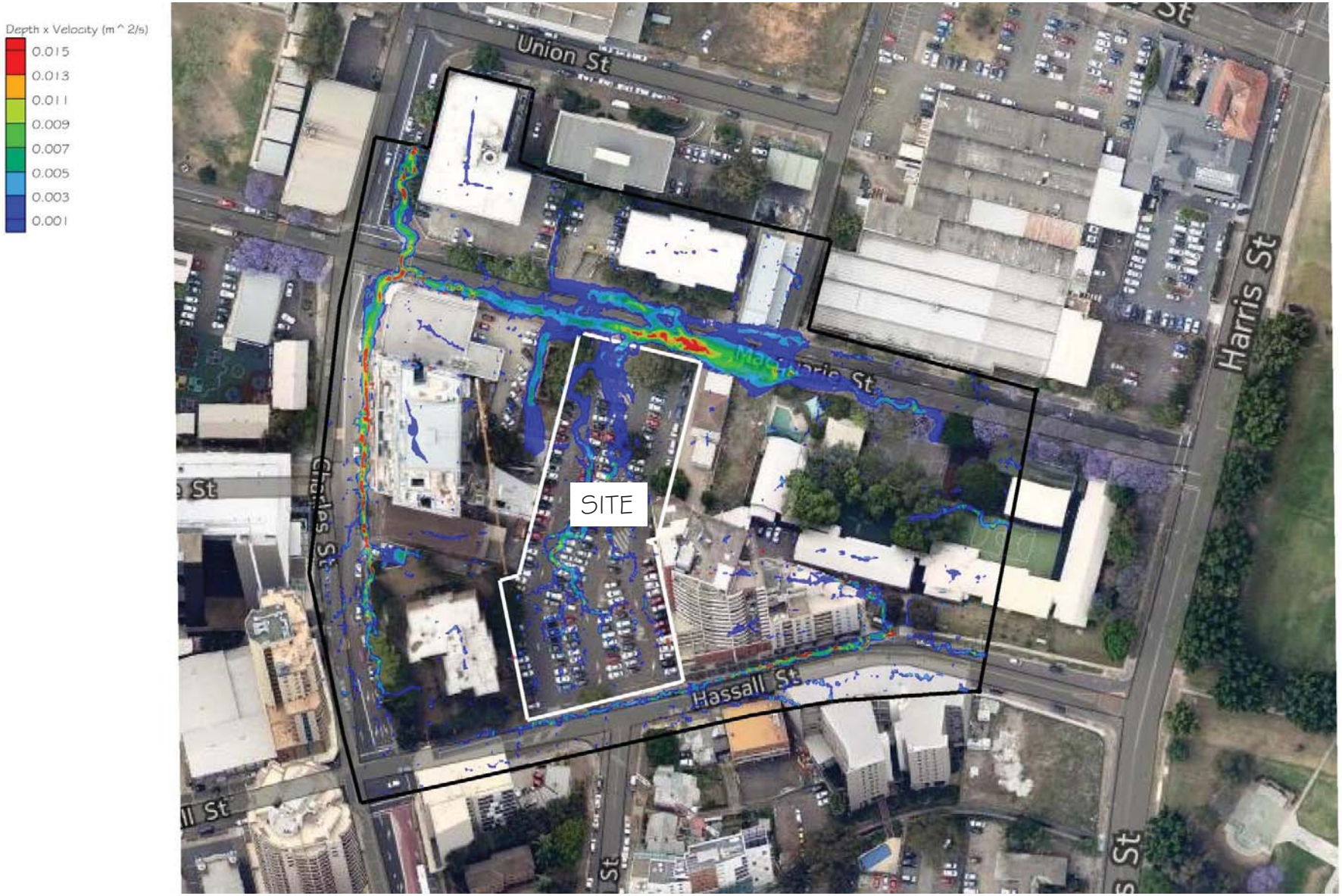
FLOOD MAPPING, 189 MACQUARIE ST, PARRAMATTA					
Conditions	Flood Event	Storm Burst Duration	Coverage	Revision	Job
Proposed (With Storage)	20yr	6hrs	Depth	-	KF111027

FLOOD MAPPING, 189 MACQUARIE ST, PARRAMATTA					
Conditions	Flood Event	Storm Burst Duration	Coverage	Revision	Job
Post (Storage) vs Existing	20yr	6hrs	Depth Difference	-	KF111027



FLOOD MAPPING, 189 MACQUARIE ST, PARRAMATTA					
Conditions	Flood Event	Storm Burst Duration	Coverage	Revision	Job
Existing	20yr	6hrs	Velocity	-	KF111027

FLOOD MAPPING, 189 MACQUARIE ST, PARRAMATTA					
Conditions	Flood Event	Storm Burst Duration	Coverage	Revision	Job
Proposed (With Storage)	20yr	6hrs	Velocity	-	KF111027



FLOOD MAPPING, 189 MACQUARIE ST, PARRAMATTA					
Conditions	Flood Event	Storm Burst Duration	Coverage	Revision	Job
Existing	20yr	6hrs	Depth x Velocity	-	KF111027

FLOOD MAPPING, 189 MACQUARIE ST, PARRAMATTA					
Conditions	Flood Event	Storm Burst Duration	Coverage	Revision	Job
Proposed (With Storage)	20yr	6hrs	Depth x Velocity	-	KF111027

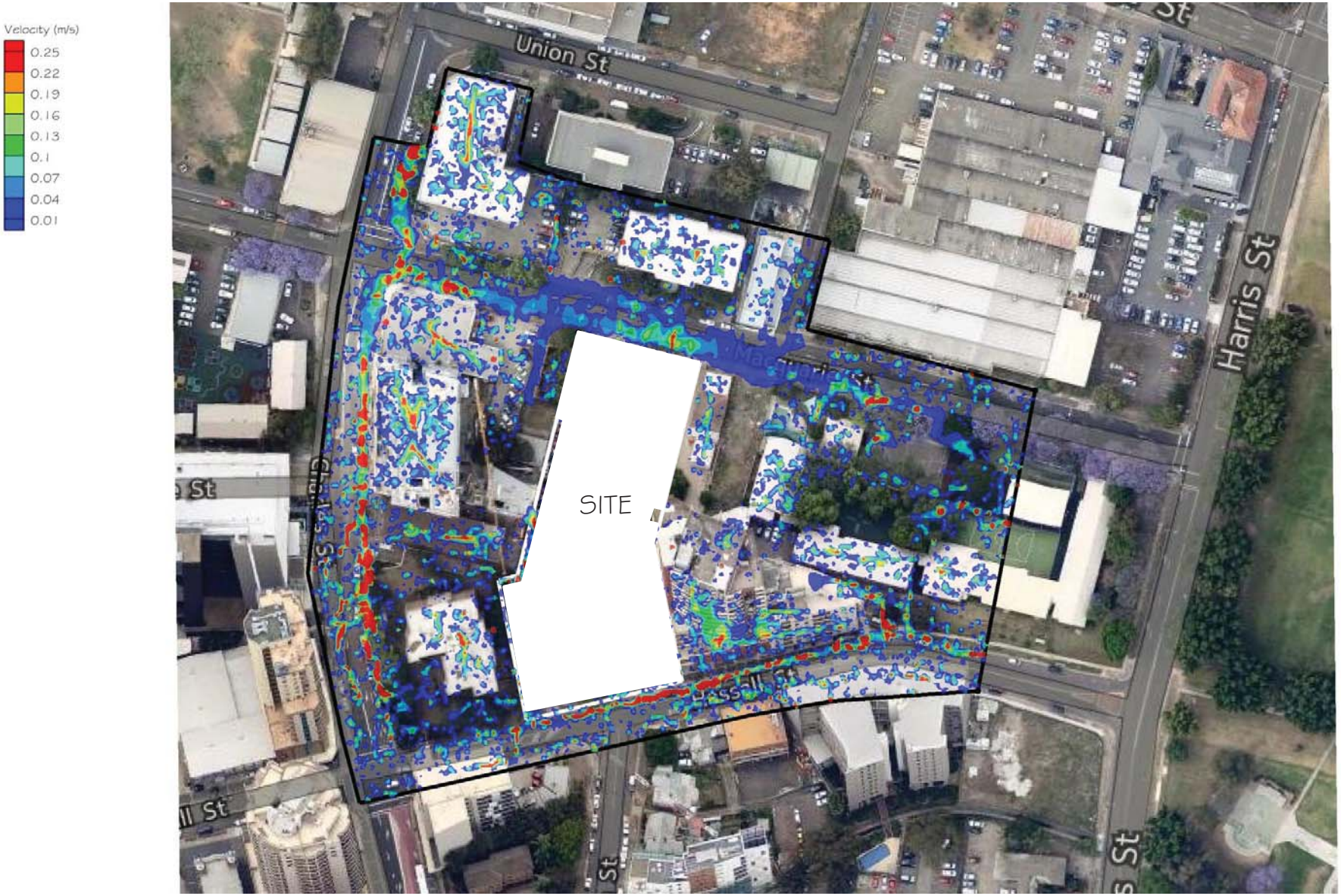
FLOOD MAPPING, 189 MACQUARIE ST, PARRAMATTA					
Conditions	Flood Event	Storm Burst Duration	Coverage	Revision	Job
Existing	100yr	6hrs	Depth	-	KF111027

FLOOD MAPPING, 189 MACQUARIE ST, PARRAMATTA					
Conditions	Flood Event	Storm Burst Duration	Coverage	Revision	Job
Proposed (No Storage)	100yr	6hrs	Depth	-	KF111027

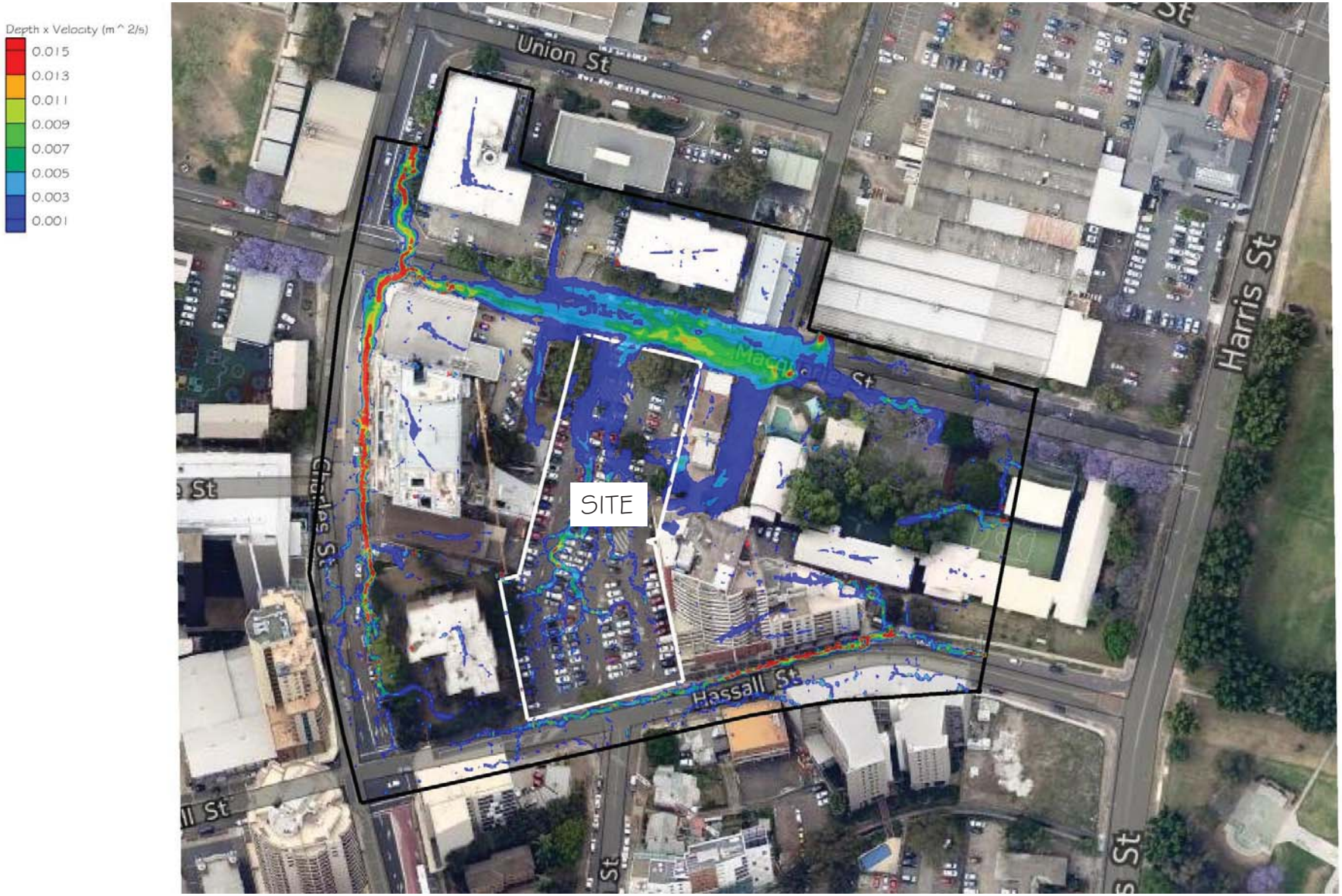
FLOOD MAPPING, 189 MACQUARIE ST, PARRAMATTA					
Conditions	Flood Event	Storm Burst Duration	Coverage	Revision	Job
Proposed (With Storage)	100yr	6hrs	Depth	-	KF111027

FLOOD MAPPING, 189 MACQUARIE ST, PARRAMATTA					
Conditions	Flood Event	Storm Burst Duration	Coverage	Revision	Job
Post (Storage) vs Existing	100yr	6hrs	Depth Difference Plot	-	KF111027

FLOOD MAPPING, 189 MACQUARIE ST, PARRAMATTA					
Conditions	Flood Event	Storm Burst Duration	Coverage	Revision	Job
Existing	100yr	6hrs	Velocity	-	KF111027



FLOOD MAPPING, 189 MACQUARIE ST, PARRAMATTA					
Conditions	Flood Event	Storm Burst Duration	Coverage	Revision	Job
Proposed (With Storage)	100yr	6hrs	Velocity	-	KF111027



FLOOD MAPPING, 189 MACQUARIE ST, PARRAMATTA					
Conditions	Flood Event	Storm Burst Duration	Coverage	Revision	Job
Existing	100yr	6hrs	Depth x Velocity	-	KF111027

FLOOD MAPPING, 189 MACQUARIE ST, PARRAMATTA					
Conditions	Flood Event	Storm Burst Duration	Coverage	Revision	Job
Proposed (With Storage)	100yr	6hrs	Depth x Velocity	-	KF111027