ORDINARY COUNCIL MEETING

ATTACHMENTS BOOKLET

Under Separate Cover

Tuesday, 19 August 2025

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CITY OF CANADA BAY TRAFFIC COMMITTEE MEETING

AGENDA

Notice is hereby given that a City of Canada Bay Traffic Committee Meeting will be held at the:

Electronically via email

Thursday, 10 July 2025

Beginning at 9:00 AM for the purpose of considering and determining matters included in this agenda.

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1 WELCOME/ACKNOWLEDGEMENT OF COUNTRY

The City of Canada Bay acknowledges the Wangal clan, one of the 29 tribes of the Eora nation and the traditional custodians of this land.

The City's Council pays respect to Elders past and present and extends this respect to all Aboriginal people living in or visiting the City of Canada Bay.

2 APOLOGIES

In accordance with clauses 6.3, 6.4 and 6.5 of Council's Code of Meeting Practice, apologies must be received and accepted from absent Councillors and a leave of absence from the Council Meeting may be granted.

3 DISCLOSURES OF PECUNIARY AND NON-PECUNIARY INTEREST

In accordance with Part 16 of Council's Code of Meeting Practice, all Committee members must disclose and manage any conflicts of interest they may have in matters being considered at the meeting.

4 CONFIRMATION OF MINUTES

4.1 MINUTES OF CITY OF CANADA BAY TRAFFIC COMMITTEE MEETING HELD 12 JUNE 2025

STAFF RECOMMENDATION

That the minutes of the City of Canada Bay Traffic Committee Meeting of 12 June 2025 copies of which were previously circulated, are hereby confirmed as a true and correct record of the proceedings of that meeting.

5 REPORTS

ITEM 5.1 **WALKER STREET, RHODES - PROPOSED ROAD CLOSURE - PUBLIC DOMAIN WORKS**

Author **Traffic Engineer**

Attachments: **1. Rhodes Station Precinct Public Domain Staging Options**

STAFF RECOMMENDATION

THAT:

1. The Committee considers 'Option 1' to be the preferred road closure method to be implemented during the public domain works on Walker Street, Rhodes.
2. The proposed 'Option 1, Stage 1 & Stage 2' bus detour routes are approved by TfNSW and Bus Service Operators for a minimum of 21 weeks.
3. Traffic Guidance Schemes are generated for the closure area and circulated to all stakeholders prior to the commencement of the works.

EXECUTIVE SUMMARY

The purpose of this report is to seek the Committee's consideration of the proposed temporary road closure to undertake public domain works on Walker Street, Rhodes. The proposed works will be undertaken in two stages to minimise impacts to local residents, however, Council has received a presentation package outlining two options, subject to stakeholder consultation.

BACKGROUND/DISCUSSION

The Rhodes Station Precinct Revitalisation is a transformative project by the City of Canada Bay to reshape the area surrounding Rhodes Train Station.

The revitalisation spans the public domain from Union Square, along Walker Street, past the station, to the new $80 million Rhodes Recreation Centre at the corner of Walker and Gauthorpe Street.

This landmark upgrade will make the precinct safer, more accessible, and visually appealing for the community — featuring new shared pathways, enhanced streetscapes, landscaping, and public art.

On 3 December 2024, Council endorsed the Fourth Deed of Variation to the Planning Agreement for the Rhodes West Station Precinct. This Variation permits the use of surplus development levies to undertake additional road and footpath works within the precinct. The aim is to complete all roadworks simultaneously, minimising disruption while achieving consistent outcomes and cost savings.

The concept design for the Walker Street public domain works is progressing to the final stage. Staging of the works has been prepared by the contractor's civil team to enable delivery of the project with minimal disruption and in the shortest feasible timeframe. This has resulted in the two options presented with a preference for Option 1, subject to consultation with TfNSW and relevant Bus Operators.

- **Option 1:**

  Full closure of Walker Street to all vehicle access, with a bus detour in place for a minimum of 21 weeks.

- **Option 2:**

  Partial closure of Walker Street, allowing one-directional vehicle and bus access, for a minimum of 25 weeks.

Both options will include:

- A two-day shutdown of Walker Street during a Sydney Trains possession weekend (either 23–24 August 2025 or 25–26 October 2025), subject to Sydney Trains approval.
- Full closure of stair and lift access to the train station for five nights (ALBF – After Last Before First) to complete pavement reconstruction.
- Pedestrian access along the western footpath to always be maintained.
- Pedestrian access (including disabled access) to Rhodes Station at all times during train operating hours.
- Access to shopfronts to be maintained during business hours.
- Driveway access to be maintained during the day and only closed at night during pavement construction.

TIMING / CONSULTATION AND / OR RISK CONSIDERATIONS

Council is currently in consultation with Sydney Trains to undertake minor tree removals along the street, however, is subject to their possession weekend approval. Should approval be obtained, the works are planned to commence in mid-August 2025.

Works are proposed to be completed by March 2026 dependent on weather and subject to the options approved by the Committee.

Following approval, the contractors undertaking the works will conduct community notification of the subject closure to all affected residents. The 3 businesses will not be affected by the closure as shown within the attached proposal.

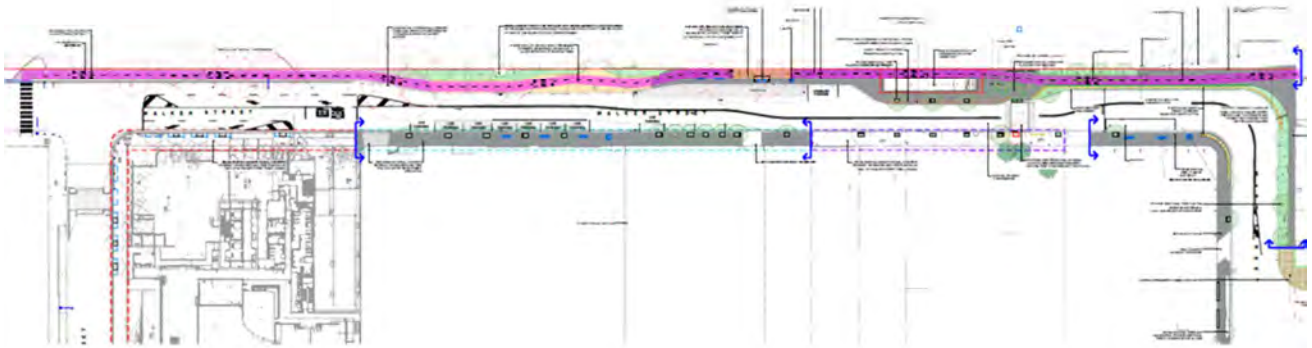
Additional communication will be provided through Council's website and social media channels.

FINANCIAL CONSIDERATIONS

The works will be funded by the City of Canada Bay using surplus development levies through the VPA process, as endorsed by Council on 3 December 2024.

Walker & Mary St Development

Construction Staging Options



02/07/2025

Billbergia
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PROJECT

Option 1– Staging Time Frame Detail

Option detail	Staging type	Duration of works
Option 1 - 2 Stages Possession & night works	Full closure to Walker St with Bus Detour	21 Weeks

Works Scope – Stage 1 - 12 Weeks

1. Tree removal – including fence remediation – Possession works Weekend 23/24 August 2025
2. Site Establishment – Barriers, Line marking, Demo, Line marking to Northern point – Ped crossing
3. Excavation works
4. New Conduit installation
5. Lighting Construction & footings
6. Concrete works – Cycleway & footpath construction
7. Hard & Soft Landscaping – Paving
8. Road construction
9. Night works to high ped areas – outside of Sydney Trains stairs & Lift (Slide 6)
10. Asphalt works & Line marking
11. **Traffic switch to stage 2 set up**

Works Scope – stage 2 - 9 Weeks

1. Site Establishment

2-10 Repeat steps 2-10 above

11. **Open Walker St to completion of works**

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- Buses detoured around Walker St for both stages of works to enable major construction around Train station
- **Works to occur Stage 1 –Full Closure – bus detour- 12 weeks**
- **Works to occur Stage 2 – Full Closure – bus detour- 9 weeks**
- Full closure to Stair & Lift access for 5 nights ALBF(After Last Before First) to complete pavement reconstruction
- Staging of Pedestrians to occur with movement of temporary pedestrian crossing to enable completion of works
- Pedestrian access open to West footpath during stage of works

Note: Pedestrian access during Normal working hours to be in place at all times

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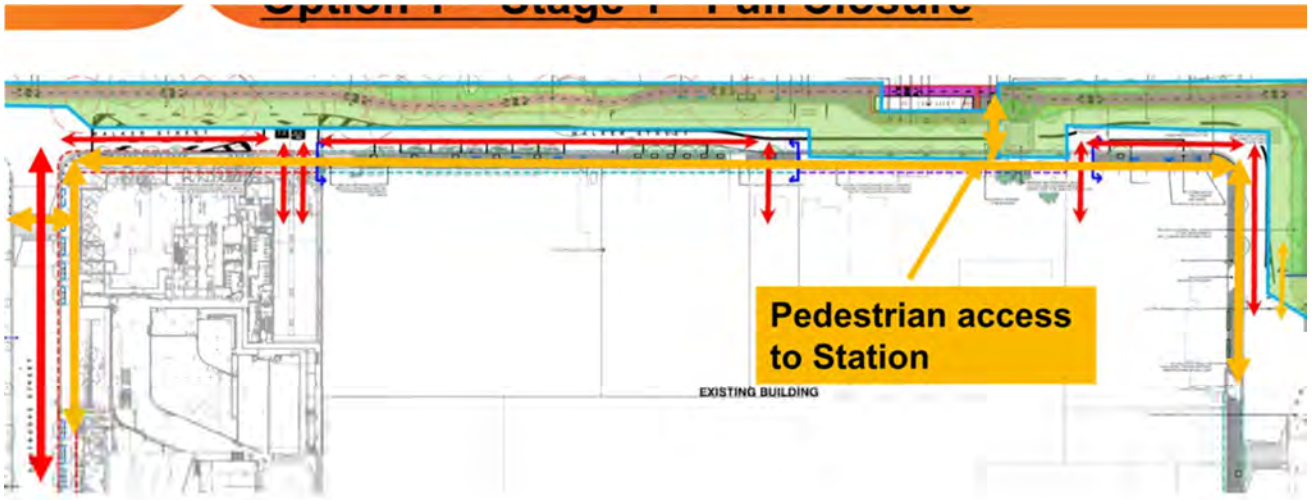

Notes -

- Full closure requiring access to come from both ends
- **Bus Detour** around Walker St – see slide 8
- Traffic control full time including traffic lights to Mary St end
- Pedestrian Movement ↔
- Traffic Movement ↔

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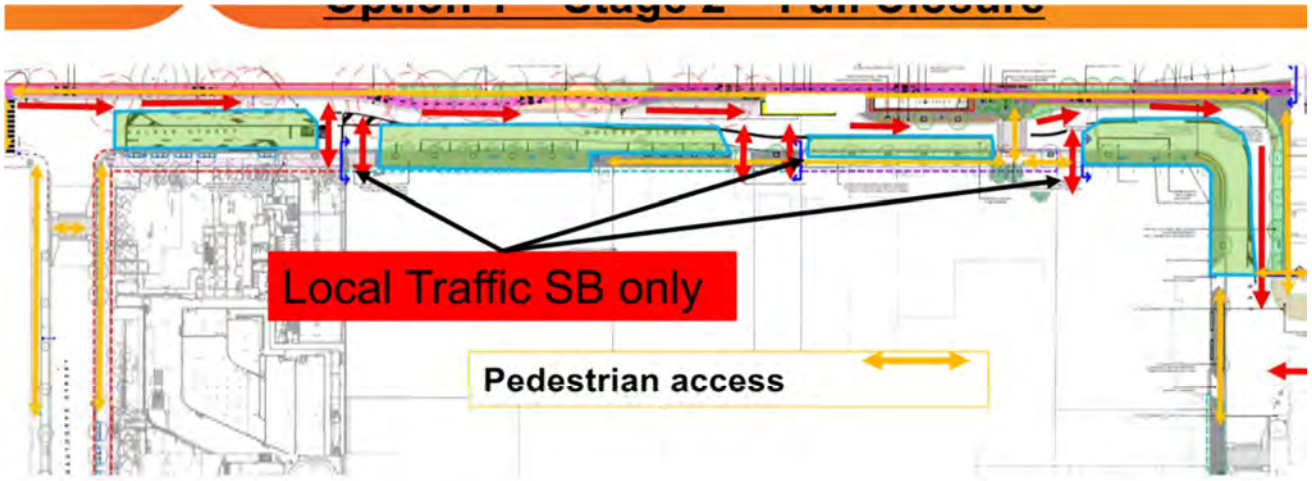

Notes – Option 1- Stage 2

- Local Access for Residents access via Northbound
- **Bused detoured** around Walker St – See slide 8.
- Closure of Driveways at night to complete pavement construction

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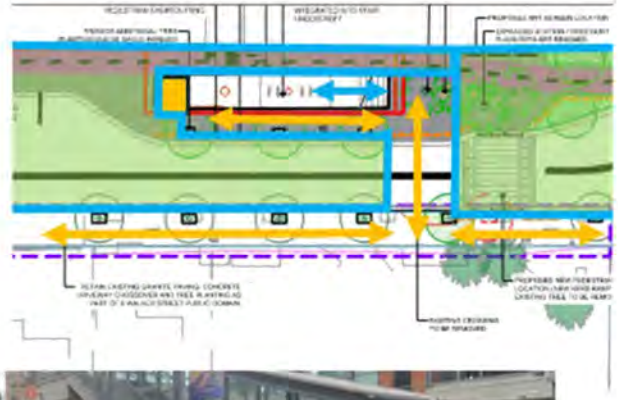
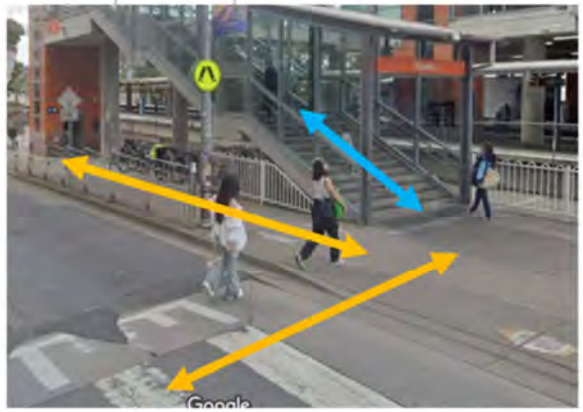
Pedestrian Access during Construction @ Rhodes Station





- Movement of pedestrian crossing to be managed during works
- Pedestrian traffic access to Rhodes station at all times
- **Disabled access maintained to Rhodes Station Lift access point**

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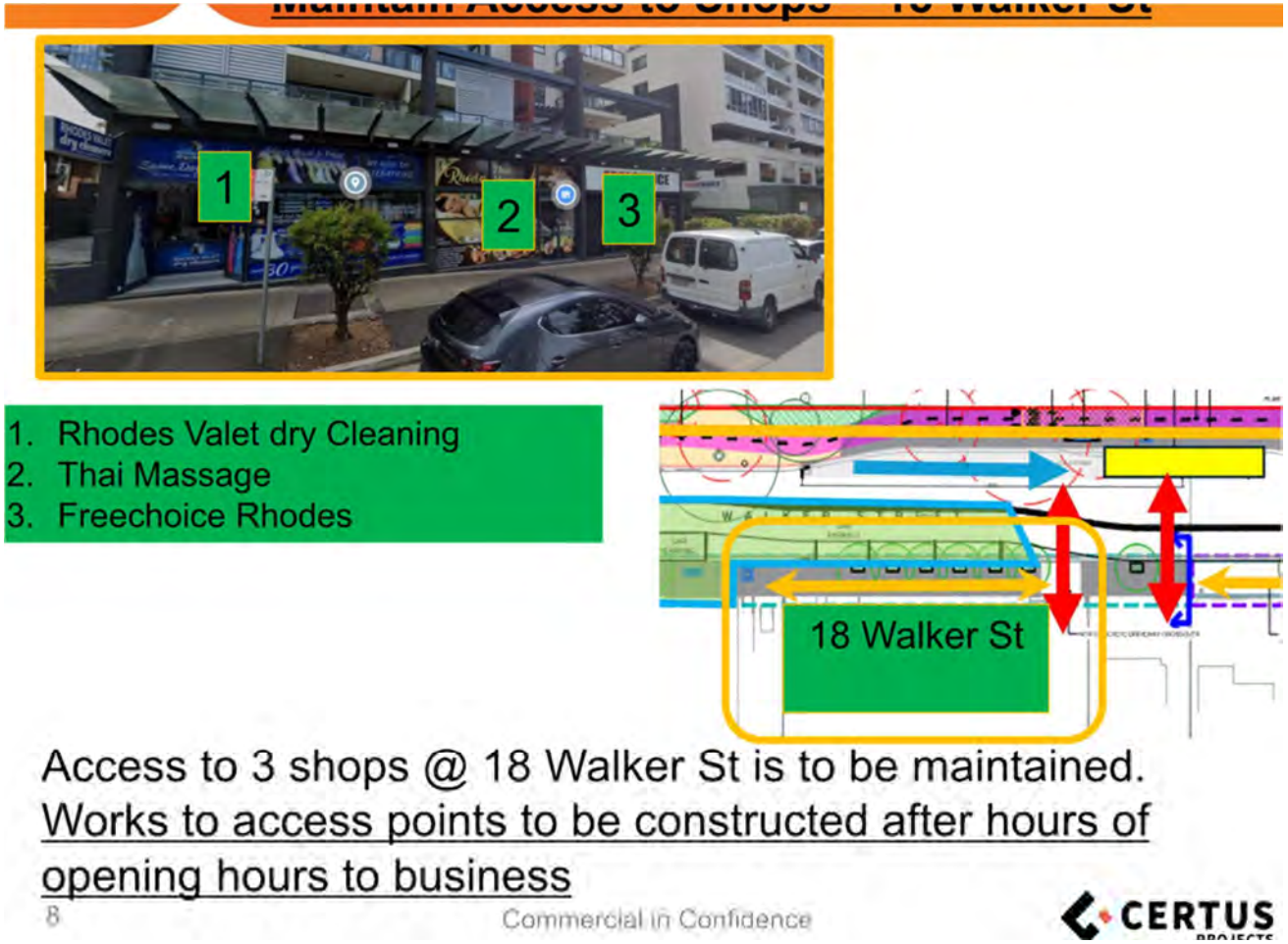
CERTUS PROJECTS


1
2
3
1. Rhodes Valet dry Cleaning
2. Thai Massage
3. Freechoice Rhodes
18 Walker St
Access to 3 shops @ 18 Walker St is to be maintained.
Works to access points to be constructed after hours of opening hours to business
8
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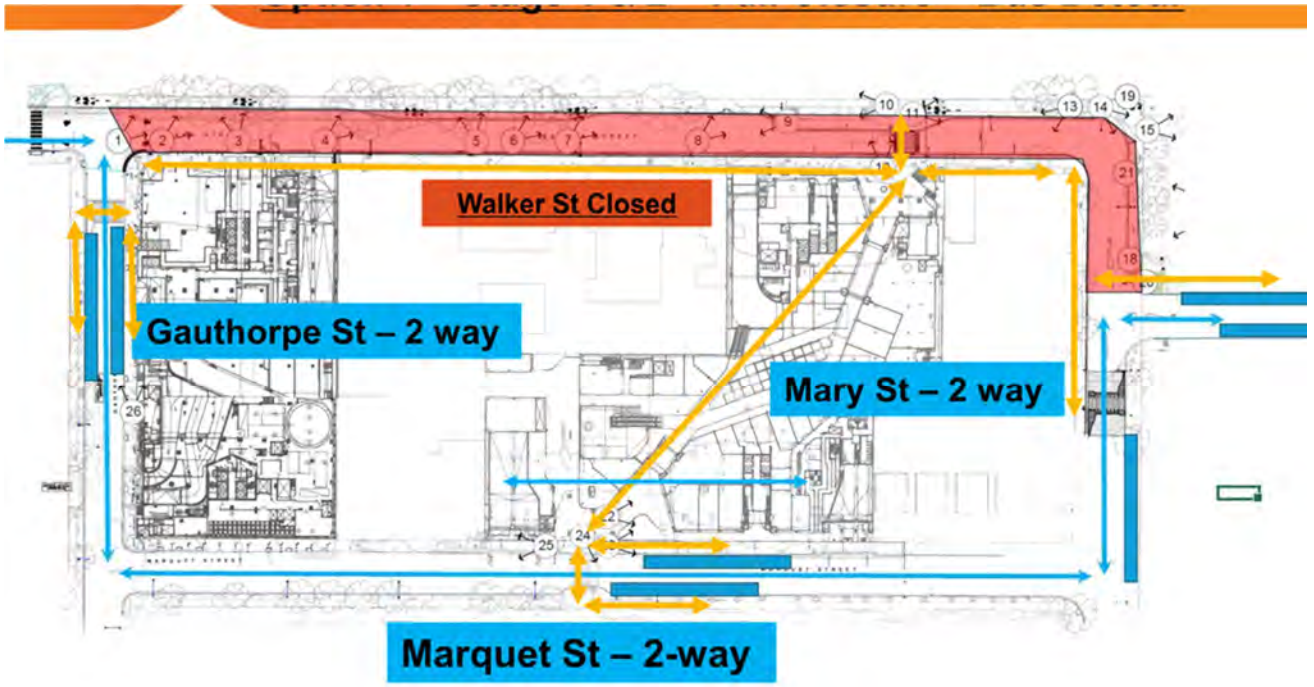
Walker St Closed
Gauthorpe St – 2 way
Mary St – 2 way
Marquet St – 2-way
Bus Stop – Temporary stops
Route – both ways
Pedestrian Access
9
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Option 2 – Staging Time frame

Option detail	Staging type	Duration of works
Option 2 – 2 Stages Possession & night works	Partial closures No Bus Detour	25 Weeks

- Buses route permitted along Walker St except one-way as per below:
- **Stage 1 (Works to Western side) – Partial Closure – Buses SB - Circa 9 weeks**
- **Stage 2 (Works to Eastern side) – Partial closure – Buses NB – Circa 16 weeks**
- Full closure to Stair & Lift access for 5 nights ALBF(After Last Before First) to complete pavement reconstruction
- Staging of Pedestrians to occur with movement of temporary pedestrian crossing to enable completion of works
- Pedestrian access open to West footpath during stage of works

Note: Pedestrian access during Normal working hours to be in place at all times

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Works Scope – Stage 1 – 9 weeks

1. Site Establishment – Barriers, Line marking, Demo, Line marking to Northern point – Ped crossing
2. Excavation
3. Conduit installation
4. Lighting Construction
5. Concrete works – Cycleway construction
6. Tree removal – including fence remediation – Possession works 23/24 August 2025
7. Hard & Soft Landscaping – Paving
8. Road construction
9. Night works to high ped areas
10. Asphalt works & Line marking
11. **Traffic switch to stage 2 set up**

Works Scope – Stage 2 - 16 Weeks

1. Site Establishment

3-10 Repeat steps 3-10 above

11. **Open Walker St to completion of works**

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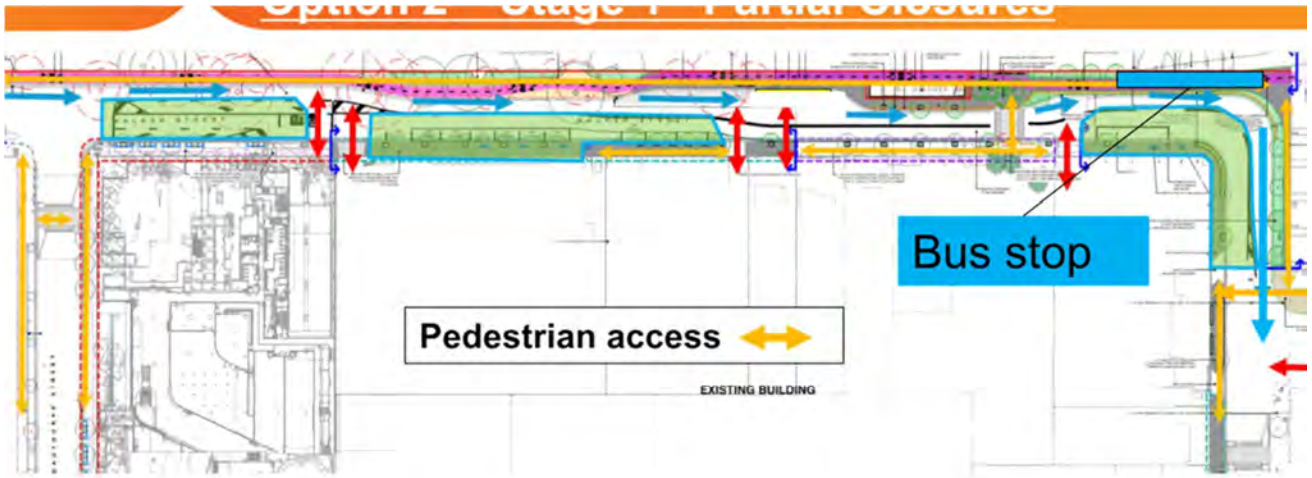

Notes – **Option 1 - Stage 1**

- Partial closure with traffic running southbound, closure of driveways at night to complete pavement construction
- Buses run southbound with bus stop located outside station on Southerr end

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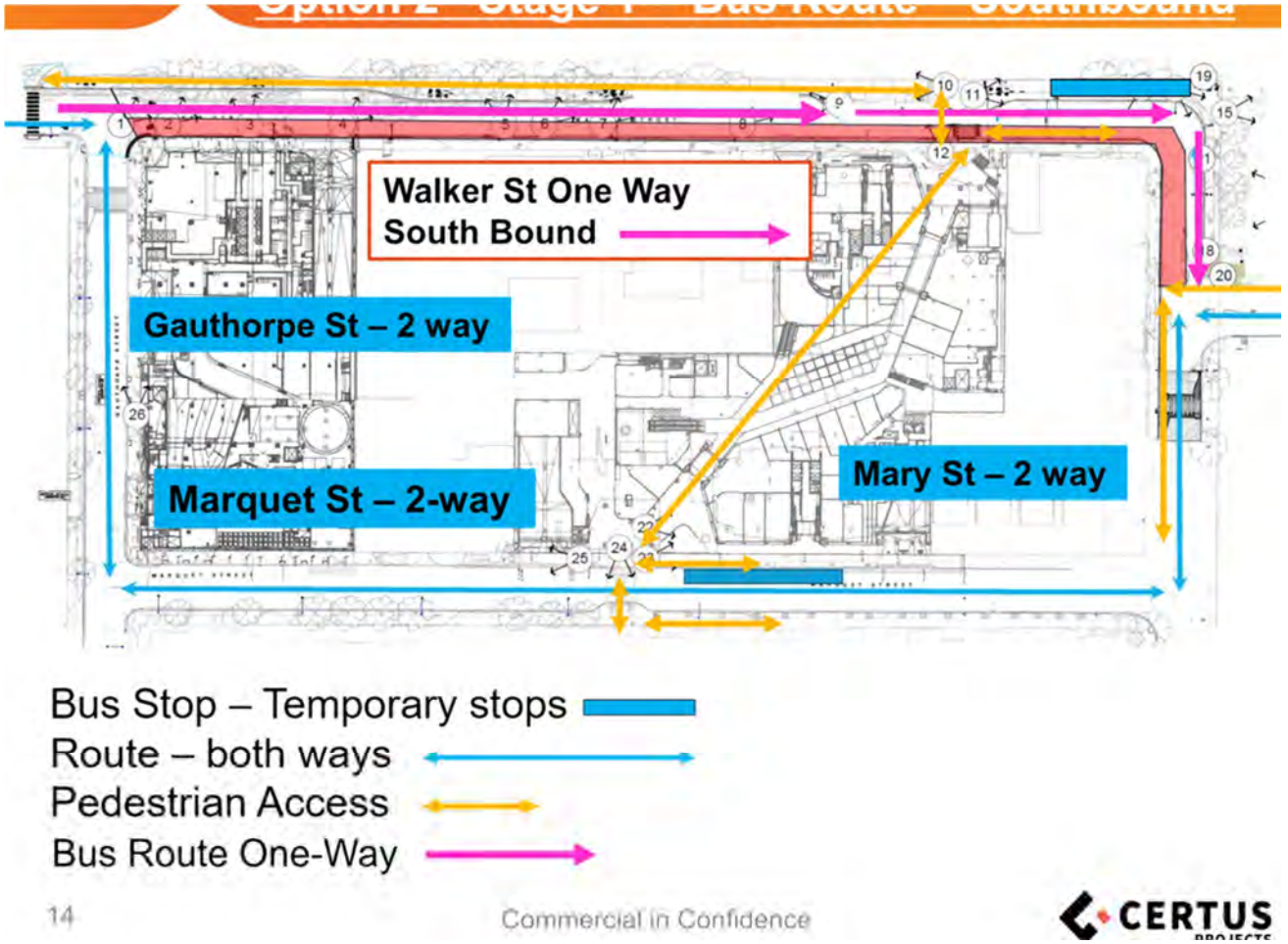
Walker St One Way
South Bound
Gauthorpe St – 2 way
Marquet St – 2-way
Mary St – 2 way
Bus Stop – Temporary stops
Route – both ways
Pedestrian Access
Bus Route One-Way
14
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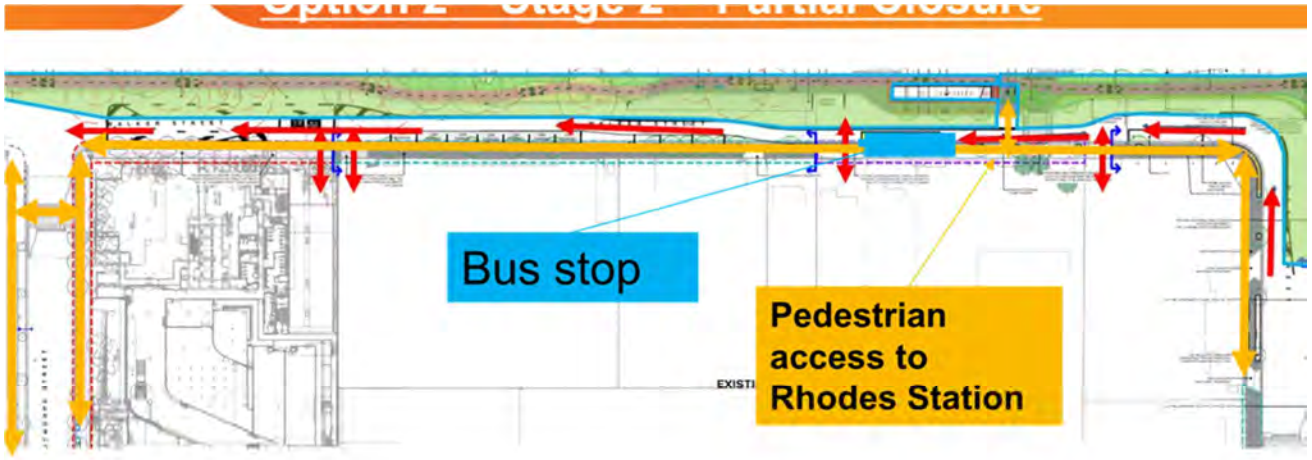

Notes – Stage 2

- Partial closure with traffic running northbound and driveways open
- Closure of Driveways at night to complete pavement construction
- Buses run northbound with temporary bus stop located outside station

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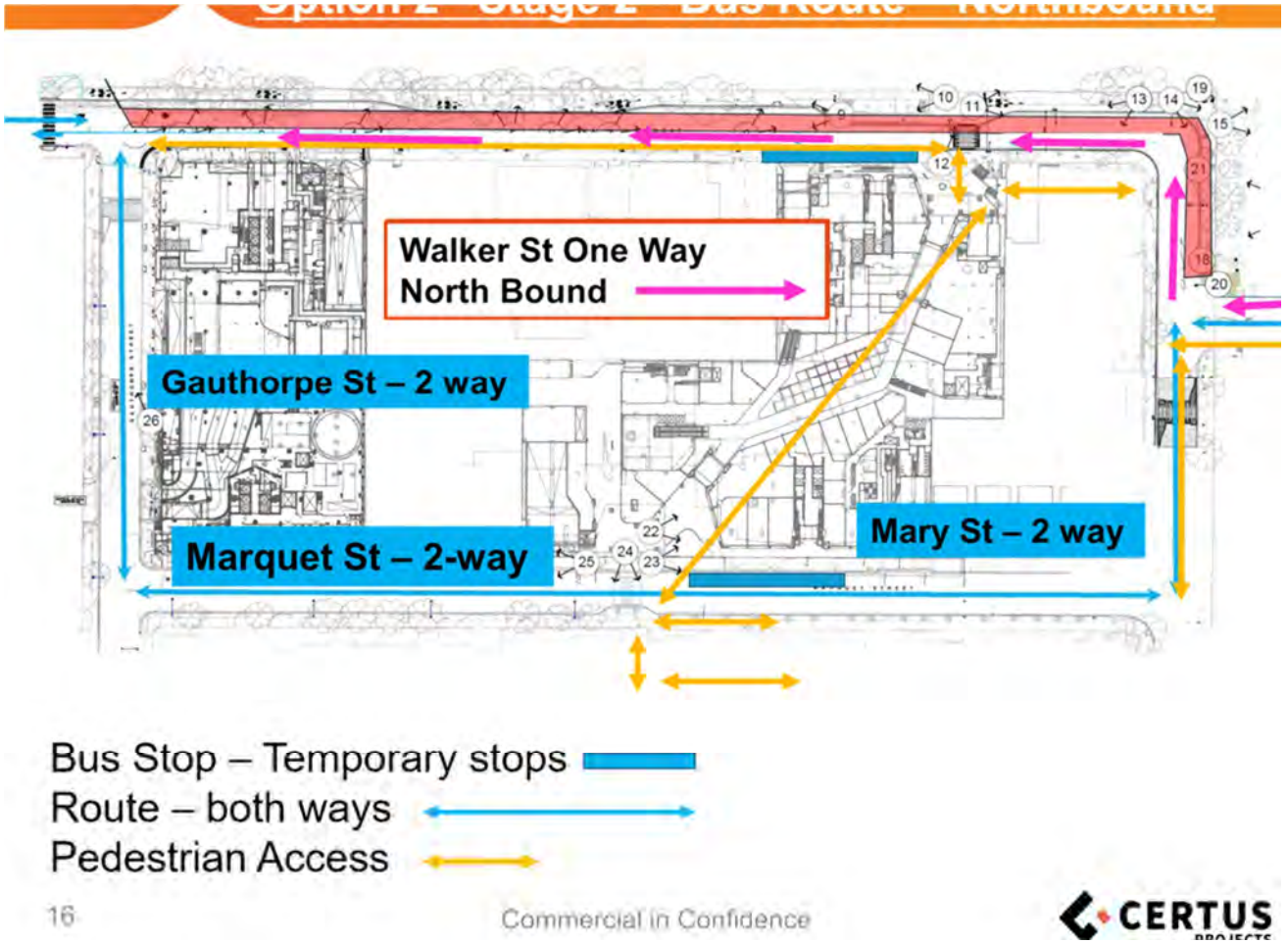
Walker St One Way
North Bound
Gauthorpe St – 2 way
Marquet St – 2-way
Mary St – 2 way
Bus Stop – Temporary stops
Route – both ways
Pedestrian Access
16
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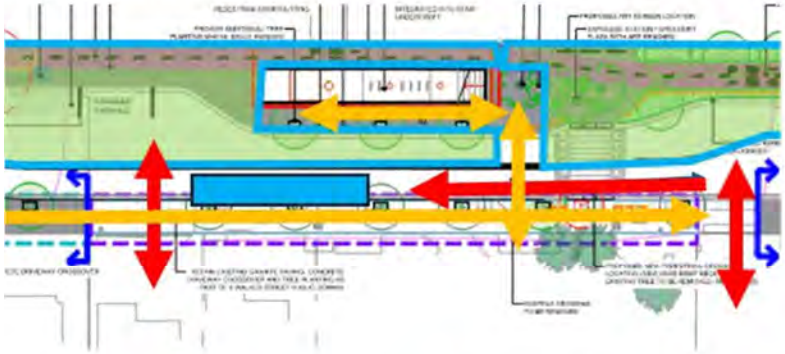
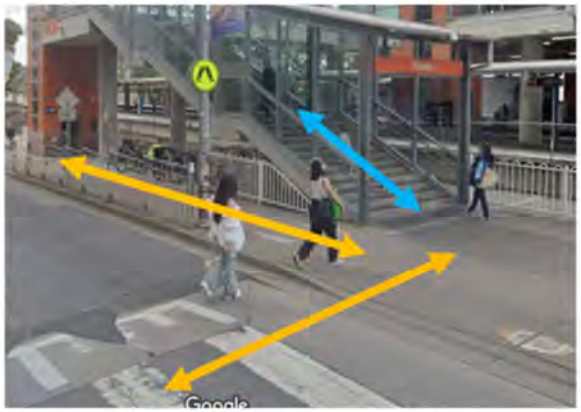
Full Traffic Closure around Rhodes Station – No buses





- Movement of pedestrian crossing to be managed during works
- Pedestrian traffic access to Rhodes station at all times
- Works to 9m2 at foot of stairs and lift access to be completed on either possession weekend or nights ALBF (after last train before first train) -10pm – 4:30 am
- Disability assess maintained

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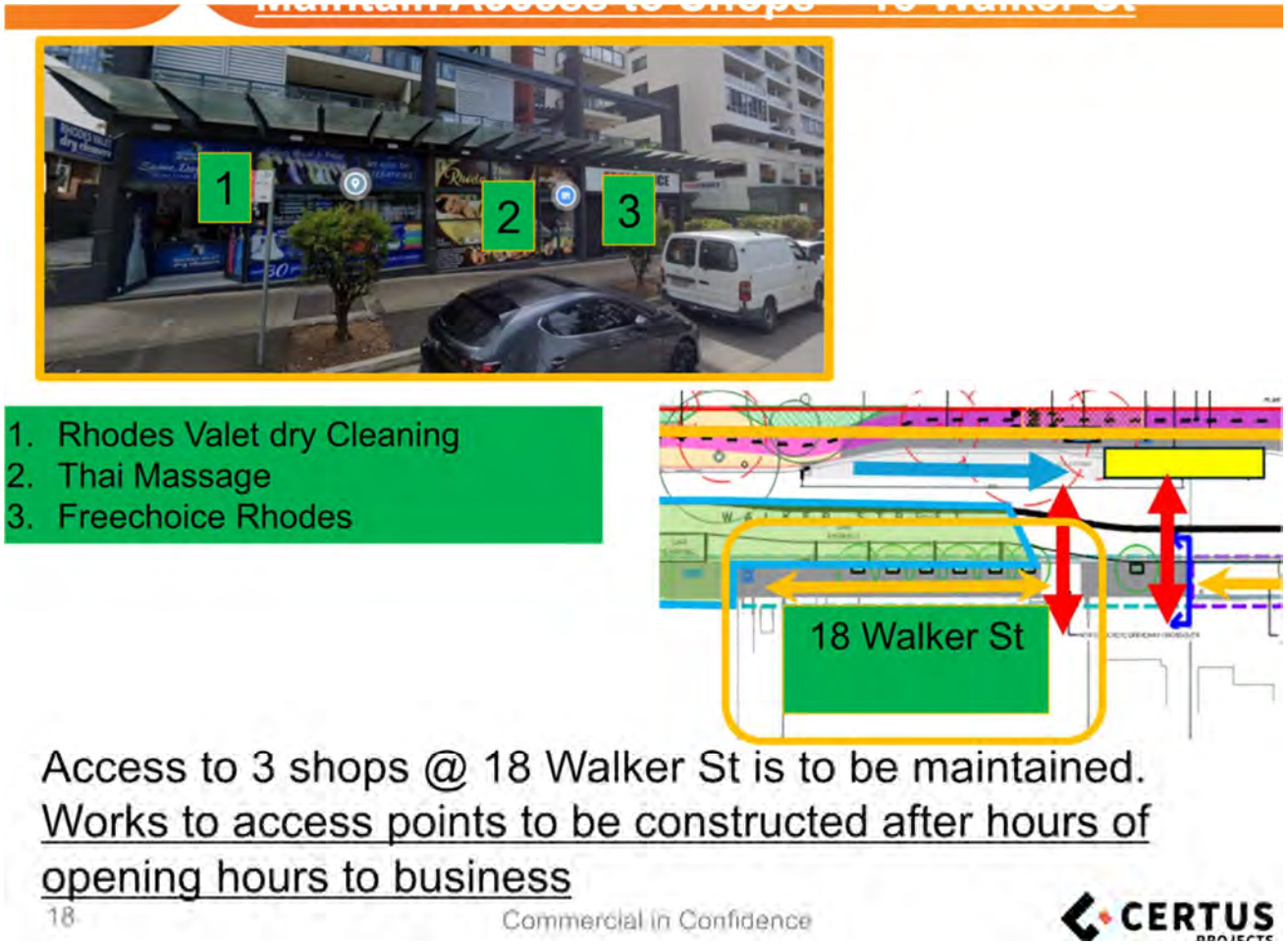
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18 Walker St
Access to 3 shops @ 18 Walker St is to be maintained.
Works to access points to be constructed after hours of opening hours to business
18
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Driveway Configurations Walker St

32 Walker St - Largest Truck size
Access & Egress – Daily Access 24/7

53 Walker St - Cars & Garbage Truck
Access & Egress – Daily Access 24/7

19

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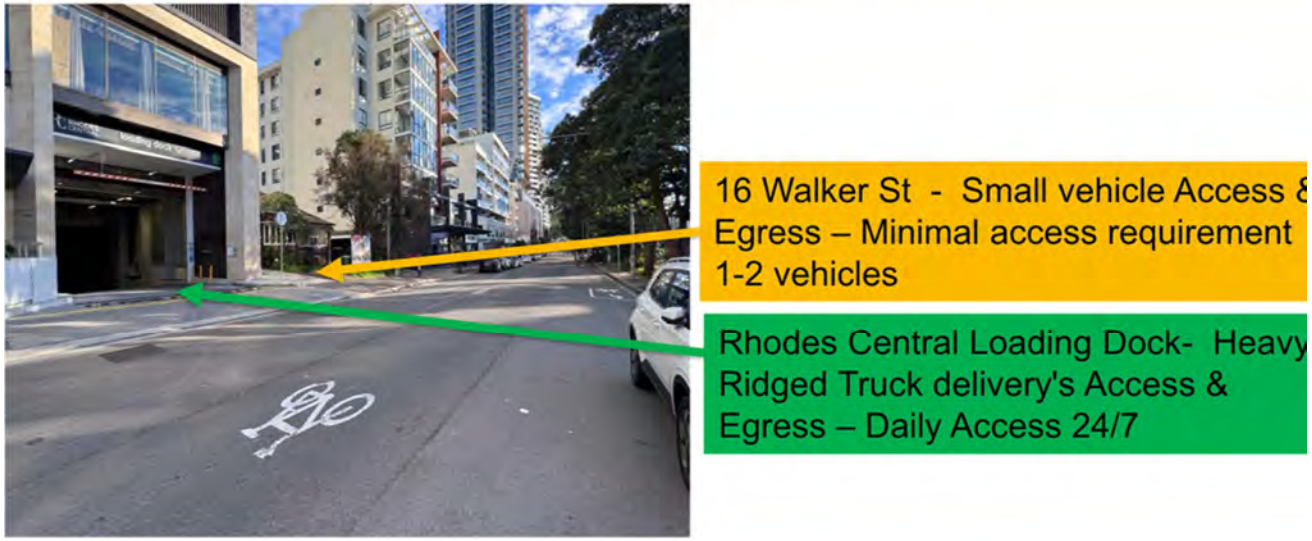
CERTUS PROJECTS



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6 Walker St - Bin Truck & Small vehicle Access & Egress –access requirement daily 24/7

21

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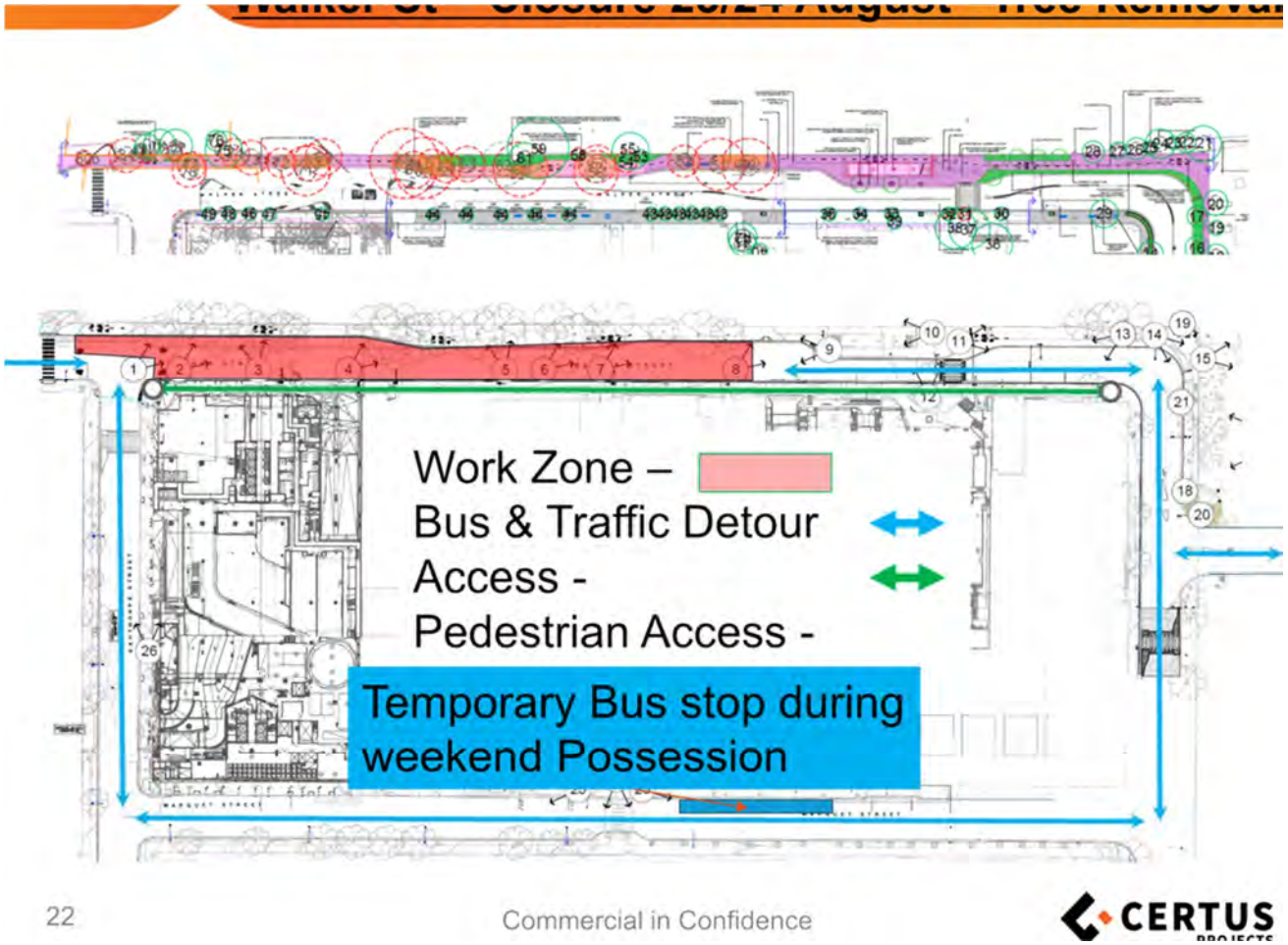
Work Zone –
Bus & Traffic Detour
Access -
Pedestrian Access -
Temporary Bus stop during weekend Possession
22
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Questions

CERTUS PROJECTS

ITEM 5.2 **ITEMS APPROVED UNDER TEMPORARY DELEGATION**
Author **Coordinator Traffic and Transport**
Attachments: **Nil**

STAFF RECOMMENDATION

That the following items have been approved under temporary delegation.

EXECUTIVE SUMMARY

To facilitate more efficient and localised decision making, Transport for NSW has issued a temporary delegation of specific powers to Council. At the Council meeting on 20 August 2024, Council resolved to give the General Manager and Director City Assets the power to approve works covered under the Delegation.

BACKGROUND/DISCUSSION

The following items were approved under Temporary Delegation granted to Council from TfNSW.

1. Proposed Refuge Island, Kerb Ramp Improvements and Speed Humps – Nirranda Street and Nullawarra Avenue intersection, Concord.

2. Installation of 'No Stopping' signs and Double Unbroken Centreline – Wellbank Street and Bent Street, Concord.

3. Proposed No Stopping Parking Signs and Linemarking - Great North Road and McKinnon Avenue, Five Dock.

4. Proposed No Stopping Parking Signs and Linemarking - Great North Road and Kerin Avenue, Five Dock.

5. Proposed Work Zone – Utz Reserve, Wrights Road, Drummoyne.

6. Proposed 'No Stopping' Parking Restrictions – Stuart Street and MacKenzie Avenue, Concord West.

7. Proposed 'No Stopping' Parking Restrictions – King Street and Concord Avenue, Concord West.

6 GENERAL BUSINESS

No General Business Items

CITY OF CANADA BAY TRAFFIC COMMITTEE MEETING

MINUTES

The meeting was held electronically via email.

Thursday, 10 July 2025

Minutes of a City of Canada Bay Traffic Committee Meeting
Held on Thursday 10 July 2025

Voting Members Present:

Councillor Hugo Robinson - Chairperson
Sergeant Tohme - NSW Police
Andy Huynh - Transport for NSW
Stephanie Di Pasqua - Local Member of Parliament

Non-voting Members Present:

M Takla - State Transit Authority, Transit Systems
A Clarke - Access Committee
D Martin - BayBUG - Canada Bay Bicycle Users Group
B Cantor - Busways

Officers in attendance:

C Di Natale - CCBC Council
R Ristevski - CCBC Council
H Huynh - CCBC Council
L Huang – CCBC Council
M Dizon - CCBC Council
M Saini - CCBC Council
S Tran - CCBC Council
C Johnson - CCBC Council

NOTES

The meeting was held electronically via email.
Refer to the City of Canada Bay Traffic Committee Meeting Agenda papers in the attached booklet.

Table of Contents

1 WELCOME/ACKNOWLEDGEMENT OF COUNTRY

The City of Canada Bay acknowledges the Wangal clan, one of the 29 tribes of the Eora nation and the traditional custodians of this land.

The City's Council pays respect to Elders past and present and extends this respect to all Aboriginal people living in or visiting the City of Canada Bay.

2 APOLOGIES

APOLOGIES

Nil

LEAVE OF ABSENCE

Nil

3 DISCLOSURES OF PECUNIARY AND NON-PECUNIARY INTEREST

4 CONFIRMATION OF MINUTES

4.1 Minutes of City of Canada Bay Traffic Committee Meeting held 12 June 2025

COMMITTEE RECOMMENDATION

That the minutes of the City of Canada Bay Traffic Committee Meeting of 12 June 2025 copies of which were previously circulated, are hereby confirmed as a true and correct record of the proceedings of that meeting.

5 REPORTS

ITEM 5.1 WALKER STREET, RHODES - PROPOSED ROAD CLOSURE - PUBLIC DOMAIN WORKS

COMMITTEE RECOMMENDATION

THAT:

1. The Committee considers 'Option 1' to be the preferred road closure method to be implemented during the public domain works on Walker Street, Rhodes.
2. The proposed 'Option 1, Stage 1 & Stage 2' bus detour routes are approved by TfNSW and Bus Service Operators for a minimum of 21 weeks.

3. Traffic Guidance Schemes are generated for the closure area and circulated to all stakeholders prior to the commencement of the works.

NSW Police Comments:

Police have no objections, however, option 1 is preferred.

Council Comments:

Council notes the comments received.

TfNSW Comments:

No objection to the proposed road closure, subject to Council receiving relevant approvals from the bus service operators and undertaking consultation with TfNSW, Sydney Trains and all other stakeholders as appropriate. Please forward the CTMP to TfNSW's Customer Journey Planning (CJP) team for review/comment.

Council Comments:

Council notes the comments received.

Busways Comments:

Busways have agreed to option 1 - full closure of Walker St with the following conditions

- provided minimum 28 days notice is given of start date(the more the better).
- Wayfinding signage is in place directing passengers to the bus stop on Marquet St
- Both stops in Marquet St(2138105 after ped crossing & 2138106 before ped crossing) are made DDA compliant, have 40m bus zones(cater of articulated buses) and Certus cover costs associated with upgraded the bus stop signage to current TfNSW standards(B-Pole)

Council Comments:

Council notes the comments received.

ITEM 5.2 ITEMS APPROVED UNDER TEMPORARY DELEGATION

COMMITTEE RECOMMENDATION

That the Committee have noted the items approved under Council's temporary delegation.

1. Proposed Refuge Island, Kerb Ramp Improvements and Speed Humps – Nirranda Street and Nullawarra Avenue intersection, Concord.

2. Installation of 'No Stopping' signs and Double Unbroken Centreline – Wellbank Street and Bent Street, Concord.

3. Proposed No Stopping Parking Signs and Linemarking - Great North Road and McKinnon Avenue, Five Dock.

4. Proposed No Stopping Parking Signs and Linemarking - Great North Road and Kerin Avenue, Five Dock.

5. Proposed Work Zone – Utz Reserve, Wrights Road, Drummoyne.

6. Proposed 'No Stopping' Parking Restrictions – Stuart Street and MacKenzie Avenue, Concord West.

7. Proposed 'No Stopping' Parking Restrictions – King Street and Concord Avenue, Concord West.

6 GENERAL BUSINESS

No General Business Items

CHAIRMAN

EXILE BAY FLOOD RISK MANAGEMENT COMMITTEE MINUTES
(CONCORD OVAL, CANADIAN EXILE ROOM 1)
2.00pm to 4.00pm, Friday 1 August 2025

ATTENDEES

Voting Members:
Michael Megna - Mayor (Mayor)
Mas Meuross - Councillor (MM)
Phillip McKee - Resident (PM)
Non-Voting Members:
Daniel Wood - Canada Bay Council, Acting Manager Strategic Asset Services & Innovation (DW)
Manisha Devarapalli - Canada Bay Council, Engineering Services Manager (MD)
Stephen Chow - Canada Bay Council, Development Engineer (SC)
Harrison Steen - Canada Bay Council, Marine, Drainage and Floodplain Engineer (HS)
Peter Giaprakas - Canada Bay Council, Senior Town Planner Statutory Planning (PG)
Anthony Wynen - Canada Bay Council, Senior Strategic Planner (AW)
Nikki Azzopardi - Canada Bay Council, City Assets Operational Support (NA)
Priom Rahman - Department of Climate Change, Environmental, Energy and Water (DCEEW) (PR)
Stephen Gray - Consultants - GRC Hydro (SG)

APOLOGIES

Voting Members:
David Williamson - Resident (DW)
Non-Voting Members:
Greig Schuetrumpf - Director, City Assets (GS)
Shannon Anderson - Canada Bay Council Manager, Statutory Planning (SA)
Paul Dewar - Canada Bay Council Manager, Strategic Planning
David Grasby - Sydney Water - Senior Planner - Systems & Asset Planning (DG)
David Johnsun - State Emergency Services (SES) Unit Commander (DJ)
Bradley Davoren - State Emergency Services (SES) (BD)
Felix Taaffe - Consultants - GRC Hydro (FG)
Kate Wen - Consultants - GRC Hydro (FG)

ITEMS FOR DISCUSSION

Time	ITEM	DISCUSSION / ACTION	PRESENTER
2:00pm	1	Welcome and Introduction – Acknowledgement of Country, Outline purpose of meeting (10min)	Chair - Mayor
Presentation after public exhibition, including findings, feedback, and next steps.			
2:10pm	2	Introductions of committee members and guests/advisors (10min)	Members
Round the table introduction of those present.			
2:20pm	3	Apologies and note last meeting minutes (5 min)	Chair - Mayor
MD confirmed apologies from Committee Members.			
2:25pm	4	Presentation from GRC Hydro regarding Exile Bay Flood Risk Management Study and Plan post public exhibition, findings and next steps (45min)	GRC Hydro, SG

Presentation from Consultants, GRC Hydro (SG):

SG - Recap of previous committee meeting and discussions - Flood Risk Management Study and Plan background, Overview of flood study results, discussion of list of mitigation strategies and ranking.

SG - Public exhibition - held from 5 June – 10 July 2025 resulting in 5,000 letters sent to residents, 33 formal responses received. 1,000 Collaborate page views with 8–10 formal submissions. 17 drop-in consultation meetings.

SG - Public Exhibition Key Feedback and Themes

- Common themes included discussion regarding the recent flooding at the respondent's house/apartment, the purpose of study and area not in floodplain or not flood affected, cause of flooding (particularly debris, stormwater drainage capacity and increased development) and the need for flood mitigation works.
- Less common themes and site specific topics included concerns regarding recommended measures, climate change and its impact, and site specific flooding issues

PM – raised a point that OSD may increase peak event water volumes - noted by committee. Runoff from New Development; General concerns raised. Council reaffirmed OSD (On-Site Detention) policy compliance.
PM – questioned Naturalisation at Massey Park and flood mitigation value. Council explained canal's flat gradient limits water outflow despite size . PR explained the tidal environments near Sydney Harbour which play a major role in water levels.

SG - Updates Post-Public Exhibition to the finalised report includes:

- Exhibition Feedback Summarised
- New Appendix: Summary of community responses and council feedback,
- Brewer Street Option: Amended to note feasibility investigation
- Updated DCP Wording: Recommended updated text within DCP to relate the land between the "Flood Planning Area (FPA)" and the land "between FPA and PMF" to the relevant flood map figures.
- 10.7 Certificate: Updated wording
- Document Revisions: References updated, Alignment with latest DCP, ARR guidelines, and DCCEEW feedback.

SG - Outcomes of Final Report

- Formalised understanding of flood risk in the catchment. Supports land zoning and development decision-making. Community awareness increased. Implementation of FRMP measures to mitigate flood risk over time.
- Used by Council planners, state government and private development, to assist in ensuring land zoning and new developments are suitably protected for flooding purposes
- A Floodplain Risk Management Plan for Council to begin implementing. Some measures relatively simple, some occur over long term.
- Provides more education and awareness to the community regarding flooding in the catchment and understand that mitigation of flooding is a shared responsibility and private property measures should also be looked at by residents and property owners.

Priority Timelines for Mitigation Measures to be Implemented

- The presentation clarified that while the council receives funding to undertake these studies, that this is a long-term plan
- High Priority: Within next few years. Medium Priority: 5–10 years. Low Priority: 10–20 years

Next Steps

- Committee to recommend adoption of the FRMP by Council

• Short-term actions: Update to DCP wording. Update SES Local Flood Plan. Update debris clearing and stormwater maintenance program. Council to commence process and timeline for how to undertake the feasibility studies on high-priority measures. • Councillor Workshop scheduled for 5 August and Council Meeting scheduled for 19 August 2025.			
3.10pm	5	Break (15mins)	Chair - Mayor
No Break – continued with meeting			
3:10pm	6	Deliberation and casting on the support of the updated Version of the Flood Risk Management Study and Plan (FRMS&P) (5min)	Voting Members
Voting members; Michael Megna – Mayor, Mas Meuross – Councillor, Phillip McKee – Resident, unanimously voted to recommend the revised Exile Bay FRMS&P for formal adoption by Council.			
3:15pm	7	Committee discussion (45min)	Members
PM - queried whether responses were addressed clearly - council confirmed inclusion in appendix. SG and Council went through the appendix within the report explaining each response individually and discussed what this means. PM - queried whether a tank under Edwards Park could help, but the site is too low in the catchment with only 2m of head, meaning the tank would often be submerged and provide minimal storage. **ARR Guideline:** PR explained ARR updates (latest vs old) have minimal impact on outcomes. Modelling based on benefit to residents. **Funding Pathway:** PR highlighted that having a "shovel-ready" document increases success in NSW grant funding applications. Plan allows timely application and phased implementation. SG concluded the presentation by thanking all contributors, noting that adoption by Council will enable actionable progress on flood mitigation across Exile Bay.			
4.00pm	8	Meeting Closed	Chair - Mayor

Exile Bay Catchment Floodplain Risk Management Study & Plan

Final Report

July 2025

Exile Bay Catchment Floodplain Risk Management Study and Plan

Final Report

Project:	Exile Bay Catchment Floodplain Risk Management Study and Plan
Project Number:	220125
Client:	City of Canada Bay
Client Contact:	Manisha Davarapalli
Report Author:	Beth Marson, Felix Taaffe
Prepared by:	Beth Marson, Kate Wen
Date:	28 July 2025
Verified By:	Stephen Gray

Date	Version	Description
19-Apr-2024	1	Draft FRMS&P
7-May-2025	2	Draft FRMS&P for Council review
28-May-2025	3	Draft FRMS&P for Public Exhibition
28-July-2025	4	Final Report

Filepath: J:\220125\Admin\Report\DraftFRMSP\ExileBay_FRMSP_v01.docx

Cover Image: Supplied by Council

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EXECUTIVE SUMMARY

Introduction

City of Canada Bay (Council) has received financial support from the State Floodplain Management program managed by the NSW Department of Climate Change, Energy, the Environment and Water to undertake a floodplain management investigation for the Exile Bay catchment. GRC Hydro Pty Ltd (GRC Hydro) have been engaged by Council to undertake a floodplain risk management study and develop a floodplain risk management plan.

This study comprises a Floodplain Risk Management Study (FRMS) and Floodplain Risk Management Plan (FRMP) which are consistent with the NSW Government's Flood Risk Management Manual (FRMM, 2023).

The objective of this study is to improve the understanding of Exile Bay flood behaviour and flood impacts on the existing and future local community. The study has undertaken testing and investigation of practical, feasible and economic management measures to treat existing, future and residual risk. The FRMS provides a basis for informing the development of a FRMP which will document and convey the decisions on the management of flood risk into the future.

Analysis of Model Results

The computer model results from the Exile Bay Catchment Flood Study (GRC Hydro, 2020) were used to develop important information to better understand and manage flood risk in the catchment. These outputs include definition of flood hazard, flood function, emergency response categories, flood planning levels, flood risk precincts and climate change impacts.

Community Risk Assessment

An assessment of Exile Bay's flood behaviour and community profile was carried out to determine specific areas of flood risk across a range of metrics, including; property flood liability, flood hazard, hydraulic categories and the economic impact of flooding.

Flood consequences for the following were assessed:

- Identification of key flood risk areas / flooding hotpots (Section 6.2);
- Information on flooded roads (Section 6.3);
- Analysis of property flood liability and an assessment of the economic impact of flooding (Section 6.4); and
- Review of critical infrastructure and sensitive land uses (Section 6.5).

The identified flooding hotspots are summarised in Table ES 1.

Table ES 1: Flooding Hotspots and Risk Factors

Hotspot #	Location	Risk Factors
1	Parramatta Road to John Street	Property flooding and road flooding issues
2	Constriction Downstream of Rothwell Park	Property flooding

3	Central Drain upstream of Davidson Avenue	Property flooding and road flooding issues
4	Davidson Avenue	Property flooding, road flooding and evacuation issues
5	Majors Bay Road and Brewer Street Intersection	Property flooding, road flooding and evacuation issues
6	Saltwater Creek	Property flooding issues

A summary of the flood liability of individual lots and buildings within the PMF extent in Exile Bay is presented in Table ES 2.

Table ES 2: Property Flood Affectation

	Residential		Commercial	
Design Event (AEP)	No. of properties flooded above ground	No. of properties flooded above floor	No. of properties flooded above ground	No. of properties flooded above floor
PMF	1,578	409	65	18
0.2%	942	96	41	4
0.5%	883	78	39	4
1%	842	72	35	3
2%	767	55	33	3
5%	706	43	32	2
10%	660	35	30	2
20%	540	20	26	2

Net flood damage estimates that combine residential and non-residential flood damages are presented in Table ES 3 and amount to an average annual cost for flooding of ~$3.1 million per annum.

Table ES 3:Exile Bay Flood Damages

Design Event (AEP)	Flood Damages Total
PMF	$90,181,000
0.2%	$14,545,000
0.5%	$11,517,000
1%	$9,743,000
2%	$7,140,000
5%	$5,211,000
10%	$4,511,000
20%	$3,148,000
Average Annual Damages (AAD)	$3,125,000

The flood liability of various sensitive and critical developments and infrastructure was examined including for medical facilities, aged care, childcare, schools and other critical infrastructure.

Flood Risk Management Measures

Flood risk management measures which aim to reduce, or otherwise, manage flood risk in Exile Bay were assessed. These measures ranged from large-scale civil works, such as the upgrade of trunk drainage systems, to non-works interventions, such as planning controls for new developments. Feasible measures, found to effectively reduce flood risk, have been ranked for implementation in the Floodplain Risk Management Plan (see Section 8).

Floodplain Risk Management measures are categorised in the NSW Floodplain Development Manual (Reference 6) as follows:

- Property Modification Measures (Section 7.1) are those which involve modifying existing properties to manage their flood risk. This includes planning-related measures such as classifying Flood Risk Precincts for Council's DCP. They also include house raising, and in cases of high flood risk, voluntary purchase schemes.
- Response Modification Measures (Section 7.2) are those that improve the ability of people to plan for and react to flood events. They often involve emergency services and can be targeted at different phases of a flood, e.g. preparation, response and recovery.
- Flood Modification Measures (Section 7.3) are those that change the behaviour of the flood itself through works or other measures. These measures often work to reduce the peak flow (for example a berm or drainage upgrade) or improve the drainage of water through flow paths.

Assessment of each of the modification measures for various options has been undertaken.

Flood Risk Management Plan

A Floodplain Risk Management Plan was developed which aims to manage existing and future flood risk for Exile Bay in accordance with the NSW Flood Risk Manage Manual (2023). The Plan aims to achieve the following overarching objectives:

- Reduce the flood hazard and risk to people and property, now and in the future;
- Protect, maintain and where possible enhance the floodplain environment; and
- Ensure floodplain risk management decisions integrate social, economic and environmental considerations.

The flood management measures recommended for implementation are presented in Table ES 4. The measures have been prioritised with high, medium and low classifications along with who is responsible for implementation and cost estimates presented.

Table ES 4: Flood Risk Management Plan

Flood Management Measure	Section	Priority	Preliminary Estimates	Responsibility
Property Modification Measure				
Clarify use of Flood Risk Precincts in the DCP	7.1.2	Medium	Council cost estimate	Council
Flood Proofing	7.1.5	Medium	-	Property Owners
Response Modification Measures				
Local Flood Plan	7.2.5	High	SES cost estimate	NSW SES
Flood Modification Measures				
Macnamara Avenue Drainage Upgrade	7.3.3.1	Low	$4.5 million	Council
Davidson Avenue Drainage Upgrade	7.3.3.2	Low	$6.8 million	Council
Clearing of debris along main flowpaths	7.3.3.4	High	Council cost estimate	Council / Property Owners
Coles Street Drainage Upgrade	7.3.3.5	Low	$2.2 million	Council
Queen Elizabeth Park Drainage Upgrade	7.3.3.6	Low	$2.5 million	Council
Shackel Avenue Drainage Upgrade	7.3.3.7	Low	$400,000	Council
Cascading berms in Goddard Park, Queen Elizabeth Park and Rothwell Park	7.3.3.10	Medium	$500,000	Council
Improve conveyance along Davidson Avenue, Majors Bay Road and Brewer Street Intersection	7.3.3.11	High	$500,000	Council
Cascading berms in Central Park	7.3.3.12	Medium	$250,000	Council
Lowering Greenlees Avenue and Greenlees Park	7.3.3.13	Low	$1 million	Council
Investigate lowering of Brewer Street near Pamela Place	7.3.3.14	Medium	Council cost estimate	Council

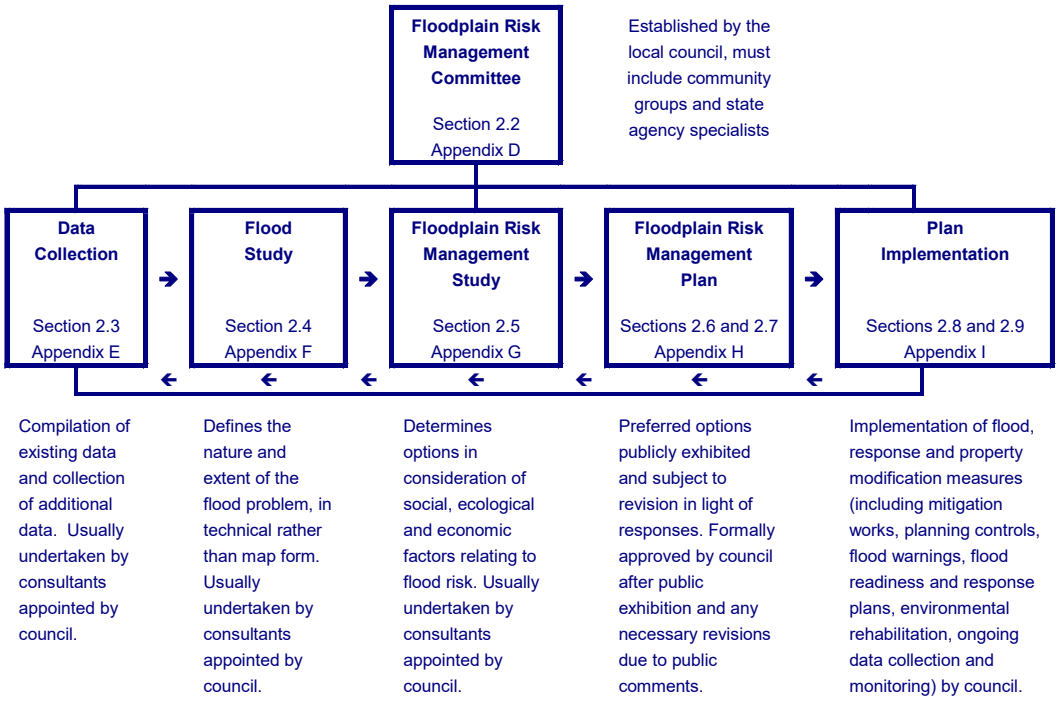
FOREWORD

The New South Wales (NSW) Government's Flood Prone Land Policy aims to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods.

Through the NSW Department of Climate Change Energy, Environment and Water (DCCEEW) and the NSW State Emergency Service (SES), the NSW Government provides specialist technical assistance to local government on all flooding, flood risk management, flood emergency management and land-use planning matters.

The Flood Risk Management Manual (NSW Government 2023) assists councils to meet their obligations through a five-stage process resulting in the preparation and implementation of floodplain risk management plans. Image 1 presents the process for plan preparation and implementation.

Image 1: The floodplain risk management process in New South Wales (FDM, 2005)



Source: NSW Government (2005)

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1. INTRODUCTION

1.1 Study Overview

This Exile Bay Catchment Floodplain Risk Management Study and Plan (FRMS&P) has been undertaken by GRC Hydro Pty Ltd (GRC Hydro) on behalf of the City of Canada Bay Council (Council), following on from the Exile Bay Flood Study completed in December 2020. The FRMS&P is a continuation of the 2020 Flood Study re-evaluating flood risks in the catchment, informing Council flood planning processes, and providing recommended flood risk mitigation measures in the Floodplain Risk Management Plan.

The Exile Bay catchment covers a 345 hectare area with elevations that range from approximately 33 m AHD to sea level at the Saltwater Creek channel and then discharges into Exile Bay proper. There are approximately 3700 cadastral lots within the catchment. Local heavy rainfall can cause flooding in the area, impacting both homes and commercial premises.

1.2 The Floodplain Risk Management Program

Council has received financial support from the NSW Floodplain Management Program (FMP) managed by the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW)to undertake a flood investigation of the Exile Bay catchment. To meet this objective, GRC Hydro have been engaged by Council to undertake the FRMS&P.

This study composes stages 3 and 4 of the five-stage process outlined in the NSW Government's Flood Risk Management Manual (NSW Government, 2023). These works include:

- Floodplain Risk Management Study (FRMS) – which assesses the impacts of floods on the existing and future community and allows the identification of management measures to manage flood risk; and a
- Floodplain Risk Management Plan (FRMP) – that outlines a range of measures, for future implementation, to manage existing, future and residual flood risk effectively and efficiently.

Following the completion of the FRMP, the final stage of the floodplain management process will involve implementing the findings of the FRMP.

Further details of the floodplain risk management stages are outlined below.

Data Collection (completed as part of the 2020 Flood Study)

The collection and collation of data necessary for the completion of the flood and floodplain risk management studies is a fundamental part of the floodplain management process. It is typically begun at the outset of the study, but generally continues throughout the period of the project as data becomes available, through community involvement. The quality and quantity of available data is key to the success of a flood study and FRMS.

Flood Study (completed as part of the 2020 Flood Study)

A flood study is a comprehensive technical investigation of flood behaviour that provides the main technical foundation for the development of a robust floodplain risk management plan. It aims to

provide an understanding of flood behaviour and consequences for a range for flood events. Consideration of the local flood history, flood data is used to assist in the development of hydrologic and hydraulic models which are calibrated and verified to improve confidence in model results.

Floodplain Risk Management Study (current study)

A floodplain risk management study increases understanding of the impacts of floods on the existing and future community. It also allows testing and investigating practical, feasible and economic management measures to treat existing, future and residual risk. The floodplain risk management study will provide a basis for informing the development of a floodplain risk management plan.

Floodplain Risk Management Plan (current study)

The floodplain risk management plan outlines a series of prioritised measures to address flood risk. The FRMP is built using the findings of a floodplain risk management study, to outline a range of measures to manage existing, future and residual flood risk effectively and efficiently.

1.3 Objectives

The objective of this FRMS&P is to improve understanding of flood behaviour and impacts within the Exile Bay Catchment, and better inform management of flood risk in the study area in consideration of the available information, relevant standards and guidelines. This study also provides a sound technical basis for any further flood risk management investigation in the area as well as allowing an increased understanding of the impacts of floods on existing and future community. It also allows testing and investigation of practical, feasible and economic management measures to treat existing and future risk so as to achieve a tolerable level of residual risk.

The FRMS provides a basis for informing the development of a FRMP which documents and conveys the decisions on the management of flood risk into the future. The FRMP outlines a range of measures to manage existing and future risk so as to achieve a tolerable level of residual risk effectively and efficiently. The FRMP includes a prioritised implementation strategy, proposed measures as well as how they will be implemented.

The overall project provides an understanding of, and information on, flood behaviour and associated risk to inform:

- Relevant government information systems;
- Government and strategic decision makers on flood risk;
- The community and key stakeholders on flood risk;
- Flood risk management planning for existing and future development;
- Emergency management planning for existing and future development, and strategic and development scale land-use planning to manage growth in flood risk;
- Selection of practical, feasible and economic measures for treatment of risk;
- Development of a floodplain risk management plan and prioritised implementation strategy;
- Providing a better understanding of the:
    - variation in flood behaviour, flood function, flood hazard and flood risk in the study area;

- impacts and costs for a range of flood events or risks on existing and future community;
- impacts of changes in development and climate on flood risk;
- emergency response situation and limitations; and
- effectiveness of current management measures.

- Facilitating information sharing on flood risk across government and with the community.

The study outputs can also inform decision making for investing in the floodplain; managing flood risk through prevention, preparedness, response and recovery activities; pricing insurance, and informing and educating the community on flood risk and response to floods. Each of these areas has different user groups with varied needs.

1.4 Project End Users

The key end-user groups that this study aims to support are identified in Table 1.

Table 1: Project End Users

Potential end user group	Use for the Project
High-level strategic decision makers	Understanding flooding in the area with regards to flood mitigation, and effect on potential zoning and redevelopment
Community	Better understand flood mechanisms, flooding at property scale, and next steps for Council in managing flood risk
Flood risk management professionals	Use the study's outputs and modelling to conduct site-specific assessments
Engineers involved in designing, constructing and maintaining mitigation works	Use the study's outputs and modelling to design, construct and maintain mitigation works
Emergency management planners	Understand flood risk with regards to road and property flooding, areas of higher risk, and available warning, in preparing response during a flood
Land-use planners (strategic planning and planning controls)	Understanding flooding in the area with regards to effect on potential zoning and redevelopment
Hydrologists and meteorologists involved in flood prediction and forecasting	Use the study's findings with regards to critical duration, rate of rise and duration of flooding
Insurers	May or may not use as insurers generally have their own studies and assessments of flood risk. Some insurers may use study outputs to confirm their flood estimates.
Emergency Services (SES, NSW Police, RFS, NSW Fire and Rescue)	Understand flood risk with regards to road and property flooding, areas of higher risk, and available warning, in preparing response during a flood

2. BACKGROUND

2.1 Study Area

The Exile Bay catchment (the study area) is situated within the suburb of Concord in Sydney's inner west. Concord has a population of 14,551 (2021 census) with a large proportion of this population living within the study area. The Exile Bay catchment is comprised of a 345 hectare area with the upper reaches of the catchment (upstream of Paramatta Road) situated within Burwood Council. Exile Bay is traversed by two key overland flow paths, the Central Drain and Main South Drain[1] (shown in Figure 1). These flowpaths meet near the intersection of Wellbank Street and Ian Parade and form Saltwater Creek. Flow then moves downstream into Exile Bay via a trapezoidal channel, adjacent to the Massey Park Golf Club. Historically, Saltwater Creek extended along the Main South Drain to Crane Street, approximately. The catchment overall is a mixture of relatively steep upper areas and relatively flat downstream areas. The study area and its key features are shown in Figure 1.

The study area is primarily comprised of residential properties with large areas of parks and reserves. As redevelopment and refurbishment of property occurs overtime, an opportunity exists to reduce flood risk for affected properties/residents and for the community more generally by having developers conform to specific flood related development controls.

2.2 Exile Bay Flood Mechanisms

Two key flood mechanisms occur in the Exile Bay catchment; overland flow flooding and mainstream flooding.

Overland flow flooding occurs when excess rainfall runoff is generated from impervious surfaces and flows toward a watercourse. This type of flooding is often referred to as overlandflooding or "flash flooding" due to short warning times Typically this type of flooding rises and recedes over a short period of time and the floodwaters are usually relatively shallow and fast moving. Image 2 (page 17) (left hand side) depicts this mechanism.

Overland flow flooding occurs in the study area along the Central Drain and Main South Drain shown in Figure 1. These drains have catchment areas of approximately 134 hectares and 147 hectares respectively. Flooding from overland flow has historically been known to occur at the following locations:

1. Between Paramatta Road and John Street;
2. At the constriction downstream of Rothwell Park;
3. Downstream of Central Park;
4. Near the intersections of Majors Bay Road with Davidson Avenue and Brewer Street; and
5. Low points in Paramatta Road, Gipps Street, Crane Street, Ian Parade, Majors Bay Road and Wellbank Street.

[1] For consistency, this study adopts the foregoing nomenclature from Reference 5

The locations of these flow paths are displayed in Figure 1.

Mainstream flooding occurs from rising water on a defined watercourse causing the watercourse to break its banks, spread over the floodplain and inundate areas that are usually dry. This mechanism typically occurs over a long period of time and generally results in deep, slow moving floodwaters. Image 2 (right hand side) depicts this mechanism.

Mainstream flooding occurs in Exile Bay along the trapezoidal channel known as Saltwater Creek (shown in Figure 1). Historically flooding has occurred along this watercourse from high astronomical tides and was potentially exacerbated between the 1960s and 1990s from the implementation of a weir structure across the channel outlet which was used to retain water for irrigation of the Massey Park Golf Course.

Image 2: Flood Mechanisms affecting Exile Bay

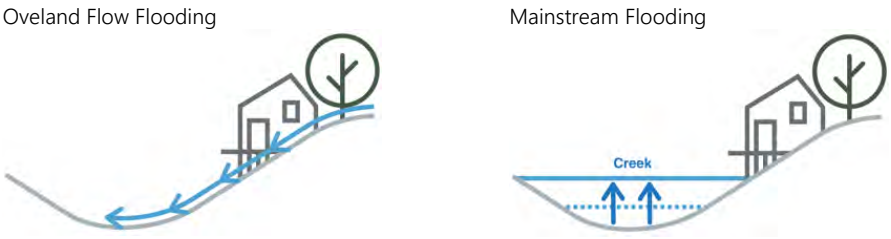
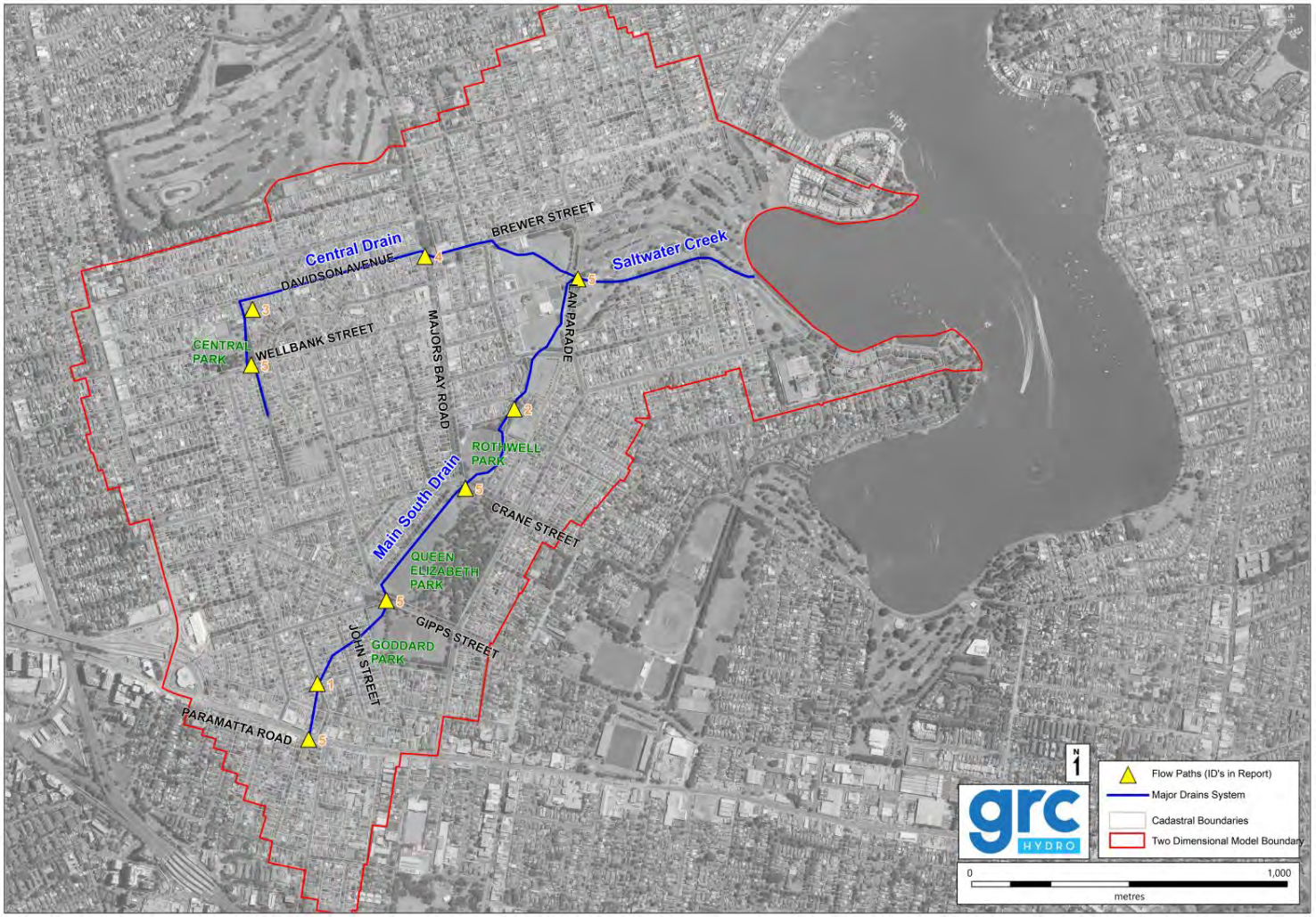


Figure 1: Exile Bay Study Area



2.3 Previous Studies

Several studies related to flooding in the Exile Bay catchment have been undertaken. The most relevant to the current study is the Exile Bay Catchment Flood Study, prepared by GRC Hydro on behalf of Council, with the final report published in December 2020. Other studies include catchment-level studies undertaken by Council, Public Works or consultants on behalf of Council. The following sections summarise the previous studies.

2.3.1 Exile Bay Catchment Flood Study (GRC Hydro, 2020)

The Exile Bay Catchment Flood Study (the Flood Study) was undertaken GRC Hydro on behalf of Council, as park of Council's Floodplain Risk Management Program. As per the NSW FRMM, the flood study covers the first and second stages in the program and prepares Council and the community for the current study, which covers the third and fourth stages of the program.

The Flood Study developed a validated hydrologic/hydraulic modelling system to define flood behaviour for a range of flood magnitudes in the Exile Bay catchment. The flood study used these design flood outputs to:

- Identify properties within the preliminary FPA that may be subject to flood related development controls;
- Analyse key overland flow paths through the catchment and investigate flood mechanism in detail;
- Assess the economics impacts of flooding in the flood damages assessment; and
- Undertake a preliminary mitigation analysis of works identified by Council. This process assessed measures such as removal of potential flow impediments and increasing the capacity of Saltwater Creek for the 10% and 1% AEP events.

2.3.2 Drainage and Catchment-level Studies

Several studies and assessments were undertaken prior to the flood study, for specific drainage or flooding-related issues in and around the Exile Bay catchment. These include a flood study in a neighbouring catchment and reports investigating localised flooding issues within the catchment, work within the Massey Park canal, large historic storms and flood related impacts of the WestConnex development. These studies are summarised in Section 3.2 of the Flood Study and having been used by the flood study in verification of the flood risk ages, do not have a direct bearing on the current study.

2.4 Social Demographics

Exile Bay's social demographics can provide valuable insight into the community flood awareness and identify factors that may impede residents from acting and reacting to a flood. Data from the 2021 Census (Australian Bureau of Statistics) in the suburb Concord has been obtained and assessed below.

Concord has a population of 14,551 residents living in 5,349. 19.7% of the population is aged 65 or older, similar to the NSW average of 17.7%.

Approximately 10% of the respondents to the 2021 Census indicated that they had moved into Concord in the last 12 months and 24% of the respondents had relocated to Concord in the last 5 years. Such information provides insight into the general flood awareness of the community, in particular close to a quarter of the population have moved to the area very recently making them less likely to have knowledge of previous flood events. Given this, additional efforts should be made to build awareness in the community of the potential flood hazards and best preparedness practice.

Community engagement and provision of flood information is a key part of the Floodplain Risk Management Process. As such, the 2021 Census data provides useful information to the languages spoken by Concord's residents. Based on this data, approximately 62% of Census respondents reported that English was the primary language spoken at home. Some other languages spoken at home included Italian, Mandarin, Cantonese and Arabic.

Evacuation, if required, during significant flood events is primarily undertaken by residents in private vehicles, however, consideration needs to be given to those dwellings that do not possess a motor vehicle and as such, alternative means of evacuation need to be provided. The 2021 Census data indicates that only 8.5% of households in Concord do not posses a motor vehicle which was greater the national average of 7.3%.

3. POLICIES, LEGISLATION AND GUIDANCE

3.1 Implemented Guidelines and References

Table 2 presents the guidelines, manuals and technical reference documents used for this study. These documents detail best practice in regard to management of flood risk. They cover both best practice regarding the technical assessment of flood behaviour and flood risk, and, more generally, who has responsibility for managing flood risk and how this management is best achieved.

Table 2: Guidelines and reference documents

Reference	Topic
Australian Emergency Management (AEM) Handbook Series, Managing the floodplain: A guide to best practice in flood risk management in Australia – AEM Handbook 7	Best practice
AEM Handbook 7, Technical flood risk management guideline – Flood Hazard	Flood hazard
AEM Handbook 7, Technical flood risk management guideline – Flood Emergency Response Classification	Emergency response
AEM Handbook 7, Technical flood risk management guideline – Flood risk information to support land-use planning	Land use
AEM Handbook 7, Technical flood risk management guideline – Assessing options and service levels for treating existing risk	Mitigation options and service levels
AEM Handbook 6, National Strategy for Disaster Resilience – community engagement framework	Community engagement
Australian Rainfall & Runoff 2016	Best practice
Section 733 of the Local Government Act, 1993	Flood prone land policy
NSW Government's Flood Risk Management Manual (2023)	Policy and Manual for management of flood liable land
SES requirements from floodplain risk management process	SES requirements
Practical consideration of climate change	Climate change
Coincidence of Coastal Inundation and Catchment Flooding	The chance of flood produced from catchment occurring at the same time as riverine flood

3.2 Summary of Council Planning Policy and Manuals

3.2.1 City of Canada Bay Local Environment Plan

A Local Environmental Plan (LEP) is a statutory document developed to guide planning decisions for local government areas. LEP's are primarily used as a planning tool to aid the future of communities and to direct development in the study area.

In July 2021, the Department of Climate Change, Energy, the Environment and Water (DCCEEW) developed a set of settled model clauses for use in LEPs, with a specific clause for flood affected land. Model provisions relating to flooding were formally incorporated into the Standard Instrument Local Environmental Plan (SI LEP) Order. The first model provision (clause 5.21) is compulsory for inclusion in all council LEPs and effectively relates to development on land within a Flood Planning Area. The second model provision (clause 5.22) is optional and relates to development on land located between the Flood Planning Area and the Probable Maximum Flood.

Both flood related clauses (clause 5.21 and clause 5.22) were incorporated into the City of Canada Bay LEP 2013 (clause 5.21). The current study will be used in the development of a FPA and Flood Risk Precincts for the Exile Bay catchment which will aid the application on these controls (see Section 5.4).

3.2.2 City of Canada Bay Development Control Plan (DCP) 2023

A Development Control Plan (DCP) is a non-statutory document which supports the planning controls in the LEP by providing detailed planning and design guidelines.

The City of Canada Bay DCP was adopted by Council in March 2023. Section B8 – Flooding Control uses a Flood Planning Matrix to outline the relevant Planning and Development Controls within the study area. This approach uses the land use and the level of flood risk at the site to determine the applicable Flood Planning Controls within the Probable Maximum Flood which aligns with the new flood related LEP clauses (clause 5.21 and clause 5.22). The DCP generally contains all the typical DCP components necessary for Council to manage flood risk in the catchment. The outputs from the current study will inform the application and refinement of these controls using the Flood Planning Area (see Section 5.4) and Flood Risk Precincts (see Section 5.4.1).

3.2.3 Section 10.7 Certificates

A Planning Certificate issued under Section 10.7(2) provides information about the zoning and permissible land uses of the property, the relevant state, regional and local planning controls and other property encumbrances such as land contamination, land acquisition, flooding and acid sulphate soils.

Item 9 of Council's 10.7(2) provides information on whether the land is within the flood planning area and/or between the flood planning area and the Probable Maximum Flood. If the lot is outside the Exile Bay catchments and other catchments that Council have a study for, the lot's designation is 'unknown' on the certificate.

3.3 The Bay Flood Emergency Sub Plan 2021

The Bay Flood Emergency Sub Plan is a subplan of The Bay Local Emergency Management Plan (EMPLAN). This plan was prepared by the Local Emergency Management Committee in accordance with the State Emergency and Rescue Management Ace 1989 (NSW). The plan sets out the emergency management for flooding in the Burwood, Canada Bay and Strathfield Local Government Areas (LGAs).

3.4 State and National Plans and Policies

Management of flood risk in the catchment is also guided by various state-wide and national policies related to floodplain management in Australia. These have been listed below, including their relevance to the current study:

- *Australian Rainfall and Runoff 2019* – This national guideline document is used for the estimation of design flood characteristics in Australia. It sets out hydrological data and procedures to be used for hydrological and hydraulic modelling of flooding in Australia.
- *NSW Environmental Planning and Assessment Act 1979* – Is the overarching state legislation for local legislation. The Act provides the framework for regulating and protecting the environment and controlling development. Pursuant to Section 9.1 of the EP&A Act, councils have the responsibility to facilitate the implementation of the NSW Government's Flood Prone Land Policy. It specifies how councils' LEPs manage flooding.
- *NSW Flood Prone Land Policy* - aims to reduce the impact of flooding and flood liability on individual land owners and occupiers of flood prone property and to reduce private and public losses resulting from floods via economically positive methods where possible. The NSW Floodplain Development Manual supports the policy.
- *NSW Government's Flood Risk Management Manual (2023)* – Defines the assessment and management of flood risk in NSW, including flood hazard, flood function, emergency management and other variables. More broadly it sets out the objectives for floodplain development in the state, including descriptions of types of mitigation measures. This manual guides councils in the development and implementation of local floodplain risk management plans to produce robust and effective floodplain risk management outcomes in accordance with the NSW Government's Flood Prone Land Policy.
- *State Environmental Planning Policy (Exempt and Complying Development Codes) (2008)* - are environmental planning tools used to address planning issues within NSW. In a flooding context, the SEPP for Exempt and Complying Development Codes 2008 is key for defining:
    - Exempt developments, where development can occur without the need for development consent; and
    - Complying development, where development must be carried out in accordance with a complying development certificate.

  The policy provides further information on where and development of flood-prone land should occur.

3.5 Previous Studies

Several studies related to flooding in the Exile Bay catchment have been undertaken. The most relevant to the current study is the Exile Bay Catchment Flood Study, prepared by GRC Hydro on behalf of Council, with the final report published in December 2020. Other studies include catchment-level studies undertaken by Council, Public Works or consultants on behalf of Council. The following sections summarise the previous studies.

3.5.1 Exile Bay Catchment Flood Study (GRC Hydro, 2020)

The Exile Bay Catchment Flood Study (the Flood Study) was undertaken GRC Hydro on behalf of Council, as park of Council's Floodplain Risk Management Program. As per the NSW FRMM, the flood study covers the first and second stages in the program and prepares Council and the community for the current study, which covers the third and fourth stages of the program.

The Flood Study developed a validated hydrologic/hydraulic modelling system to define flood behaviour for a range of flood magnitudes in the Exile Bay catchment. The flood study used these design flood outputs to:

- Identify properties within the preliminary FPA that may be subject to flood related development controls;
- Analyse key overland flow paths through the catchment and investigate flood mechanism in detail;
- Assess the economics impacts of flooding in the flood damages assessment; and
- Undertake a preliminary mitigation analysis of works identified by Council. This process assessed measures such as removal of potential flow impediments and increasing the capacity of Saltwater Creek for the 10% and 1% AEP events.

3.5.2 Drainage and Catchment-level Studies

Several studies and assessments were undertaken prior to the flood study, for specific drainage or flooding-related issues in and around the Exile Bay catchment. These include a flood study in a neighbouring catchment and reports investigating localised flooding issues within the catchment, work within the Massey Park canal, large historic storms and flood related impacts of the WestConnex development. These studies are summarised in Section 3.2 of the Flood Study and having been used by the flood study in verification of the flood risk ages, do not have a direct bearing on the current study.

4. COMMUNITY CONSULTATION

Community consultation formed an integral part in completing Stages 1 and 2 of the Exile Bay Catchment Flood Study. Following on from this approach, community consultation was undertaken during the Study to inform residents about the current Study, gather further information on flooding as well as potential flood mitigation measures, identify community concerns, and most importantly, develop and maintain community confidence and collaboration in the Study results.

Following the inception of the Study, Council provided information on the floodplain risk management process on their website. A newsletter and online questionnaire was distributed to selected residents in August 2023. Community members who did not receive a newsletter were still able to participate in the questionnaire via Council's website. The results of the survey are documented in the following section.

4.1 Newsletter and Questionnaire

A newsletter and questionnaire was developed for the community in collaboration with Council and presented in Appendix B. The newsletter introduced the study and its objectives and requested feedback via the online questionnaire. Preliminary flood results were used to identify key locations where the targeted newsletter and questionnaire were sent (approximately 1600 properties). Community members who did not receive a questionnaire were still able to participate in the questionnaire via Council's website.

In August 2023, Newsletters were distributed by Council and 80 responses were received from the community. Approximately 23% of respondents indicated that they had experienced flooding in their yard or garage, while 3% of respondents had experienced over floor flooding. These results highlight that there is some awareness of flooding in the study area and the potential for flooding to impact on properties.

Community members were asked whether they had noticed anything that had made flooding in their area worse, with 40% of respondents indicating that they had. These community members provided insight regarding of key areas of concern within the catchment and noted factors exacerbating flooding in their locality such as blocked drains, too few stormwater inlets and development in the area. This input has helped to inform the assessment of Flood Modification Measures in Section 7.

The questionnaire provided a range of potential mitigation measures to manage flood risk and asked community members to select their preferred measures. A large majority of respondents indicated that they would prefer an upgrade of stormwater drains to increase their capacity to handle flood events. Given this, stormwater upgrades has been a key focus area for the subsequent analysis of Floodplain Risk Management Measures (see Section 7). Other popular measures included an improvement of overland flow paths to increase their capacity and imposing greater flood-related development controls and increase strategic flood planning. Consideration of these community preferences has been taken into account when deriving and assessment potential flood management measures.

4.2 Public Exhibition

Public exhibition of the draft Floodplain Risk Management Study and Plan was held in June and July 2025. The exhibition was aimed at informing residents and other stakeholders of the draft study findings, for their review and feedback, before the report is finalised. The exhibition was endorsed by the Floodplain Risk Management Committee after the draft report was presented to them in May, after which the exhibition period was 5 June to 10 July 2025.

The following methods were used in promoting awareness of the exhibition period:

- Collaborate project page: https://collaborate.canadabay.nsw.gov.au/exilebayfloodstudy
- Notification letter sent to all residents and property owners in the catchment area
- Email to approx. 100 previous participants
- Three in-person drop-in sessions at Concord Library where residents could make an appointment to talk to GRC Hydro and Council representatives

A large number of residents viewed the website while a significant number also responded across the various channels. Specifically, the website received 1,013 page views, and 333 users downloaded the report. Eight online submissions and eight emails were received. 17 meetings/appointments were made for the drop-in sessions with each covering between 5 minutes and 2 hours of discussion.

The main stakeholder response was from local residents concerned with either flooding or the findings of the study. Responses were varied and nearly all were unique from one another, with topics generally covering recent flooding at the respondent's house/apartment, the need for flood mitigation works, the causes of flooding (particularly debris, stormwater drainage capacity and increased development) and concerns with particular recommended measures. A response for each submission will be prepared by GRC Hydro and Council. Appendix D contains a more comprehensive list of the topics that were raised and a response to each.

5. ANALYSIS OF FLOOD MODEL RESULTS

5.1 Flood Hazard

Flood hazard is defined as a source of potential harm or a situation with the potential to result in loss (Reference 2). It is initially calculated based on the depth and velocity of floodwaters. Flood Hazard is calculated in accordance with the Australian Emergency Management Handbook 7 Guideline (Reference 1) and ARR2019. This considers the threat to people of various ages (children, adults) and to the community interacting with floodwaters (pedestrians, vehicles and those within buildings). Chart 1 and Table 3 present the relationship between the velocity and depth of floodwaters and the corresponding classification.

Chart 1: Flood Hazard Curves (Australian Emergency Management Handbook 7)

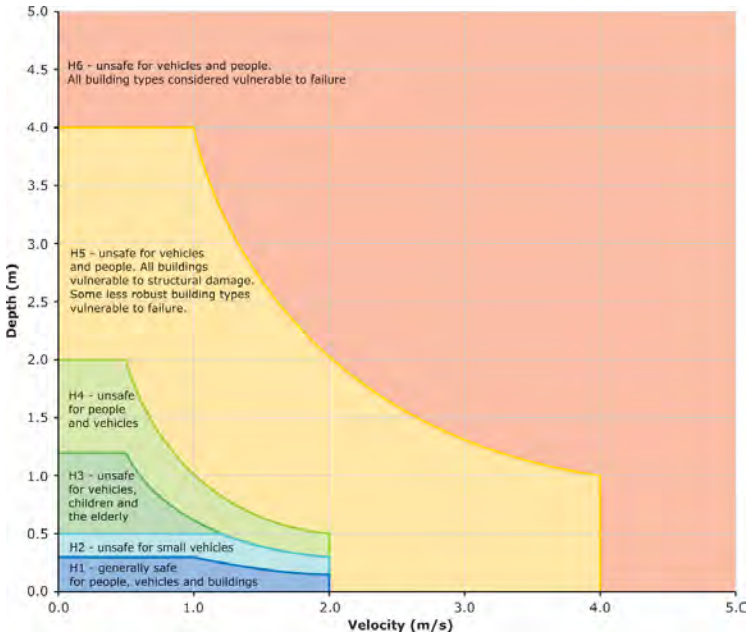


Table 3: Flood Hazard – Vulnerability Thresholds

Hazard Classification	Description
H1	Generally safe for vehicles, people and buildings.
H2	Unsafe for small vehicles.
H3	Unsafe for vehicles, children and the elderly.
H4	Unsafe for vehicles and people.
H5	Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6	Unsafe for vehicles and people. All building types considered vulnerable to failure.

Figure 2 to Figure 5 present the flood hazard classifications for the 5% AEP, 1 % AEP, 0.2% AEP and PMF events respectively. Across all design flood events, the majority of the study area has been classified as H1 hazard indicating that flooding in these areas is generally safe for the community. As the flood event increases in magnitude, so too does the flood hazard classifications along the Central Drain and the Main South Drain.

In the 1% AEP event, the majority of the Main South Drain is either a H2 or H3 hazard classification indicating that flooding along this waterway is unsafe for vehicles, children and the elderly. On the Main South Drain there is a small area of H4 to H5 at the constriction downstream of Rothwell Park (Hotspot 2, see Section 6.2.2) indicating that flooding is unsafe for all vehicles and people. Similarly, along the Central Drain, the hazard classification in the 1% AEP event is typically H2 or H3 with areas of H4 or H5 along on Davidson Avenue as it approaches Majors Bay Road and along Brewer Street. These high hazard classifications (H4 to H5) are primarily located along roadways rather than within properties in the 1% AEP event. As such, it is recommended that traffic and pedestrian management measures are implemented to ensure those in the hazardous areas are safe i.e. cars and pedestrians are not entering hazardous floodwaters. These measures have been considered further in Section 7.

In the 5% AEP event, a number of key roadways in the catchment are affected by H2 hazard. These include, John Street, Gipps Street, Crane Street, Greenlees Avenue, Davidson Avenue, Majors Bay Road, Brewer Street and Spring Street. Further, Ian Parade and Wellbank Street are both affected by H3 hazard in the 5% AEP making it unsafe for vehicles and people during this event.

5.2 Flood Function

Flood Function (also known as Hydraulic Categories) refers to the classification of floodwaters into three categories; Floodways, flood storage and flood fringe. These categories help to describe the nature of flooding across the floodplain and aid planning when assessing developable areas. According to the NSW Government's Flood Function these three categories can be defined as:

- Floodways – are generally areas which convey a significant portion of water during floods and are particularly sensitive to changes that impact flow conveyance. They often align with naturally defined channels. ;
- Flood Storage – which are areas outside of floodways, are generally areas that store a significant proportion of volume of water and where flood behaviour is sensitive to changes that impact on the storage of water during a flood..
- Flood Fringe –are area with in the extent of flooding for the event but which are outside floodways and flood storage areas. Flood fringe areas are not sensitive to change in either flow conveyance or storage. .

There is no prescribed methodology for deriving each category and as such categorisation is typically determined based on experience and knowledge of the study area.

For the current study, the flood function classifications have been undertaken in accordance with the findings of Howells et al, 2003 (Reference 4), who defined these categories based on the depth and velocity of flood waters. For the technical calculation of these classifications in Exile Bay the following is proposed:

- Floodway – areas where:
  - the velocity-depth product > 0.25 m^2/s and peak velocity >0.25 m/s
    or
  - velocity > 1 m/s
- Flood Storage - areas outside the Flow Conveyance where depths exceed 0.5 m
- Flood Fringe – areas outside of Flow Conveyance where depths are less than 0.5 m

Figure 6 to Figure 9 present the Flood Function for the 5% AEP, 1% AEP, 0.2% AEP and PMF events respectively.

In the 1% AEP event, the flow conveyance in Exile Bay occurs primarily along key flow paths such as the Central Drain, Main South Drain and Saltwater Creek. Flow conveyance also occurs along key overland flow paths through private properties. Development in these areas is likely to significantly alter the distribution of flow and increase flood levels nearby.

Flood Storage areas are predominantly found along the downstream areas at Edwards Park, Greenlees Park and in Massey Park Golf Course. Filling of flood storage areas may cause flood level impacts in downstream neighbouring areas.

The remainder of flood affected areas in the catchment are classified as Flood Fringe. Development in areas of Flood Fringe are unlikely to significantly alter flood behaviour.

5.3 Emergency Response Classifications

Flood Emergency Response pertains to a set of classifications that advise how a community is affected by flooding and informs the decision-making process during a flood event. These classifications consider the full range of flood behaviour up to the PMF event. Factors such as isolation, evacuation routes, effective warning times, the rate of rise of floodwaters and the duration of isolation are considered when determining the classification.

In the current study, Flood Emergency Response classifications have been undertaken in accordance with the Australian Emergency Management Handbook 7 (Reference 1) and are detailed in Table 4.

Table 4: Flood Emergency Response Classifications (Reference 1)

Primary Classification	Secondary Classification	Tertiary Classification
Flooded (F) The area is flooded in the PMF	Isolated (I) Isolated from community evacuation facilities by floodwater and/or impossible terrain as waters rise during events up to the PMF. Likely to lose services during a flood.	Submerged (FIS) Where all land in isolate area will be fully submerged in PMF after becoming isolated.
		Elevated (FIE) Where there is a substantial amount of land in isolated areas elevated above the PMF.
	Exit Route (E) Areas that are not isolated in the PMF and have an exit	Overland Escape (FEO) Evacuation from the area relies upon overland escape routes that rise out of the floodplain

	route to community evacuation facilities.	Rising Road (FER) Evacuation routes from the area follow roads that rise out of the floodplain.
Not Flooded	Indirect Consequence (NIC) Areas that are not flooded but may lose services.	
	Flood Free Areas that are not flood affected or indirectly affected by flooding.	

Emergency response classifications typically pertain to areas impeded by mainstream flooding where there are significant warning times allowing for preventative action to be taken. In areas predominantly affected by overland and flash flooding, such as Exile Bay, preventative action cannot be undertaken due to a lack of flood warning time (effectively zero). In the event of flooding, generally, residents are safest indoors and should avoid walking or driving in flood waters. Therefore, in Exile Bay, emergency response classifications will be most useful for agencies, such as the SES, as a response to the aftermath of a flood.

Figure 10 presents the emergency response classifications for Exile Bay. Much of the catchment was found to be Flood Free, Indirect Consequence or Flooded with a Rising Road Exit Route (see Table 4). Along the Main South Drain and the Central Drain there are large areas of Flooded, Isolated and Submerged (FIS) or areas with an Overland Escape Exit Route (FEO).

In areas of FEO, road access would not be possible for the duration of the flood event however access can be achieved overland (i.e. on foot). Due to the short duration of these events (for much of the catchment – peak duration will be measured in minutes), residents in these areas would generally be safest waiting for floodwaters to recede before exiting their properties.

In areas of FIS, road access would be cut prior to properties being inundated by floodwaters. The flooding Hotspots assessed in Section 6.2 are located within areas classified as FIS.

Flood Emergency Response classifications are derived for the PMF flood event only. Due to the flash flood nature of the catchment the event magnitude is unknown at the time of the event. If those responding to a flood used Emergency Response classifications derived for a smaller event than that which is occurring, these classifications may be incorrect. A key example of this is the classification of Flooded, Isolated, Elevated (FIE) and Flooded, Isolated, Submerged (FIS). The classifications derived for a smaller event may define areas as FIE meaning that they lose flood access however they are not inundated. In larger events however, these FIE areas may become inundated meaning that their classification changes to FIS and as such their affectation is more severe. Thus, given the flash flood nature of the catchment and the unknown event magnitude, it is precautionary to only use the PMF emergency response classifications.

5.4 Flood Planning Area

The Flood Planning Area (FPA) defines properties that are subject to flood related development controls. The FPA is a key planning tool for managing and mitigating flood risk in an LGA.

The process of deriving the FPA varies greatly depending on the dominant flood mechanism in a study area. The Floodplain Development Manual (Reference 6) recommends the generation of the FPA using the 1% AEP flood level plus 0.5 m freeboard level. This methodology is suitable for mainstream flooding however in Exile Bay if this approach is used to define the FPA, homes with no level of flood affectation will be subject to flood related development controls. Since such an outcome is untenable, a different approach is utilised for deriving the FPA in areas of overland flow. Where the two flood mechanisms exist, such as in the study area, FPA's generated by both methods will be enveloped.

For areas affected by overland flow, analysis of the flood affection of each cadastral lot can be undertaken to derive the FPA. This approach has been adopted in numerous studies within the Sydney Metropolitan area.

The following methodology has been used to select cadastral lots within the preliminary Exile Bay FPA:

- Mainstream Flooding: The 1% AEP peak flood level within Saltwater Creek, Edwards Park and Greenlees Park plus 0.5 m freeboard, then extending the level perpendicular to the direction of flow.
- Overland Flow Flooding: Cadastral lots where 10% or greater of the cadastral lot is affected by 1% AEP peak flood depths of greater than 0.15 m.

Using the aforementioned criteria, a set of properties were identified using the 1% AEP design flood results and their flood affectation was verified during a ground truthing exercise carried out during the Flood Study. Following the site visit, further understanding was gained regarding the different flood mechanisms that can affect individual properties within the study area. This process identified 274 properties for inclusion in the Section 10.7 certificate and these residents were notified and consulted with during public exhibition of the Flood Study. These properties were also included in the Flood Planning Maps in Council's DCP.

The properties which form the current FPA are shown in Figure 11.

5.4.1 Flood Risk Precincts

Since the completion of the Flood Study, new flood related LEP clauses (clause 5.21 and clause 5.22) and state government ministerial directions have shifted the focus of the application of flood related development controls from the 1% AEP extent to a wider range of events. Given this, Council's DCP (see Section 3.2.2), adopted in March 2023, has introduced a Flood Planning Matrix approach to outline relevant Planning and Development controls using the land use and level of flood risk at a site. The DCP outlines Flood Risk Precincts to define flood affected areas as Low, Medium and High Risk using the 1% AEP and PMF flood outputs. The DCP defines these precincts as follows:

High Flood Risk Precinct: An area of land that under 1% AEP conditions is either subject to high hydraulic hazard or present significant evacuation difficulties.

Medium Flood Risk Precinct: An area of land that under 1% AEP conditions is not subject to high hydraulic hazard and presents less than significant evacuation difficulties.

Low Flood Risk Precinct: An area of land above the 100 year flood and includes all area up to and including the 'Probable Maximum Flood (PMF)'.

Council may consider expanding the FPA to include all areas in the PMF extent to align with the DCP's Flood Planning Matrix (see Section 7.1.2). Should this approach be adopted, it is expected that a very small number of properties within the Flow Conveyance would be classified as a High Flood Risk Precinct, properties within the 1% AEP would receive a Medium classification and remaining lots within the PMF extent would be categorised as a Low Flood Risk Precinct.

5.5 Climate Change

The impact of climate change on flood producing rainfall and resultant flooding has been assessed. The assessment used the IPCC (Intergovernmental Panel on Climate Change) greenhouse gas concentration scenarios to estimate the effect of climate change on rare rainfall events. There are four IPCC greenhouse gas concentration projections named Representative Concentration Pathways (RCPs) 2.6, 4.5, 6.0 and 8.5, with the RCP 2.6 being the most optimistic and 8.5 the least optimistic. The ARR2019 methodology recommends the use of RCP 4.5 and 8.5 scenarios, and their projected increase in precipitation intensity were obtained from the ARR Data Hub and shown in Table 5 for the 2090 planning horizon.

Table 5: Climate Change Factors – Percentage Increase in Rainfall Intensity in 2090

Year	RCP 4.5	RCP 8.5
2090	+9.1%	+18.6%

The IPCC recommendations indicate, under a relatively low emissions scenario (RCP 4.5), that rainfall intensity is expected to increase by 9.1% in the Exile Bay catchment by 2090. The significance of this percentage is measured by comparing it to the range of design flood events. The results of this assessment are shown in Table 6, which lists the total rainfall depth for the 1%, 0.5% and 0.2% AEP events (for the 1% AEP critical duration) and then compares those events with the increased rainfall caused by two emissions scenarios – RCP 4.5 and RCP 8.5.

Table 6: Comparison between Design Rainfall and Projected Climate Change Rainfall Depths

AEP	Duration (mins)	Total Rainfall Depth (mm) IFD	2090 RCP 4.5 +9.1%	2090 RCP 8.5 +18.6%
1%	60	64.2	70.0	76.1
	180	94.8	103.4	112.4
0.5%	60	70.2	76.6	83.3
	180	103	112.4	122.2
0.2%	60	79.6	86.8	94.4
	180	117	127.6	138.8

The table shows that the 1% AEP flood event will increase to a magnitude close to the present day 0.5% AEP event under the 2090 RCP 4.5 scenario (corresponding depths shown in red in Table 6).

Under the 2090 RCP 8.5 scenario, the 1% AEP storm event will be equivalent to a present-day event between 0.5% and 0.2% AEP (shown in red and green in Table 6). Accordingly, these rarer design events have been used as proxies for the assessment of climate change sensitivity with flood impact maps comparing the 1% AEP event to the 0.5% AEP and 0.2% AEP events presented in Figure 12 and Figure 13.

The results show that increases in flood level associated with climate change is likely to be less than 0.15 m for along the central drain and the main south drain under both emissions scenarios. For the RCP 8.5 emissions scenario, increase in flood level of typically less than 0.2 m are noted at the constraint between Rothwell Park and Jessie Stewart Reserve.

5.5.1 Sea Level Rise

Guidance on predicted sea level rise was released by the NSW Government in 2009, again in 2010 and then, in 2012, the NSW State Government retracted this advice. Since that time, sea level rise has been determined by individual local government areas.

In the absence of sea level rise advice, a 2100 level of 0.9 m has been adopted and tested for the current study in accordance with the "NSW Sea Level Rise Policy Statement" (October 2009). The application of these levels in the Exile Bay hydraulic model are summarised in Table 7.

Table 7: Adopted 2100 Sea Level Rise Tailwater Conditions

Design Event (AEP)	2100 Sea Level Rise Tailwater Level (m AHD)
1% Envelope	1% Harbour Level + 0.9 m 1.435 m AHD + 0.9 m = 2.335 m AHD
	5% Harbour Level + 0.9 m 1.375 m AHD + 0.9 m = 2.275 m AHD
0.5%	1% Harbour Level + 0.9 m 1.435 m AHD + 0.9 m = 2.335 m AHD
0.2%	1% Harbour Level + 0.9 m 1.435 m AHD + 0.9 m = 2.335 m AHD
PMF	1% Harbour Level + 0.9 m 1.435 m AHD + 0.9 m = 2.335 m AHD

Changes to peak flood levels from the sea level rise scenario are presented in Table 8. As expected, peak, flood levels in upstream areas were found to be generally unaffected by a change in sea level however significant increases of up to 0.86 m were found in downstream areas such as Massey Park Golf Club and along Saltwater Creek.

Table 8: Sea Level Rise Sensitivity

ID	Location	Change in Design Flood level with 2100 sea level rise (0.9 m)			
		1% AEP	0.5% AEP	0.2% AEP	PMF
1	Low Point on Davidson Ave, near Flavelle St	0.00	0.00	0.00	0.00
2	Intersection of Davidson Ave & Majors Bay Rd	0.01	0.01	0.00	0.00
3	Low Point on Spring St, near Brewer St	0.04	0.04	0.04	0.02
4	Low Point on Curtin Pl	0.01	0.01	0.01	0.00
5	Low Point on Wellbank St, near Central Park	0.01	0.01	0.01	0.00
6	Low Point on Creewood St	0.00	0.00	0.00	0.00
7	Low Point on Kentwell Ave	0.00	0.00	0.00	0.00
8	Low Point on Parramatta Rd	0.00	0.00	0.00	0.00
9	Low Point on Ada St	0.00	0.00	0.00	0.00
10	Low Point on Coles St	0.00	0.00	0.00	0.00
11	Low Point on Melbourne St	0.00	0.00	0.00	0.00
12	Low Point on John St, near Goddard Park	0.00	0.00	0.00	0.00
13	Low Point on Gipps St, downstream of Goddard Park	0.00	0.00	0.00	0.00
14	Intersection of Crane St & Majors Bay Rd	0.00	0.00	0.00	0.00
15	Eastern edge of Rothwell Park	0.00	0.00	0.00	0.00
16	Downstream of the Rothwell Park	0.01	0.01	0.01	0.00
17	Low Point on Jones St	0.03	0.03	0.02	0.00
18	Western edge of Jessie Stewart Reserve	0.05	0.04	0.04	0.02
19	Low Point on Greenlees Ave	0.05	0.04	0.04	0.02
20	Low Point on Ian Parade	0.05	0.04	0.03	0.02
21	Intersection of Wellbank St & Ian Parade	0.06	0.04	0.03	0.03
22	Low Point on Brewer St, close to Edwards Park	0.01	0.01	0.01	0.02
23	Low Point on Smythes St	0.01	0.01	0.01	0.00
24	Low Point on Anderson Rd	0.00	0.00	0.00	0.00
25	Upstream of the first Saltwater Creek Crossing	0.27	0.27	0.22	0.03
26	Upstream of the second Saltwater Creek Crossing	0.73	0.73	0.67	0.06
27	Upstream of the Saltwater Creek Crossing closest to Exile Bay	0.81	0.86	0.85	0.86
28	Low Point on Cabarita Rd, near Massey Park Golf Club	0.00	0.00	0.00	0.00
29	Low Point on Massey Park Golf Course	0.26	0.26	0.22	0.03
30	Low Point on Broughton St	0.00	0.00	0.00	0.00
31	Downstream of Central Park	0.00	0.00	0.00	0.00

6.COMMUNITY FLOOD RISK ASSESSMENT

6.1 Overview

An assessment of Exile Bay's flood behaviour and community profile has been carried out to determine specific areas of flood risk across a range of metrics, including; property flood liability, flood hazard, hydraulic categories and the economic impact of flooding.

The Flood Study results have been utilised in the following sections to examine areas of risk associated with flooding in the Exile Bay catchment. The following sections describe the consequences of flooding in the study area and include:

- Identification of key flood risk areas and the development of flooding hotpots (Section 6.2);
- Information on flood roads (Section 6.3);
- Assessment of the economic impact of flooding in Exile Bay (Section 6.4) and
- Review of critical infrastructure and sensitive land uses (Section 6.5).

The findings from this analysis have aided the selection and assessment flood risk management measures in Section 7.

6.2 Flooding Hotspots

Hotspots refer to areas that are particularly flood affected and/or affected by hazardous flooding. These areas have been identified over the course of the floodplain risk management process via consultation with Council and the community and analysis of flood modelling results. The following sections will discuss the flood mechanisms affecting the selected hotspots.

Please note that all figures for the Hotspot Analysis are presented at the end of the report.

6.2.1 Hotspot 1: Parramatta Road to John Street

Hotspot 1 denotes the natural overland flow path at the upstream reach of the Main South Drain. Hotspot 1 traverses properties between Parramatta Road and John Street. Figure 14 presents the 5% AEP, 1% AEP and PMF design flood results at Hotspot 1 and the peak flow results at various locations along the flow path.

Flow originates in the upper Exile Bay catchment areas (in Burwood Council LGA) and flows in a northerly direction toward Parramatta Road where it enters the Canada Bay LGA. The catchment area upstream of Parramatta Road is approximately 22 hectares. In the 1% AEP event, approximately 5.5 m^3/s (4.3 m^3/s overland flow and 1.2 m^3/s of pipe flow) crosses Parramatta Road at the low point downstream of Phillip Street, Strathfield. Flood waters then enter Coles Street where 6.6 m^3/s (4.7 m^3/s of overland flow and 1.9 m^3/s of pipe flow) flows toward the low point in the road before traversing properties along Coles Street and Melbourne Street. In the 1% AEP event, 10 m^3/s (7.2 m^3/s of overland flow and 2.8 m^3/s of pipe flow) moves through properties on Melbourne Street toward John Street.

The capacity of the trunk drainage system, between Ada Street and Gipps Street is reached in the 1 EY event and as such additional flow is conveyed overland. Increasing the capacity of the trunk

drainage system would provide some benefit however the application of this measure has limited feasibility as the current pipe network lies beneath private property. This has been investigated in Section 7.3.3.5.

6.2.2 Hotspot 2: Constriction downstream of Rothwell Park

Hotspot 2 represents a flow constriction along the Main South Drain downstream of Rothwell Park. At this constriction, overland flow moves along the low point between the Council Depot in the east and behind properties on Jones Street in the west. Figure 15 present the 5% AEP, 1% AEP and PMF design flood results at Hotspot 2 and the peak flow results at various locations along the flow path.

The Main South Drain at Hotspot 2 has an upstream catchment area of approximately 115 hectares. In the 1% AEP event, 19.6 m^3/s (10.1 m^3/s of overland flow and 9.5 m^3/s of pipe flow) flows through the constriction and properties nearby are inundated by depths of up to 0.7 m. Although Hotspot 2 is traversed by several large stormwater assets, these assets are full in the 1EY event.

GRC Hydro have previously undertaken numerous studies which have investigated modifications to the mounding of the Council depot site to the increase conveyance capacity along this flow path.. Furthermore, Section 7.3.3.3, 7.3.3.6 and 7.3.3.8 have looked at drainage modifications in this location to mitigate the more frequent flood events. Other topographic modifications such a lowering roadway and implementing embankments in this area were investigated Section 7.3.3.10 and 7.3.3.13.

6.2.3 Hotspot 3: Central Drain upstream of Davidson Avenue

Hotspot 3 pertains to the upper reaches of the Central Drain where several overland flow paths meet at Wellbank Street, upstream of Central Park. Figure 16 present the 5% AEP, 1% AEP and PMF design flood results at Hotspot 3 and the peak flow results at various locations along the flow path.

Overland flow paths from the 34 hectare catchment, upstream of Wellbank Street, combine before flowing through Central Park and Curtin Place and moving toward Davidson Avenue (see Section 6.2.4). These overland flow paths and their respective peak 1% AEP flows are listed below:

- Overland flow path from Station Street and Cross Street – 4.1 m^3/s (2.8 m^3/s of overland flow and 1.3 m^3/s of pipe flow);
- Overland flow path from Macnamara Avenue – 4.9 m^3/s (4.4 m^3/s of overland flow and 0.5 m^3/s of pipe flow);
- Overland flow path from Castlereagh Street – 1.4 m^3/s of overland flow; and
- Minor overland flow path from the catchment east of Wellbank Street – 0.8 m^3/s (0.7 m^3/s of overland flow and 0.1 m^3/s of pipe flow).

As flow moves downstream, through Central Park, 8.8 m^3/s approaches Davidson Avenue (6.3 m^3/s of overland flow and 2.5 m^3/s of pipe flow) in the 1% AEP event. Approximately 4.3 m^3/s of the overland flow from Central Park, deviates and inundates Curtin Place to the east where floodwaters store in the cul-de-sac. Flow from Curtin Place and Central Park then traverses properties on Davidson Avenue and moving in an easterly direction (see Section 6.2.4).

Despite there being several large trunk drainage assets along Hotspot 3, the capacity of this system is typically reached in the 1EY event. Section 7.3.3.1 and 7.3.3.12 have examined drainage and topographic modifications, respectively, in this location to alleviate flooding at this location.

6.2.4 Hotspot 4: Davidson Avenue

Hotpot 4 is a continuation of the Central Drain from Hotspot 3 (see Section 6.2.3) and denotes the natural overland flow path that moves along Davidson Avenue toward Majors Bay Road. Figure 17 present the 5% AEP, 1% AEP and PMF design flood results at Hotspot 4 and the peak flow results at various locations along the flow path.

At Favelle Street, overland flow paths from the north, south and west, with a total catchment area of 64 hectares, meet at Davidson Avenue and continue to flow in an easterly direction. From the north of Favelle Street, 1.2 m^3/s in the 1% AEP event (1.1 m^3/s of overland flow and 0.1 m^3/s of pipe flow) approach Davidson Avenue. To the south, 1.5 m^3/s (1.2 m^3/s of overland flow and 0.3 m^3/s of pipe flow) approach Davidson Avenue in the 1% AEP event. Upstream of Favelle Street (west), 12.5 m^3/s (9.7 m^3/s of overland flow and 2.8 m^3/s of pipe flow) flow along Davidson Avenue. Downstream of Favelle Street, 14.5 m^3/s (12.1 m^3/s of overland flow and 2.4 m^3/s of pipe flow) flows along Davidson Avenue in the 1% AEP event.

As floodwaters on Davidson Avenue approach Majors Bay Road, flood depths increase to up to 0.85 m in the 1% AEP event as the flow path crosses Majors Bay Road to Brewer Street (see Hotspot 5, Section 6.2.5)

Hotspot 4 is a key thoroughfare for flood waters along the Central Drain and as such, it has been a key location for the investigation of Floodplain Risk Management Measures. Section 7.3.3.2 investigates drainage enhancements along this roadway.

6.2.5 Hotspot 5: Majors Bay Road and Brewer Street intersection

Hotspot 5 is located downstream of Hotspot 4 (see Section 6.2.4), along the Central Drain, at the intersection of Majors Bay Road and Brewer Street. Figure 18 present the 5% AEP, 1% AEP and PMF design flood results at Hotspot 4 and the peak flow results at various locations along the flow path.

At the Majors Bay Road intersection, the Davidson Avenue flow path (Hotspot 4, see Section 6.2.4) meets flow from the north and south of Majors Bay Road and then flows along Brewer Street. In the 1% AEP event, 15.7 m^3/s (13.4 m^3/s of overland flow and 2.3 m^3/s of pipe flow) enters the Hotspot 5 intersection from Davidson Avenue. This flow is met by 1.0 m^3/s (0.7 m^3/s of overland flow and 0.3 m^3/s of pipe flow) from the north of Majors Bay Road and 2.2 m^3/s (1.7 m^3/s of overland flow and 0.5 m^3/s of pipe flow) from the south. On Brewer Street, 19.2 m^3/s (14.2 m^3/s of overland flow and 5.0 m^3/s of pipe flow) continues downstream.

Similar to Hotspot 4 (see Section 6.2.4), Hotspot 5 is a key thoroughfare for floodwaters on the Central Drain and as such, given the large upstream catchment area, flooding is unlikely to be eliminated. The current study has assessed ways in which these floodwaters could be better managed to improve flooding in the vicinity. The current study has considered reconfiguring the vegetated and median strip at this intersection and regrading the roadway to allow for efficient flow to Brewer Street (see Section 7.3.3.11).

6.2.6 Hotspot 6: Saltwater Creek

Hotspot 6 denotes Saltwater Creek, downstream of Ian Parade, which acts as the key drain to the catchment outlet at Exile Bay. The Saltwater Creek channel flows through the Massey Park Golf

Course and is adjacent to properties on the southern side. Figure 19 present the 5% AEP, 1% AEP and PMF design flood results at Hotspot 4 and the peak flow results at various locations along the flow path.

In the 1% AEP event, 25.3 m^3/s flows along Saltwater Creek toward Exile Bay. The capacity of Saltwater Creek is reached in the 1 EY event albeit for a very brief period. In the 10% AEP event, flooding from the overtopped creek begins to encroach on nearby properties to the south which becomes progressively worse as flood magnitude increases. The Flood Study investigated several mitigation strategies outlined by Council to mitigate flooding in this area. Council has since undertaken steps toward upgrading the Saltwater Creek Channel.

6.3 Road Inundation

Hazardous flooding of roads occurs when there is enough flow to knock over pedestrians or transport cars off the road due to buoyancy and frictional instability. In Australia, vehicles attempting to cross flooded roads is the largest causes of injury and fatality during a flood. The ability of flow to move or completely float a car is often underestimated, with as little as 0.3 m (30 cm) depth enough to move a small car, even at low flow speeds (this corresponds to H2 hazard). Given these figures, an analysis of key flooding hotspots and evacuation routes has been undertaken.

Table 9 presents the flood hazard at key hotspots and roadways throughout the study area and shown in Figure 3.

Table 9: Inundation of hotspots and roads in Exile Bay

ID	Location	Peak Flood Hazards per design event						
		1EY	20% AEP	10% AEP	5% AEP	1% AEP	0.2% AEP	PMF
1	Davidson Ave intersection with Flavelle St	H2	H2	H2	H2	H3	H4	H5
2	Davidson Ave intersection with Majors Bay Rd	H2	H2	H3	H3	H3	H3	H4
3	Spring Street near Brewer Street	H2	H3	H3	H3	H3	H3	H5
4	Curtin Pl near Churchill Cres	H2	H3	H3	H3	H3	H3	H5
5	Wellbank St intersection with Castlereagh St	H1	H1	H1	H1	H2	H2	H4
6	Creewood St near Patterson St	H1	H1	H1	H1	H2	H2	H3
7	Kentwell Ave near Cross St	H1	H1	H2	H2	H2	H2	H4
8	Parramatta Rd intersection with Philip St	H2	H2	H2	H2	H2	H3	H3
9	Ada St near Coles St	H1	H2	H2	H2	H2	H2	H3
10	Coles St near Ada St	H1	H1	H2	H2	H2	H2	H4
11	Melbourne St near Alexandra St	H1	H1	H2	H2	H2	H3	H4
12	John St near Alexandra St	H2	H2	H2	H2	H3	H3	H4
13	Gipps St near Flavelle St	H2	H2	H2	H2	H3	H3	H5
14	Intersection of Major Bay Rd and Crane St	H2	H2	H2	H2	H3	H4	H5
15*	East of Rothwell Park near Beaconsfield Ave	H2	H3	H3	H3	H4	H4	H5
16*	North of Rothwell Park near Beaconsfield Lane	H4	H5	H5	H5	H5	H5	H5
17	Jones St near Rhonda Place	H1	H2	H2	H2	H3	H3	H5

18*	Greenlees Ave- near Gallipoli St	H3	H3	H3	H3	H3	H4	H5
19	South-west of Greenlees Park on Greenlees Ave	H1	H2	H2	H2	H3	H3	H5
20	Ian Parade near Freeman Place	H2	H3	H3	H3	H3	H3	H5
21	Intersection of Wellbank St and Ian Parade	H2	H3	H3	H3	H3	H3	H5
22	Pamela Pl near Spring St	H3	H3	H3	H3	H3	H3	H5
23	Symthes St near Noble St	H1	H1	H1	H1	H2	H2	H5
24	Anderson Rd near Symthes St	H1	H2	H2	H2	H2	H2	H3
28	Cabarita Rd near Bayview Street	H1	H1	H1	H1	H2	H2	H4
30	Broughton St near Richards Pl	H1	H2	H2	H2	H2	H2	H3
31*	North of Scout Hall Central Park	H1	H1	H1	H1	H1	H1	H5

*Note these points are not located on a road, rather on a reserve or parkland

The information presented in Table 9 indicates that roadways in key hotspot areas present safety risks to cars and pedestrians in events as frequent as the 1EY.

6.4 Flood Damages Assessment

6.4.1 Overview

A flood damages assessment is used to quantitively assess the impacts of flooding on the community (Reference 2). Generally, a flood damages assessment aggregates the following:

- Direct costs to individual properties such as structural damages or damage to contents;
- Indirect costs to individual properties such as clean-up, disposal or loss of income; and
- Cost of damage to infrastructure.

The assessment is based on design flood results and information on properties' floor levels, flood hazard and ground levels. Based on the flood liability of each development, a monetary value is applied to each property based on the level of property damage over a range of design flood events. The flood damages assessment is not of sufficient accuracy to determine the exact potential cost of damage at the individual property level. However it gives a fairly accurate catchment-wide estimate that can be compared to other catchments, which use the same assumptions, and also can be used to quantitatively assess any mitigation options that reduce property damage.

The current study uses the recently updated NSW government Flood Damages spreadsheet. A total of 2146 properties were included in the analysis including, 2058 residential properties and 88 non residential sites. Figure 20 and Figure 21 present the first event to inundate each property over ground level (above 0.1 m) and floor level, respectively.

6.4.2 Floor Level Estimation

Floor level estimation was completed for all properties within the Flood Planning Area (FPA) (see Section 5.4). This process was undertaken by estimating the height between the ground level and the lowest habitable floor level. The ground level for each property was determined using LiDAR data. The floor level was determined by adding the LiDAR ground level to the estimated height from ground to floor level.

The height from ground level and to the lowest habitable floor level was estimated, where possible, via Google StreetView for each property within the FPA. Nearby physical features were used to aid the estimation of the ground to floor height, such as the number of bricks to the floor level or the height of a nearby garbage bin. A site visit was undertaken to verify existing floor level estimates and obtain ground to floor estimates for properties that were unable to be seen from Google StreetView. During this process, additional information pertaining to each property was recorded such as the type of house construction and the number of storeys.

For the properties outside of the FPA but within the PMF extent, the ground to floor level was estimated based on the average ground to floor level difference derived for the properties within the FPA.

6.4.3 Residential Flood Damages

Residential flood damages have been estimated in accordance with 'Disaster Cost Benefit Analysis Framework' (NSW Treasury, 2023) and Flood Risk Management Measures: Flood Risk Management Guide (DPE, 2023) which uses the revised 'DT01' flood damages tool. Applied parameters used in this analysis are presented in Table 10.

Table 10: Residential flood damages inputs

	Input Value
Inflation adjustment CPI level	132.7 (Q1, 2024)
Nexis Data Region	Canada Bay LGA
Regional Uplift Factor	1.00 (default)
Infrastructure Damages Uplift	10% of resd. Damage
Emergency Management Uplift	0% (default)
Damage Downscale (Townhouse or Units)	30% (default)
Road repair cost	$5.65
Relocation Cost	$0 (default)
House size	220 m^2 (default)
Average contents per m2	$550
Residential clean-up cost	$4,500
Estimated cost per fatality	$5,300,000
Speed of onset category	3 (rate of rise less than one hour)
Primary Nature of Area	Detached residential dwellings
Effective Warning Time	0 hours

Residential Flood Damage estimates provide a monetary value of flood damages for each property for a range of design flood events. A key outcome of this assessment is the Average Annual Damage (AAD). The AAD is equal to the total damage caused by all floods over a long period of time divided by the number of years in that period. The AAD is primarily used during a Floodplain Risk Management Study and Plan (FRMS&P) to compare the relative economic merits of various proposed flood mitigation measures.

A residential AAD of $2,664,000 was calculated for the Exile Bay catchment. Table 11 presents the AAD and total Residential Flood Damages per design event. Relatively small events have around $3-4 million damage while rare events have around $8-10 million damage, due to the significant amount

of overland flow moving through the catchments. The majority of the AAD is from relatively common events.

Table 11: Residential Flood Damages

Design Event (AEP)	No. of properties flooded above ground	No. of properties flooded above floor	Total Damages	Contribution to AAD total
PMF	1,578	409	$78,330,000	$91,000
0.2%	942	96	$12,737,000	$34,000
0.5%	883	78	$10,076,000	$46,000
1%	842	72	$8,515,000	$74,000
2%	767	55	$6,267,000	$162,000
5%	706	43	$4,536,000	$211,000
10%	660	35	$3,899,000	$330,000
20%	540	20	$2,711,000	$1,715,000
			Average Annual Damages (AAD)	$2,664,000

6.4.4 Non-Residential Flood Damages

The calculation of tangible non-residential flood damages on a large scale can be highly varied. Non-residential flood damages are dependent on factors such as:

- The nature of business undertaken at the property. For example, a business which has a quick turnaround of produce (or limited stock), such as a florist, is likely to suffer a smaller economic loss due to flooding than a business with highly valuable stock and a slower turnaround time, such as an electronics store.
- The floor space of a non-residential property can be related to the amount of stock stored on site and therefore the amount of stock vulnerable to flooding.
- The duration of inundation of a non-residential property and extent of damages can directly affect the length of time that the business may be closed.
- The level of flood awareness/preparedness such as the amount of flood warning and ability to move vulnerable stock can affect the level of flood damage experienced.

The study area is largely residential with only 6 properties in the flooded area identified as non-residential.

Table 12 presents the AAD and the total Non-residential Flood Damages per design event.

Table 12: Non-Residential Flood Damages

Design Event (AEP)	No. of properties flooded above floor	Total Damages	Contribution to AAD total
PMF	18	$4,011,000	$5,000
0.2%	4	$535,000	$1,000
0.5%	4	$434,000	$2,000
1%	3	$377,000	$3,000
2%	3	$247,000	$7,000
5%	2	$222,000	$11,000
10%	2	$222,000	$19,000
20%	2	$167,000	$111,000

Average Annual Damages (AAD)	$160,000

6.4.5 Combined Flood Damages

Net flood damage estimates that combine residential and non-residential flood damages are presented in Table 13. The total damages estimates include infrastructure uplift, estimated as 10% of the residential damages cost.

Table 13: Combined Flood Damages

Design Event (AEP)	Properties Flooded Above Floor	Flood Damages Total
PMF	427	$90,181,000
0.2%	100	$14,545,000
0.5%	82	$11,517,000
1%	75	$9,743,000
2%	58	$7,140,000
5%	45	$5,211,000
10%	37	$4,511,000
20%	22	$3,148,000
Average Annual Damages (AAD)		$3,125,000

6.5 Risk to Sensitive Land Uses and Critical Infrastructure

Critical infrastructure is located throughout the area and if inundated during a flood, may significantly impact the functioning of the local area. The following section describes the flood liability of various critical infrastructure. The section also describes the exposure of facilities particularly sensitive to inundation, including childcare, schools and aged care.

6.5.1 Medical Facilities

Medical Facilities often house vulnerable persons who may require additional resources, warning time and assistance, flooding occurs. In Exile Bay, there are no critical medical facilities such as hospitals or ambulance stations however there are a number of facilities providing medical service during business hours. These facilities have been detailed in Table 14..

Table 14: Flood affectation at medical facilities

Medical Facility	Location	First Flooded at Ground Level	Hazard on Lot and Access Route
Concord Medical Centre	114 Majors Bay Road	Not Flooded	Access issues with H5 on Majors Bay Road in PMF
Majors Bay Medical Centre	77 Majors Bay Road	Not Flooded	Access issues with H5 on Majors Bay Road in PMF
Wellbank Street Medical Practice	28 Wellbank Street	Not Flooded	Not Flooded
Concord Family Doctors	19 Brewer Street	PMF	Up to H4 in PMF on the lot On access route, H2 in 1% AEP (up to H5 in PMF)

Majors Bay Family Dental	148 Majors Bay Road	PMF	Up to H5 in PMF on the lot. Access issues from Majors Bay Road and Davidson Road in the south. Clear access from the north.
Concord Dental Care	126 Majors Bay Road	Not Flooded	Access issues from Majors Bay Road to the north. Clear access from the south.
Concord Dental Practice	103 Majors Bay Road	Not Flooded	Access issues from Majors Bay Road to the north. Clear access from the south
Cabarita Dental	15 Cabarita Road	Not Flooded	Some access issues in extreme events with H5 on roadway in 1% AEP and H6 in the PMF event.
Distinct Dental Centre	219-221 Concord Road	Not Flooded	Not Flooded
Better Teeth Dental Care	177A Concord Road	Not Flooded	Not Flooded

6.5.2 Aged and Vulnerable Care

Aged and special care facilities often house vulnerable persons who may require additional resources, warning time and assistance, if flooding occurs. The unplanned/abrupt evacuation of aged care facilities is associated with increased mortality rates in vulnerable people.

It is important that the three aged care facilities in the Exile Bay catchment have effective flood plans for extreme flood events.

Table 15 presents the flood affection of these aged care facilities. One of these facilities is isolated from access in the PMF event.

Table 15: Flood affectation at aged care facilities

Aged Care Facility	Location	First Flooded at Ground Level	Hazard on Lot and Access Route
Right at Home Sydney	103 Majors Bay Road	Not Flooded	Access issues at the Majors Bay Road and Brewer Street intersection however access is possible to the south up to the 0.2% AEP. Access not possible in the PMF.
Redleaf Manor Aged Care	16 Flavelle Street	PMF	Access is available up to the PMF via the western end of Patterson Street. Access via Flavelle Street is possible up to the PMF event.

St Mary's Villa Residential Aged Care	56 Burton Street	Not Flooded	Not Flooded

6.5.3 Schools and Childcare Centres

Table 16 and Table 17 present the flood affectation of early learning facilities and educational facilities in the Exile Bay catchment. Typically, these locations are not flooded or only experience flooding during extreme events. Of note are Amanda's Family Day Care and Wellbank Children's Centre which experience flooding on the lot in the 1% AEP event and are subject to access issues in extreme events, as does Concord Kindergarten.

Table 16: Flood affectation at Exile Bay catchment early learning facilities

Early Learning Facility	Location	First Flooded at Ground Level	Hazard on Lot and Access Route
St Mary Early Learning Centre Concord	40 Brays Road	Not Flooded	H1 on surrounding roads in PMF
Cabarita-Mortlake Kindy	Cnr Willam & Denison Streets	Not Flooded	H1 on surrounding road in PMF and1% AEP
Concord Kindergarten	19A Bent Street	PMF	H2 in 1% AEP H5 in PMF Access issues with flooding on Brewer St up to H2 in 1% AEP and H6 in PMF
Amanda's Family Day Care	1 Davidson Ave	1% AEP	Significant flooding and access issues. H5 in the 1% AEP on Davidson Avenue
Wellbank Children's Centre/Concord Occasional Childcare Service	60 Flavelle Street	1% AEP	H3 on southern part of lot. Up to H4 in PMF on Churchill Crescent
Cubby College	81/83 Correys Ave	Not Flooded	Not Flooded
Integricare North Strathfield Early Learning Centre/Kids at Weldon	132 Davidson Ave	Not Flooded	Not Flooded

Table 17: Flood affection at Exile Bay catchment educational facilities

Educational Facility	Location	First Flooded at Ground Level	Hazard on Lot and Access Route
Strathfield North Public School	251 Concord Road	Not Flooded	Not Flooded
St Mary's Catholic Primary School	60 Burton Street	Not Flooded	Not Flooded

6.5.4 Risk to Critical Infrastructure

Flood damage to public infrastructure can have a significant contribution to the total cost of a flood event as well as disturbing the day-to-day operations of the local community. Table 18 presents the flood affectation of Concord Fire Station in the Exile Bay catchment.

Ausgrid were contacted to obtain the location of any electrical substations within the study area to undertake an analysis of the flood liability of these structures. Due to confidentiality concerns and issues with putting this information in the public domain, however, GRC Hydro did not obtain these locations (if any).

Table 18: Flood affectation to critical public infrastructure

Critical Infrastructure	Location	First Flooded at Ground Level	Hazard on Lot and Access Route
Concord Fire Station Fire and Rescue NSW	153 Concord Road	Not Flooded	Not Flooded

7. FLOODPLAIN RISK MANAGEMENT MEASURES

Assessment of flood risk management measures is a key objective of the current study which aims to reduce, or otherwise, manage the flood risk in Exile Bay. These measures can vary from large-scale civil works, such as the construction of levee, to non-works interventions, such as planning controls for new developments. The current study has undertaken a detailed assessment of management measures and their relative cost/benefit. Feasible measures, found to effectively reduce flood risk, have been ranked for implementation in the Floodplain Risk Management Plan (see Section 8).

Floodplain Risk Management measures are categorised in the NSW FRMM as follows:

- Property Modification Measures (Section 7.1) are those which involve modifying existing properties to manage their flood risk. This includes planning-related measures such as minimum floor levels and zoning based on the locality's flood risk. They also include house raising, and in cases of high flood risk, voluntary purchase schemes.
- Response Modification Measures (Section 7.2) are those that improve the ability of people to plan for and react to flood events. They often involve emergency services and can be targeted at different phases of a flood, e.g. preparation, response and recovery.
- Flood Modification Measures (Section 7.3) are those that change the behaviour of the flood itself through works or other measures. These measures often work to exclude flow from an area (for example a levee bank) or to reduce the peak flow (for example a detention basin).

Table 19 briefly describes typical mitigation measures in each of these categories.

Table 19: Description of Modification Measures (according to (Reference 6))

	Measure	Description
Property Modification Measures	Land Use Planning	Strategic assessment of flood risk to guide consent authorities to manage and reduce exposure to flood risk for future development areas.
	Zoning	Application of land use controls for flood prone areas of future development without also unjustifiably restricting development in these areas.
	Development Controls	Where development is acceptable, development controls are used to manage flood risk.
	Voluntary Purchase	In residential areas of high hazard on the floodplain posing a risk to life, the purchase of properties can their removal/demolition can be undertaken.
	Voluntary House Raising	In residential areas, exposed to frequent over floor flooding from low hazard and localised flow, this can be avoided by voluntary house raising.
	Flood Proofing of Buildings	Flood proofing pertains to the design and construction of buildings using materials that are flood compatible as to minimise flood damage to the building and its contents.
	Flood Access	In areas where isolation occurs during a flood event for long periods of time, planning measures need to be considered for access during these times.

Response Modification Measures	Flood Education, Flood Information Leaflets & Community Readiness	Flood education pertains to informing the community of the flood risk to ensure general community awareness and flood readiness.
	Flood Prediction and Warning	Flood prediction and warning can be implemented on catchments with large times of concentration to allow time to ready to the community.
	Local Flood Plans	Local flood plans can be used to identify significantly flood affected areas and outline various measures to be undertaken before, during and after a flood.
	Recovery Planning	Plans for recovery planning can be developed to ensure that Council and other authorities have addressed the community's needs and provided the needed services.
Flood Modification Measures	Flood Mitigation Dams	Flood mitigation dams can be used to reduce downstream discharges. This relies on the dam having capacity to store flood waters prior to a flood.
	Retarding Basins	Retarding basins pertain to small dams to provide flood storage on overland flowpaths or small tributaries.
	Levees	Levees and embankments can be used to protect existing developed areas by excluding flood waters.
	Bypass Floodways	Bypass floodways can be used to redirect floodwaters away from flood existing developed areas to reduce flood levels along a channel.
	Channel Modifications	Channel modifications refer to modifying a channel either by widening, deepening, realigning or clearing the waterway to allow for more efficient channel flow.
	Floodgates	Floodgates can be used to control and exclude flow along a small creeks or waterways.

The following sections provide detailed assessment of these measures and their relative cost/benefit.

7.1 Property Modification Measures

7.1.1 Background

Property Modification (PM) measures are those that modify existing properties, or future development in the area, to manage the area's flood risk. These measures tend to be either interventions for specific properties with high flood risk, such as house raising or voluntary purchase (few suitable examples in the study area), or broader policy changes that gradually reduce flood risk as development occurs (more applicable to this study area). While such measures do not change the flood behaviour itself, over time they can remove dwellings and other buildings from hazardous flood areas and ensure the remaining flood-prone areas are well-equipped to deal with flooding. Such measures are particularly suited to areas where flood modification measures (works) are either not feasible or prohibitively expensive. In most cases property modification measures are implemented via Council policies, which can be used to stipulate where and how development can occur within the floodplain.

The measures outlined in the following sections are proposed to be included in the Floodplain Risk Management Plan.

7.1.2 Clarify Use of Flood Risk Precincts in the DCP

In keeping with the new LEP clauses (clause 5.21 and clause 5.22) and state government ministerial directions, Council's updated DCP, adopted in March 2023, has included a Flood Planning Matrix approach to the implementation of flood related development controls within the PMF extent. This matrix uses Flood Risk Precincts (see Section 5.4.1) and the land use to provide relevant controls at a site. Council may consider revising the following part of the DCP, to show that all properties in the PMF extent have flood planning controls that apply to them, in accordance with these DCP controls.

Current DCP text: "This section applies to: Land which is shown as 'Flood Planning Area' in a Flood Planning Map. Refer to Figure B8.1 to Figure B8.5."

Recommended updated text: "This section applies to: Land which is shown as 'Flood Planning Area' and "Land between Flood Planning Area and Probable Maximum Flood" in a Flood Planning Map. Refer to Figure B8.1 to Figure B8.5."

This will clarify that all properties in the 'Low Flood Risk' and many properties in the 'Medium Flood Risk' area outside the FPA, are subject to flood planning controls.

Recommendation: The continued use of Flood Risk Precincts in the DCP is recommended in the Floodplain Risk Management Plan. It is recommended that the set of properties to which the controls apply should be updated or otherwise clarified.

7.1.3 Voluntary Purchase

In a situation where it is impractical or uneconomical to mitigate high hazard flooding from properties, it may be necessary to acquire the affected properties and undertake demolition to remove them from the floodplain. Where dwellings lie in flow conveyance, voluntary purchase (VP) may be the best way to manage flood risk. This would remove residents from the high-risk areas and restore the hydraulic capacity of the floodplain. The purchase of such properties should be at an equitable price and only where voluntarily offered. Generally, voluntary purchase has minimal impacts on the environment though this scheme can have significant economic and social costs.

Recommendation: This option is supported in the Floodplain Risk Management Plan. VP is a sensitive issue and so the recommendation herein is for further work to be done in this regard to identify suitable properties based on VP criteria and then to assess the feasibility of VP for identified properties and make specific recommendations to Council.

7.1.4 Voluntary Floor Raising

This measure can be undertaken to raise habitable floor levels and eliminate above floor flooding for affected properties. It is suitable mainly for timber or non-brick single storey buildings and for properties generally located in low hazard areas. The building structure must be able to withstand loadings from floodwaters and debris. Even though the raised building provides safe refuge to residents during a flood event, the risk to life remains present should residents choose to exit the building or a medical emergency occurring during the flood event. For properties located in high hazard areas, rare floods could still cause inundation of the building should the floor levels not be sufficiently raised.

Recommendation: The option is not considered in the Floodplain Risk Management Plan as most properties within the study area are of slab-on-ground construction and the shallow nature of overland flow flooding means comparatively cost-effective measures such as flood proofing are available.

7.1.5 Flood Proofing

Flood proofing can be undertaken to seal all building entry points such as doors and windows from floodwaters. Both temporary and permanent flood proofing methods are available with the temporary ones being sandbags, portable flood barriers, whilst permanent ones being flood gates, sealing of gaps between brick works and electrical wiring insulation. This measure is generally less expensive compared to other property modification measures and causes less disruption. The effective deployment of temporary flood proofing measures would rely on the experience and knowledge of the user as well as sufficient warning time before the onset of flooding. As the study area experiences mainly flash flooding, this is generally not possible.

Recommendation: Permanent flood proofing measures are considered as an option in the Floodplain Risk Management Plan.

7.1.6 Property Modifications

Modifications can be made to flood-affected properties either to manage overland flows through the property or strengthening the building to provide shelter and reduce flood risk to the residents. For the former, this can be in the form of adjustment to walls and fences within the property or provision of an easement to maintain continuity of overland flow paths. This, however, may have knock on effects on neighbouring properties which may prompt adjustment on neighbouring properties as well. In terms of building strengthening, this is undertaken to provide a structurally stable refuge for residents. Both measures, nevertheless, cannot be mandated by Council nor can Council or the State Government provide funding for these modifications. As such, any decision to employ these measures would be up to the individual property owners.

Recommendation: The option is not considered in the Floodplain Risk Management Plan as the benefits are generally localised and as such implementation of the scheme is problematic.

7.1.7 Assessment of On-Site Detention Requirements

On-Site Detention (OSD) is a means of stormwater management whereby runoff is temporarily stored and slowly released to offset potential downstream flooding impacts from increasing paved surfaces within a catchment. During the community consultation process (see Section 4), residents expressed concern regarding increases in rainfall runoff due to new developments, inadequate installation of OSD and pumping of basement carparks increasing runoff. Given this, a brief examination of Council's OSD requirements in the DCP was undertaken and found to be detailed and prescriptive. Thorough review could be undertaken by a qualified stormwater engineer to ensure these requirements are adequate.

Recommendation: No action required from a flooding standpoint as Council's DCP provides detailed OSD requirements for stormwater engineers to adhere to.

7.2 Response Modification Measures

7.2.1 Background

Owing to the flash flood nature of flooding within the LGA, Response Modification (RM) measures have limited use in flood risk management for this study area. Simply put, flooding happens irregularly, and without any effective warning. For most if not all impacted properties the idea that a response can be planned and implemented is not realistic. The exception may be for road crossings throughout the study area impacted by overland flow, buildings in lower catchment areas frequented by the public that are subject to high levels of flood hazard and basements (e.g. car parks) that have persistent and hazardous flooding problems.

7.2.2 Flood Prediction and Warning

BOM provides flood forecasting and warning services suited mainly for mainstream riverine flooding rather than flash flooding which is more common in the Exile Bay catchment. The services may be of some benefit in alerting residents of potential flooding though there is not adequate time to develop reliable flood warnings or to disseminate same. The BOM services include:

- Weather forecast – which may indicate the likelihood of heavy rain with often more than 24 hours' notice;
- Flood Watch – will typically provide +24 hours' notice of potential flooding;
- Severe Weather Warning – typically issued when heavy rain and/or flash flooding are forecast; and
- Severe Thunderstorm Warning – generally provide between 0.5 to 2 hours' notice of impending severe storms.

Recommendation: The difficulty in predicting flash flooding and lack of warning time available for the catchment means that the provision of an effective flood warning service is not possible, hence this option is not considered in the Floodplain Risk Management Plan.

7.2.3 Education and Flood Awareness

The community readiness in responding to a flood event is correlated to awareness of flood occurrence and issues within their neighbourhood. The responses from the community consultation undertaken during the current study (see Section 4) and during the flood study indicate that there is some awareness of flooding from overland flow in the catchment and within individual properties. In the absence of a recent significant rainfall event within the catchment, community awareness of flooding typically declines. Further with a quarter of the population relocating to the area within the last five years (see Section 2.4), flood awareness within the study area is likely to be quite low This is usually addressed by implementing a community awareness programme.

Given the lack of frequency of flooding, its transitory nature and the overall lack of consequence associated with it for the community in the study area (whilst acknowledging there will be private losses), keeping flooding at the forefront of community awareness is unrealistic and perhaps also unwarranted given the level of flood risk in the catchment.

Recommendation: Community education and raising flood awareness among the residents are deemed unrealistic and unwarranted, hence this option is not considered in the Floodplain Risk Management Plan.

7.2.4 Flood Signage

For areas with flood liability issues especially road crossings, specific actions such as the installation of flood signage may prove of use in reminding people of existing flood issues and how best to respond to them. On flood-prone roads and locations, a warning sign and a depth marker is often used to warn vehicles and pedestrians of dangerous flooding. They are used particularly in regional areas where a creek may completely submerge a section of road when the cross-drainage is exceeded. Recent research has found that while such signage is important given the high number of fatalities due to vehicles crossing flooded roads, signage is often ineffective at persuading motorists to turn around, especially if it is static signage that does not change the warning when a flood is occurring.

In Exile Bay there are a number of flood-affected roads where vehicles are likely to enter hazardous floodwaters during a flood (see Table 9, Section 6.3). Overall, upgraded cross-drainage and general awareness is recommended for such locations, over warning signage. Signage in the study area would have to be static, as there is not robust advance warning of flooding occurring in the area, and as such vehicles are likely to ignore the signage as in virtually all instances it will be perceived as warning against a non-existent risk. In addition, the primary risk that signage would be aimed at, which is risk to life, is largely not present in Exile Bay and is more applicable to larger creeks and rivers in other areas of Sydney and NSW.

Recommendation: Proposal for the installation of flood signage at the appropriate locations is not included in the Floodplain Risk Management Plan.

7.2.5 Local Flood Plan

As discussed in Section 3.3, The Bay Flood Emergency Sub Plan sets out the emergency response arrangements for Exile Bay catchment. The plan identified the NSW SES as the primary agency responsible for dealing with emergencies related to storm and flash flooding. The characteristics of the study area's flood behaviour, however, do not lend themselves to a managed flood response as there is lack of effective warning time and flooding would be distributed across the LGA. Hence, the SES response would be ad-hoc or demand based.

No local Flood Plan is currently available for Exile Bay and the development of such a plan in conjunction with the SES to complement the Local Emergency Management Plan (EMPLAN) would be useful. The Plan should include the following as a minimum:

- Purposes and authority of the plan;
- Responsibilities of the SES Local Controller, other officers, agencies and local organisations;
- Description of the local catchment flood behaviour, hotspots of flooding and its consequences (as per Section 6.2);

- List of key emergency egress routes and their trafficability during a flood event (as per Section 6.3);
- List of vulnerable facilities and sensitive infrastructure (as per Section 6.5); and
- List of suitable evacuation centres which are flood free and accessible by road.

Recommendation: Preparation of a local Flood Plan to complement the EMPLAN is considered in the Floodplain Risk Management Plan. The Plan will include description of the responsibilities of SES and other local agencies as well as provide details of flood-related arrangements.

7.2.6 Requirement for Site Specific Flood Emergency Plans

This measure involves requiring a Flood Emergency Plan to form part of a development application for any lot in a high hazard area. The Plan will ensure that development in these areas includes planning for evacuation if required (including access routes) and other preparation (e.g. responsibilities of individuals or building management and warning systems).

Such a plan should only be required as a risk mitigation measure where the lot has significant areas of high hazard (e.g. H3 to H6 flow) or evacuation constraints (e.g. not flooded but isolated).

Recommendation: No further action required as the flood related planning controls in Council's DCP includes a requirement for a site-specific Flood Emergency Plan.

7.3 Flood Modification Measures

7.3.1 Background

Flood Modification (FM) measures were developed based on assessment of the flood risk and flooding hotspots, with support for measures also coming via consultation with Council and the community. As the catchment is highly urbanised and fully developed, suitable measures are limited to costly and disruptive drainage upgrades or repurposing of park lands for flood storage or attenuation of overland flows.

The following sections present the findings from the detailed assessment of agreed flood modification measures. A 'Longlist' of flood modification measures was developed with Council and in consideration of community input obtained from questionnaire responses (Section 4). These measures are discussed in the following section. The 'Longlist' of options was then refined to produce a 'Shortlist' of options based on discussions with Council.

7.3.2 Flood Modification Measures – Longlist

A staged process was used to select measures that warranted detailed assessment. This involved developing a longlist of measures, and then further assessing those that were most likely to be effective, with input from Council and the Floodplain Management Committee.

The longlist of measures has been summarised in

Table 20, with the location of each option presented in Figure 22.

Table 20: Flood Modification Measures Longlist

Code	Description	Preliminary Assessment Outcome
FM01	Macnamara Avenue Drainage Upgrade	Selected for further assessment.
FM02	Davidson Avenue Drainage Upgrade	Selected for further assessment.
FM03	Beaconsfield Lane Drainage Upgrade	Selected for further assessment.
FM04	Clearing of debris along main flowpaths	Selected for further assessment.
FM05	Damaged drain at corner of Flavelle Street and Wordsworth Avenue due to tree roots	Council to review and address any issues. Not selected for further assessment
FM06	Coles Street Drainage Upgrade	Selected for further assessment.
FM07	Queen Elizabeth Park Drainage Upgrade	Selected for further assessment.
FM08	Shackel Avenue Drainage Upgrade	Selected for further assessment.
FM09	Catchment wide Drainage Upgrade	Selected for further assessment.
FM10	Upgrade of Saltwater Creek Channel and Sea Wall	Not selected for further assessment. Council is investigating this separately.
FM11	Formalise overland flowpath between Central Park and Davidson Avenue	Selected for further assessment
FM12	Investigated lot re-grading at 23-25 Macnamara Avenue	Not selected for further assessment. Being investigated separately
FM13	Additional flood storage in lower catchment including golf course	Not selected for further assessment. This was subject to several detailed assessments between 2020 and 2022. It found that changes to the area are unlikely to provide any benefit, short of completely regrading large sections of the golf course.
FM14	Cascading berms in Queen Elizabeth Park, Goddard Park and Rothwell Park	Selected for further assessment.
FM15	Improve conveyance around Council depot site	Not selected for further assessment. This was subject to detailed assessment in 2022. It found that removal of this mounding led to increased flood impacts on neighbouring properties.
FM16	Improve conveyance along Davidson Avenue, Majors Bay Road and Brewer Street intersection	Selected for further assessment.
FM17	Cascading berms in Central Park	Selected for further assessment.
FM18	Lowering of Brewer Street near Pamela Place	Selected for further assessment.
FM19	Lowering Greenlees Avenue and Greenlees Park	Selected for further assessment.

7.3.3 Flood Modification Measures – Shortlist

Options identified for further consideration and analysis are presented in the following sections.

7.3.3.1 Macnamara Avenue Drainage Upgrade (Option FM01)

Option Overview

Option FM01 aimed to reduce flooding along Macnamara Avenue and the surrounds. This location was identified as Hotspot 3 (see Section 6.2.3) and feedback from the community consultation suggested increasing the stormwater capacity may help to alleviate inundation in frequent events.

This mitigation measure involved doubling the pipe capacity along Macnamara Avenue and extending to Davison Avenue, as well as increasing the pit capacity and adding pits on the western side of Macnamara Avenue to capture additional overland flow.

Impact on Flood Liability

Figure 23 presents the 20% AEP and 1% AEP event flood level impacts for the implementation of Option FM01. In both the 20% and 1% AEP events, peak flood level reductions of up to 0.08 m occur between the northern end of Macnamara Avenue through to Davidson Avenue. Notably, however, was that these reductions in flood levels were fairly localised and only provide benefit to a few properties relative to the large scale of the proposed works. Pipe flow in the 20% AEP event along Macnamara Avenue increased from 0.3 m^3/s in the existing case to 0.65 m^3/s.

Option FM01 was simulated for a range of flood events with the results presented in Table 21 below. The table shows that the option provides from benefit with several properties no longer flooded over floor level in the 20%, 10% and 5% AEP events and a reduction of $143,000 in Average Annual Damages.

Table 21: Economic Impacts of Option FM01

Design Event (AEP)	Number of Properties No Longer Flooded Over Ground	Number of Properties No Longer Flooded Over Floor	Reduction in Event Damages
PMF	0[2]	0[2]	+$3,000[1]
0.2%	1	0	$187,000
0.5%	0	1	$153,000
1%	0	1	$118,000
2%	3	0	$272,000
5%	1	4	$318,000
10%	1	4	$138,000
20%	10	2	$146,000
Average Annual Damages Reduction			$143,000

[1]These numbers represent an increase with the implementation of Option FM01

[2]Note, pipes are modelled fully blocked in the PMF event

Cost Estimate

A preliminary cost estimate for Option FM01 estimated that this measure would cost $4.5 million. Further cost estimate details area presented in Appendix C. This cost estimate is indicative only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment.

Benefit / Cost Ratio Analysis

This option's reduction in Average Annual Damages, the Net Present Value (NPV) of this reduction (assuming 30 year design life and 5% discount rate) and the benefit-cost ratio are as follows:

- Average Annual Damage reduction: $143,000
- NPV of reduction: $2,098,000
- Cost estimate of option: $4,461,000
- Benefit-Cost Ratio: 0.47

The benefit-cost ratio is 0.47, which means the cost of Option FM01 outweighs the economic benefit and as such, this measure cannot be justified on economic grounds alone.

Social and Environmental Impacts

The proposed works are not expected to have significant adverse environmental impacts.

The reduction in risk to life provides intangible benefits including reduced disruption, social stresses, trauma and impacts on emergency personnel and health care facilities.

Community Acceptance

This measure was assessed after residents raised it in the Community questionnaire (see Section 4). It is likely that the general community may be less accepting once the economic impacts are understood.

Recommendation: Option FM01 is recommended as a long term measure in the Floodplain Risk management Plan due to the reductions in peak flood levels achieved along the trunk alignment.

7.3.3.2 Davidson Avenue Drainage Upgrade (Option FM02)

Option Overview

Option FM02 worked to address the flood liability along Davidson Avenue (Hotspot 4, see Section 6.2.4) by implementing large-scale stormwater upgrades along Davidson Avenue at Flavelle Street and extending to Saltwater Creek. This measure aimed to reduce nuisance flooding on the roadway in frequent flood events and property inundation in the locality in rare flood events.

This mitigation measure involved doubling the pipe capacity along Davidson Avenue and extending to Saltwater Creek, as well as increasing the pit capacity to capture additional overland flow.

Impact on Flood Liability

Figure 24 presents the 20% AEP and 1% AEP event flood level impacts for the implementation of Option FM02. In the 20% AEP event, peak flood levels reductions typically in the order of 0.05 m to 0.01 m occur along Davidson Avenue from Central Park extending down to Edwards Park. Peak flood

level increases, largely less than 0.03 m, occur in Saltwater Creek and Massey Park Golf Course. In the 1% AEP event, peak flood level reductions were found to be more significant and widespread as flood water is able to move downstream more efficiently. Peak flood level reductions of up to 0.04 m along Davidson Avenue occur in the 1% AEP event with a 2.4 m^3/s increase in pipe flow (87% increase).

Table 22 presents the changes in pipe flow and overland flow along Davidson Avenue, downstream of Flavelle Street. Of note is the decrease in overland flow that occurs in Davidson Avenue due to the increased pipe capacity.

Table 22: Comparison of flows on Davidson Avenue with Option FM02

		20% AEP	1% AEP
Existing Case	Pipe Flow (m^3/s)	2.4	2.4
	Overland Flow (m^3/s)	3.9	12.1
	Total Flow	6.3	14.5
Option FM02	Pipe Flow (m^3/s)	4.8	4.8
	Overland Flow (m^3/s)	1.5	9.9
	Total Flow	6.3	14.7

Option FM02 was simulated for a range of flood events with the results presented in Table 23 below. The table shows that this measure provides from benefit for floods in the 20% to 0.2% AEP range, with a $321,000 reduction in damages.

Table 23: Economic Impacts of Option FM02

Design Event (AEP)	Number of Properties No Longer Flooded Over Ground	Number of Properties No Longer Flooded Over Floor	Reduction in Event Damages
PMF	0[2]	0[2]	+$3,000[1]
0.2%	5	5	$681,000
0.5%	5	1	$504,000
1%	4	3	$376,000
2%	14	3	$536,000
5%	12	7	$421,000
10%	19	3	$339,000
20%	19	6	$433,000
		Average Annual Damages Reduction	$321,000

[1]These numbers represent an increase with the implementation of Option FM02
[2]Note, pipes are modelled fully blocked in the PMF event

Cost Estimate

A preliminary cost estimate for Option FM02 estimated that this measure would cost $6.8 million. Further cost estimate details area presented in Appendix C. This cost estimate is indicative only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment.

Benefit / Cost Ratio Analysis

This option's reduction in Average Annual Damages, the Net Present Value (NPV) of this reduction (assuming 30 year design life and 5% discount rate) and the benefit-cost ratio are as follows:

- Average Annual Damage reduction: $321,000
- NPV of reduction: $4,705,000
- Cost estimate of option: $6,791,000
- Benefit-Cost Ratio: 0.69

The benefit-cost ratio is 0.69, which means the cost of Option FM02 outweighs the economic benefit and as such, this measure cannot be justified on economic grounds alone.

Social and Environmental Impacts

The proposed works are not expected to have significant adverse environmental impacts.

The reduction in risk to life provides intangible benefits including reduced disruption, social stresses, trauma and impacts on emergency personnel and health care facilities.

Community Acceptance

This measure was assessed after residents raised it in the Community questionnaire (see Section 4). Given the widespread benefit and minimal negative impact, it is likely that the general community would be supportive of this measure. Support may decline once the economic impact is understood along with the disruption caused to residents during the construction phase.

Recommendation: Option FM02 is recommended as a long term measure in the Floodplain Risk management Plan due to the reductions in peak flood levels achieved along Davidson Avenue, Brewer Street and Edwards Park.

7.3.3.3 Beaconsfield Lane Drainage Upgrade (Option FM03)

Option Overview

Feedback from the Community Consultation indicated that overland flow from Beaconsfield Lane, at the northern end of Rothwell Park was causing inundation of the roadway and residents yards. As such, Option FM03 investigated doubling the drainage capacity and increasing the pit capacity along this laneway.

Impact on Flood Liability

Figure 25 presents the 20% and 1% AEP peak flood level impacts of the implementation of this measure. Of note, is the negligible change to peak flood levels in both flood magnitudes. This is likely because the stormwater system downstream is full and, as such, the additional drainage capacity cannot be optimised.

Recommendation: Option FM03 is not recommended as a measure in the Floodplain Risk management Plan due to the negligible changes to peak flood levels and likely costly construction.

7.3.3.4 Clearing of debris along main flowpaths (Option FM04)

Debris management may provide limited localised benefits for flood affectation. Widespread removal of stormwater debris or vegetation is not feasible or cost effective, and will result in significant detrimental impacts to the riparian corridor. Feedback from the community consultation indicated that debris along flow paths and blockage of stormwater pits was exacerbating flooding. A level of blockage of stormwater pits is expected during significant rainfall events however excessive blockage can be problematic. As such, a debris management program can be implemented after significant rainfall events to ensure that flow paths and stormwater drains are optimised. Key flow paths and stormwater pits susceptible to blockage can be identified and prioritised for maintenance.

Council is however known to maintain these assets to a high standard and even if perfectly maintained, the inadequate capacity of such assets (by design) to address all floods, means that maintenance is not the solution it is sometimes perceived to be by the community.

Recommendation: Council is recommended to better document and communicate their current debris management program that aims to remove vegetation and debris along key flowpaths and large inlet pits after significant rainfall events.

7.3.3.5 Coles Street Drainage Upgrade (Option FM06)

Option Overview

Option FM06 aimed to ease the level of flood inundation experienced between Ada Street and John Street in the upper catchment (Hotspot 1, see Section 6.2.1) by implementing a secondary stormwater system. This approach sought to collect additional overland flow from the topographic low points on Coles Street and Melbourne Street via a new stormwater system. This system followed the street alignment to Alexandra Street and John Street where it connected back into the existing stormwater network. This measure was suggested during the flood study and flooding issues in the area were raised during the Community Consultation.

Impact on Flood Liability

Figure 26 presents the 20% and 1% AEP peak flood level impacts for the implementation of the Coles Street Drainage Upgrade. In the 20% AEP event peak flood level decreases of up to 0.04 m and typically in the order of 0.02 m occur between Coles Street and John Street. In the 1% AEP event reductions of 0.01 m occur in the vicinity. The secondary stormwater system takes approximately 0.5 m^3/s from Coles Street and Melbourne Street in the 20% AEP event and 0.6 m^3/s in the 1% AEP event.

Option FM06 was simulated for a range of flood events with results presented in Table 25 below. An Annual Average Damages reduction of $66,000 is achieved with the implementation of Option FM06 with two properties no longer flooded over floor level in the 20% AEP event.

Table 24: Economic Impacts of Option FM06

Design Event (AEP)	Number of Properties No Longer Flooded Over Ground	Number of Properties No Longer Flooded Over Floor	Reduction in Event Damages
PMF	0[2]	0[2]	+$3,000[1]
0.2%	0	0	$47,000
0.5%	0	0	$68,000
1%	1	0	$129,000
2%	2	0	$6,000
5%	2	1	$92,000
10%	1	-1[1]	$66,000
20%	0	2	$113,000
		Average Annual Damages Reduction	$66,000

[1]These numbers represent an increase with the implementation of Option FM06
[2]Note, pipes are modelled fully blocked in the PMF event

Cost Estimate

A preliminary cost estimate for Option FM06 estimated that this measure would cost $2.2 million. Further cost estimate details area presented in Appendix C. This cost estimate is indicative only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment.

Benefit / Cost Ratio Analysis

This option's reduction in Average Annual Damages, the Net Present Value (NPV) of this reduction (assuming 30 year design life and 5% discount rate) and the benefit-cost ratio are as follows:

- Average Annual Damage reduction: $66,000
- NPV of reduction: $971,000
- Cost estimate of option: $2,252,000
- Benefit-Cost Ratio: 0.43

The benefit-cost ratio is 0.43, which means the cost of Option FM06 outweighs the economic benefit and as such, this measure cannot be justified on economic grounds alone.

Constraints

To obtain the grade required to implement Option FM06, the stormwater system will need to be very deep below the road surface (up to 4 metres below ground at points). This depth of this system will pose significant construction and maintenance constraints.

Social and Environmental Impacts

The proposed works are not expected to have significant adverse environmental impacts.

The reduction in risk to life provides intangible benefits including reduced disruption, social stresses, trauma and impacts on emergency personnel and health care facilities.

Community Acceptance

This measure was assessed after residents raised it in the Community questionnaire (see Section 4). It is likely that the general community would be supportive of this measure, given the benefit to residents in the vicinity. The economic cost of construction and disruption caused by the construction may affect the community acceptance of the upgrade.

Recommendation: Option FM06 is recommended as a long term measure in the Floodplain Risk management Plan due to the reductions in peak flood levels achieved along Coles Street, Melbourne Street and John Street.

7.3.3.6 Queen Elizabeth Park Drainage Upgrade (Option FM07)

Option Overview

During the Community Consultation (see Section 4) residents noted that flooding had occurred along Queen Elizabeth Park and the adjacent roadways to the north causing traffic issues. Given this, analysis was undertaken whereby the pipe capacity along Queen Elizabeth Park was doubled through to Rothwell Park as well as increasing the pit capacity through this area to capture additional overland flow.

Impact on Flood Liability

Figure 27 presents the 20% and 1% AEP peak flood level impacts for the implementation of the Queen Elizabeth Park Drainage Upgrade. In the 20% AEP event peak flood levels reductions predominantly occur along Rothwell Park and extend to Jesse Stewart Reserve. Reductions of up to 0.06 m occur at the properties adjacent to Rothwell Park. In the 1% AEP event, peak flood level reductions are less widespread with decreases of up to 0.03 m at the properties adjacent to Rothwell Park.

Option FM07 was simulated for a range of flood events with results presented in Table 26 below. This table shows modest reductions in damages for events between the 10% AEP and the 0.2% AEP with an Average Annual Damages reduction of $37,000.

Table 25: Economic Impacts of Option FM07

Design Event (AEP)	Number of Properties No Longer Flooded Over Ground	Number of Properties No Longer Flooded Over Floor	Reduction in Event Damages
PMF	0	0	+$3,000[1]
0.2%	0	0	$6,000
0.5%	2	0	$1,000
1%	1	0	$6,000
2%	1	0	$18,000
5%	1	0	$1,000
10%	0	0	$3,000
20%	0	0	$0
		Average Annual Damages Reduction	$37,000

[1]These numbers represent an increase with the implementation of Option FM07

Cost Estimate

A preliminary cost estimate for Option FM07 estimated that this measure would cost $2.5 million. Further cost estimate details area presented in Appendix C. This cost estimate is indicative only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment.

Benefit / Cost Ratio Analysis

This option's reduction in Average Annual Damages, the Net Present Value (NPV) of this reduction (assuming 30 year design life and 5% discount rate) and the benefit-cost ratio are as follows:

- Average Annual Damage reduction: $37,000
- NPV of reduction: $549,000
- Cost estimate of option: $2,453,000
- Benefit-Cost Ratio: 0.22

The benefit-cost ratio is 0.22, which means the cost of Option FM07 far outweighs the economic benefit and as such, this measure cannot be justified on economic grounds alone.

Social and Environmental Impacts

The proposed works are not expected to have significant adverse environmental impacts.

The reduction in risk to life provides intangible benefits including reduced disruption, social stresses, trauma and impacts on emergency personnel and health care facilities.

Community Acceptance

This measure was assessed after residents raised it in the Community questionnaire (see Section 4). Given the benefit and minimal negative impact, it is likely that the general community would be supportive of this measure. Support may decline once the economic impact is understood along with the disruption to traffic, pedestrians and park users during the construction phase.

Recommendation: Option FM07 is recommended as a long term measure in the Floodplain Risk management Plan due to the reductions in peak flood levels achieved along Rothwell Park.

7.3.3.7 Shackel Avenue Drainage Upgrade (Option FM08)

Option Overview

Option FM08 aimed to capture overland flow from the eastern end of Shackel Avenue by extending the existing stormwater network at Cormiston Avenue. Flooding issues in this area was reported by respondents to the community questionnaire (see Section 4). The nature of flooding at this location is typically widespread, shallow flow and as such, very large pits (in the order of 10 m wide) were required on either side of the roadway to capture the dispersed flow on the roadway.

Impact on Flood Liability

Peak flood level impacts for the 20% and 1% AEP events are shown in Figure 28. In the 20% AEP event, the proposed stormwater extension captures 0.27 m^3/s of flow which results in a flood level

decrease of up to 0.04 m at downstream properties on Cormiston Avenue and Majors Bay Road. In the 1% AEP, 0.33m^3/s is captured in the proposed stormwater network and peak flood level reductions of up to 0.02 m occur at the downstream properties.

This measure was simulated for a range of flood events with results presented Table 26 below. The table generally shows that Option FM08 is beneficial across all flood events with a modest reduction in Annual Average Damages of $19,000.

Table 26: Economic Impacts of Option FM08

Design Event (AEP)	Number of Properties No Longer Flooded Over Ground	Number of Properties No Longer Flooded Over Floor	Reduction in Event Damages
PMF	0[2]	0[2]	$0
0.2%	1	0	$4,000
0.5%	1	0	+$1,000[1]
1%	0	0	$139,000
2%	3	1	$24,000
5%	2	2	$45,000
10%	3	2	$45,000
20%	4	0	$14,000
		Average Annual Damages Reduction	$19,000

[1]These numbers represent an increase with the implementation of Option FM08
[2]Note, pipes are modelled fully blocked in the PMF event

Cost Estimate

A preliminary cost estimate for Option FM08 estimated that this measure would cost $391,000. Further cost estimate details area presented in Appendix C. This cost estimate is indicative only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment.

Benefit / Cost Ratio Analysis

This option's reduction in Average Annual Damages, the Net Present Value (NPV) of this reduction (assuming 30 year design life and 5% discount rate) and the benefit-cost ratio are as follows:

- Average Annual Damage reduction: $19,000
- NPV of reduction: $277,000
- Cost estimate of option: $391,000
- Benefit-Cost Ratio: 0.71

The benefit-cost ratio is 0.71, which means the cost of Option FM08 outweighs the economic benefit and as such, on economic grounds, this measure cannot be justified.

Constraints

A key constraint pertaining to the design and implementation of Option FM08 is the shallow, dispersed and relatively high velocity (~1m/s in the 20% AEP) of flood water moving along Shackel Avenue. To capture flow of this nature, large pits are required leading to considerable economic and logistical impacts.

Social and Environmental Impacts

The proposed works are not expected to have significant adverse environmental impacts.

The reduction in risk to life provides intangible benefits including reduced disruption, social stresses, trauma and impacts on emergency personnel and health care facilities.

Community Acceptance

This measure was assessed after residents raised it in the Community questionnaire (see Section 4). Since, Option FM08 has a benefit to properties along Cormiston Avenue and Majors Bay Road and minimal negative impact, it is likely that the general community would be supportive of this measure. Support may decline once the economic impact is understood along with the disruption to traffic, residents and pedestrians during the construction phase.

Recommendation: Option FM08 is recommended as a long term measure in the Floodplain Risk management Plan due to the reductions in peak flood levels achieved along Cormiston Avenue and Majors Bay Road.

7.3.3.8 Catchment Wide Trunk Drainage Upgrade (Option FM09)

Option Overview

An investigation was undertaken to determine the flood impact of a catchment wide trunk drainage upgrade. This strategy (Option FM09) involved tripling the existing trunk drainage capacity along the Central Drain and the Main South Drain (see Figure 1) and increasing the pit capacity along these drainage lines. While this upgrade would involve significant cost and disruption to the catchment, the impact of such extreme scenarios can inform future decisions and expectations pertaining to flood mitigation.

Impact on Flood Liability

Figure 29 presents the 20% AEP and 1% AEP peak flood level impact of Option FM09 where the capacity of the trunk drainage lines were tripled. Along Davidson Avenue, peak flood levels are typically decreased by approximately 0.05 m and up to 0.25 m in the 20% AEP event. In the 1% AEP event, peak flood level reductions along Davidson Avenue were generally around 0.05 m and up to 0.07 m. In Edwards Park and Greenlees Park, peak flood levels are reduced by 0.19 m and 0.12 m respectively in the 20% AEP event and 0.17 m and 0.21 m respectively in the 1% AEP event. Peak flood level increases of less than 0.1 m occur on Massey Park Golf Course, along Saltwater Creek and at properties adjacent to the creek channel.

Table 27 presents the change in peak flows in the 20% and 1% AEP events along the Central Drain and the Main South Drain. Of note is the significant reduction in peak flows with an average overland flow decrease of 76% in the 20% AEP event and 48% in the 1% AEP event at the reported locations.

Table 27: Comparison of overland flows along main drainage lines with Option FM09

	Location	Flow (m^3/s)			
		20% AEP		1% AEP	
		Existing Case	Option FM09	Existing Case	Option FM09
Central Drain	Upstream of Trafalgar Parade	3.9	0.8	12.1	7.8
	Brewer Street Downstream of Majors Bay Road	3.9	1.7	14.2	8.8
	Edwards Park	3.4	0.6	11.7	7.6
Main South Drain	Melbourne Street	1.4	0.4	7.2	4.7
	Queen Elizabeth Park	3.7	0.7	13.3	7.6
	Downstream of Rothwell Park	2.3	0.1	11.4	4.0
	Greenlees Park	1.6	0.5	10.1	1.7
Average Percentage Change		-76%		-48%	

This option would benefit road access since the depth of inundation of key routes would be reduced. Several flood affected properties would also benefit from the reduction in flood levels. If this option is adopted, further refinements can be made to the alignment of the proposed trunk upgrade and pit locations.

Table 28 presents the economic impacts of Option FM09 for a range of flood events. With the implementation of this measure, many properties are no longer flooded above floor level and ground level across the range of flood events and the Annual Average Damages is reduced by $700,000.

Table 28: Economic Impacts of Option FM09

Design Event (AEP)	Number of Properties No Longer Flooded Over Ground	Number of Properties No Longer Flooded Over Floor	Reduction in Event Damages
PMF	0[2]	0[2]	+$3,000[1]
0.2%	15	14	$2,081,000
0.5%	20	7	$1,854,000
1%	28	9	$1,605,000
2%	35	14	$1,625,000
5%	33	14	$1,286,000
10%	30	11	$1,111,000
20%	25	10	$866,000
Average Annual Damages Reduction			$700,000

[1]These numbers represent an increase with the implementation of Option FM09
[2]Note, pipes are modelled fully blocked in the PMF event

Cost Estimate

A preliminary cost estimate for Option FM09 estimated that this measure would cost over $650 million. Further cost estimate details area presented in Appendix C. This cost estimate is indicative

only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment.

Benefit / Cost Ratio Analysis

This option's reduction in Average Annual Damages, the Net Present Value (NPV) of this reduction (assuming 30 year design life and 5% discount rate) and the benefit-cost ratio are as follows:

- Average Annual Damage reduction: $700,000
- NPV of reduction: $10,245,000
- Cost estimate of option: $655,000,000
- Benefit-Cost Ratio: 0.02

The benefit-cost ratio is 0.02, which means the cost of Option FM09 is fifty times more than its expected benefit, and it cannot be justified on economic grounds.

Constraints

While there are significant benefits associated with the implementation of Option FM09, this The option has technical and administrative constraints that would need to be addressed in the planning stages. Key constraints of implementing Option FM09 include:

- Cost of construction;
- Mitigating peak flood level increases at properties in downstream areas;
- Disruption caused by construction to residents, pedestrians and traffic; and
- Design and construction of sections of drainage in urbanised areas would likely encounter significant issues relating to the high density of underground utilities in the area.

Social and Environmental Impacts

An environmental impact assessment would likely be required while scoping these proposed works given the significant upgrades over a large area.

The reduction in risk to life provides intangible benefits including reduced disruption, social stresses, trauma and impacts on emergency personnel and health care facilities.

Community Acceptance

Implementation of Option FM09 is likely to be met with mixed support from the community. It is expected that given the large economic cost and disruption to the community of such a measure, the general community would not support Option FM09's implementation.

Recommendation: Option FM09 is not recommended as a strategy in the Floodplain Risk management Plan due to various feasibility constraints.

7.3.3.9 Formalised overland flow path between Central Park and Davidson Avenue (Option FM11)

Option Overview

In the upper reaches of the Central Drain, several overland flow paths meet upstream of Central Park and move through neighbouring properties on Curtin Place and Davidson Avenue before flowing onto the roadway. This flood mechanism, known as Hotspot 3 (see Section 6.2.3), causes inundation for residents in the vicinity and as such the Flood Study suggested collecting overland flow in Central Park and channelling the flow through a pedestrian footpath to Davidson Avenue. A 0.3 m berm along the eastern boundary of Central Park was used to collect overland flow and the pedestrian footpath was lowered by 0.06 m on average to convey floodwaters to Davidson Avenue.

Impact on Flood Liability

Peak flood level impacts for the 20% and 1% AEP events are shown in Figure 30 for the implementation of Option FM11. In the 20% AEP event, peak flood levels are decreased at properties in Curtin Place and Davidson Avenue by up to 0.02 m and there are increases at two properties upstream of up to 0.06 m. Similarly in the 1% AEP event, downstream properties experience flood level decreases of up to 0.02 m and properties upstream have flood level increases of up to 0.07 m.

Summary and Recommendations

The current study has investigated a similar mitigation measure recommended by Council in Option FM17 (see Section 7.3.3.12) whereby a series of cascading berms in Central Park capture overland flow. Option FM17 was found to have favourable peak flood level impacts compared to Option FM11. Given this, Option FM11 has not been recommended for inclusion in the Floodplain Risk Management Plan.

Recommendation: Option FM11 is not recommended as a strategy in the Floodplain Risk Management Plan as a similar measure has favourable peak flood level impacts.

7.3.3.10 Cascading berms in Goddard Park, Queen Elizabeth Park and Rothwell Park (Option FM14)

Option Overview

Option FM14 implemented a series of berms of varying heights in Goddard Park, Queen Elizabeth Park and Rothwell Park to attenuate flood flows and decrease peak flood levels along the Main South Drain. This measure was suggested by Council and aimed to use public land to address flooding issues over a large area with minimal disruption to the community.

This measure implemented eight berms (0.5 m to 0.7 m high) perpendicular to the flow direction in the parklands and three smaller berms (0.2 m high) to protect neighbouring properties (see Figure 31). This assessment has not incorporated a freeboard to the height these embankments however freeboard would be required during the design and construction of these structures.

Impact on Flood Liability

Figure 31 presents the 20% AEP and 1% AEP peak flood level impacts associated with the implementation of Option FM14. In the 20% AEP event, peak level decreases extend to the Exile Bay outlet. Typically these decreases are less than 0.05 m , with larger reductions of up to 0.10 m at the construction downstream of Rothwell Park (Hotspot 2, see Section 6.2.2). There are some peak flood level increases at properties adjacent to the berms (up to 0.1 m) which would require further assessment during the design stages for the berms. Peak flood level decreases in the 1% AEP event extend to the downstream outlet however they are less significant (typically less than 0.02 m decrease). This is to be expected as the berms are overtopped with the greater volume of runoff in rare events.

The option was simulated for a range of flood events with the results presented in Table 29 below. The table shows that the measure provides a benefit to overfloor flooring for a number of properties for a range of flood events leading to a reduction in Annual Average Damages of $102,000.

Table 29: Economic Impacts of Option FM14

Design Event (AEP)	Number of Properties No Longer Flooded Over Ground	Number of Properties No Longer Flooded Over Floor	Reduction in Event Damages
PMF	0	+2[1]	+$377,000[1]
0.2%	0	1	$104,000
0.5%	0	0	$1,000
1%	+1[1]	1	$15,000
2%	+1[1]	0	$59,000
5%	2	1	$191,000
10%	1	1	$127,000
20%	1	1	$105,000
		Average Annual Damages Reduction	$102,000

[1]These numbers represent an increase with the implementation of Option FM14

Cost Estimate

A preliminary cost estimate for Option FM14 estimated that this measure would cost $500,000. Further cost estimate details area presented in Appendix C. This cost estimate is indicative only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment.

Benefit / Cost Ratio Analysis

This option's reduction in Average Annual Damages, the Net Present Value (NPV) of this reduction (assuming 30 year design life and 5% discount rate) and the benefit-cost ratio are as follows:

- Average Annual Damage reduction: $102,000
- NPV of reduction: $990,000
- Cost estimate of option: $500,000
- Benefit-Cost Ratio: 1.98

The benefit-cost ratio is 1.98, which means the economic benefit of Option FM14 outweighs the cost by two times and as such, on economic grounds, this measure is justified for further investigation.

Social and Environmental Impacts

The proposed works are not expected to have significant adverse environmental impacts.

The reduction in risk to life provides intangible benefits including reduced disruption, social stresses, trauma and impacts on emergency personnel and health care facilities.

Community Acceptance

Provided that flood impacts on affected residents are properly assessed and mitigated during the design phase and the proposed berms do not affect the utility of the parks, it is likely that the general community would be supportive of this measure given the benefits.

Recommendation: Option FM14 is recommended as a measure for inclusion in the Floodplain Risk management Plan due to the reductions in peak flood levels particularly in frequent flood events.

7.3.3.11 Improve Conveyance along Davidson Avenue, Majors Bay Road and Brewer Street intersection (Option FM16)

Option Overview

The Flood Study noted that the kerbs, guttering and median strips at the intersection of Davidson Avenue, Majors Bay Road and Brewer Street were impeding the efficient movement of overland flow through the vicinity and exacerbating the flood affectation of Hotspot 5 (see Section 6.2.5). Furthermore, residents have noted that the slightly raised footpath at the Davidson Avenue and Majors Bay Road intersection causes floodwaters to pool and backwater to residential properties. Given this, Option FM16 aimed to reduce flood affectation by smoothing the topography through the intersection by works such as removal of low-lying bushes, lowering gutter heights and median strips.

Impact on Flood Liability

In the 20% AEP event, peak flood level decreases of up to 0.23 m occur on Majors Bay Road (see Figure 32) with a decrease of up to 0.1 7 m at properties in the vicinity. There are some increases to peak flood levels at the corner of Majors Bay Road and Brewer Street which would require further mitigation assessment during design stages. In the 1% AEP event, peak flood levels are reduced by up to 0.25 m at the corner of Davidson Avenue and Majors Bay Road (see Figure 32), as flow can move through the intersection more easily.

Option FM16 was simulated for the full range of flood events with results presented in Table 30 below. The table shows that this measure provides modest benefit across all flood events, excluding the PMF event where the flood damages increase slightly (0.01% increase relative to the total PMF damages). One property which was previously flooded above floor level in the 20% event is instead flooded above floor in the 10% AEP event.

Table 30: Economic Impacts of Option FM16

Design Event (AEP)	Number of Properties No Longer Flooded Over Ground	Number of Properties No Longer Flooded Over Floor	Reduction in Event Damages
PMF	0	0	+$13,000[1]
0.2%	0	1	$72,000
0.5%	2	1	$48,000
1%	+1[1]	1	$49,000
2%	0	0	$50,000
5%	0	0	$55,000
10%	1	+1[1]	$60,000
20%	0	1	$76,000
		Average Annual Damages Reduction	$53,000

[1]This number represents an increase with the implementation of Option FM16

Cost Estimate

A preliminary cost estimate for Option FM16 estimated that this measure would cost $505,000. Further cost estimate details area presented in Appendix C. This cost estimate is indicative only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment.

Benefit / Cost Ratio Analysis

This option's reduction in Average Annual Damages, the Net Present Value (NPV) of this reduction (assuming 30 year design life and 5% discount rate) and the benefit-cost ratio are as follows:

- Average Annual Damage reduction: $53,000
- NPV of reduction: $780,000
- Cost estimate of option: $505,000
- Benefit-Cost Ratio: 1.58

The benefit-cost ratio is 1.58, which means the economic benefit of Option FM16 outweighs the cost and as such, on economic grounds, this measure is justified for further investigation.

Constraints

The safety of frequent ponding behind berms would need to be considered as well as embankment failure during flood events.

Social and Environmental Impacts

The proposed works are not expected to have significant adverse environmental impacts.

The reduction in risk to life provides intangible benefits including reduced disruption, social stresses, trauma and impacts on emergency personnel and health care facilities.

Community Acceptance

Provided that flood impacts on affected residents are properly assessed and mitigated during the design phase, it is likely that the general community would be very supportive of this measure given the benefits.

Recommendation: Option FM16 is recommended as a measure for inclusion in the Floodplain Risk management Plan due to the reductions in peak flood levels particularly in frequent flood events.

7.3.3.12 Cascading berms in Central Park (Option FM17)

Option Overview

Option FM17 worked to reduce the flood affectation in the Davidson Avenue area (Hotspot 4, see Section 6.2.4) by implementing a series of berms of varying heights in Central Park to attenuate flood flows. This measure was suggested by Council and aimed to use public land to address flooding issues with minimal disruption to the community.

This measure implemented five berms (0.6 m high) perpendicular to the flow direction in the park framed by two berms parallel to flow (up to 1.3 m high, 0.5 m on average) to capture and retain flood waters (see Figure 33). This assessment has not incorporated a freeboard to the height these embankments however freeboard would be required during the design and construction of these structures.

Impact on Flood Liability

In the 20% AEP event, peak flood levels are reduced by up to 0.06 m along Davidson Avenue and Curtin Place with the implementation of Option FM17 (see Figure 33). Within the berms, peak flood levels are increased up 0.5 m. Further, peak flood level increases occur in the vicinity of Central Park with up to 0.06 m at properties which would require further mitigation assessment during design stages.

Peak flood level reductions of up to 0.12 m and typically 0.01 m occur in the 1% AEP event along Davidson Avenue and Curtin Place with the implementation of Option FM17 (see Figure 33). Peak flood levels increase to the height of the berms (0.6 m) and by up to 0.05 m at properties in the vicinity. These flood level increases are relatively minor and would require further mitigation if the design would progress.

This measure was modelled for a range of flood events with results presented in Table 31 below. The table shows that Option FM17 has significant benefit across the full range of flood events with 4 properties no longer experiencing above-floor flooding in the 1% AEP event and a corresponding reduction of around $441,000 in flood damages expected. A reduction in AAD of $343,000 is expected with the implementation of this measure.

Table 31: Economic Impacts of Option FM17

Design Event (AEP)	Number of Properties No Longer Flooded Over Ground	Number of Properties No Longer Flooded Over Floor	Reduction in Event Damages
PMF	0	1	$541,000
0.2%	4	2	$365,000
0.5%	6	1	$570,000
1%	3	4	$441,000
2%	10	5	$550,000
5%	9	5	$399,000
10%	12	2	$265,000
20%	15	6	$423,000
Average Annual Damages Reduction			$343,000

Cost Estimate

A preliminary cost estimate for Option FM17 estimated that this measure would cost $250,000. Further cost estimate details area presented in Appendix C. This cost estimate is indicative only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment.

Benefit / Cost Ratio Analysis

This option's reduction in Average Annual Damages, the Net Present Value (NPV) of this reduction (assuming 30 year design life and 5% discount rate) and the benefit-cost ratio are as follows:

- Average Annual Damage reduction: $343,000
- NPV of reduction: $5,018,000
- Cost estimate of option: $250,000
- Benefit-Cost Ratio: 20.07

The benefit-cost ratio is 20.07, which means the economic benefit of Option FM17 outweigh the cost by 20 times and as such, on economic grounds, this measure is justified for further investigation.

Constraints

The safety of frequent ponding behind berms would need to be considered as well as embankment failure during flood events.

Social and Environmental Impacts

The proposed works are not expected to have significant adverse environmental impacts.

The reduction in risk to life provides intangible benefits including reduced disruption, social stresses, trauma and impacts on emergency personnel and health care facilities.

Community Acceptance

Provided that flood impacts on affected residents are properly assessed and mitigated during the design phase and the proposed berms do not affect the utility of the park, it is likely that the general community would be supportive of this measure given the benefits.

Recommendation: Option FM17 is recommended as a measure for inclusion in the Floodplain Risk management Plan due to the reductions in peak flood levels particularly in frequent flood events.

7.3.3.13 Lowering Greenlees Avenue and Greenlees Park (FM19)

Option Overview

Inundation along the Main South Drain in the vicinity of Jessie Stewart Reserve (Hotspot 2, see Section 6.2.2) is exacerbated by several factors. Consultation with the community indicated that the slightly elevated level of the Greenlees Avenue roadway and Greenlees Park was causing floodwater to pond and worsen flooding for nearby residential properties. Given this, Option FM19 investigated lowering the level of the roadway and Greenlees Park by 0.1 m on average over a 0.6 hectare area and implementing a 0.6 m high embankment along the western side of Jesse Stewart Reserve to protect neighbouring properties from inundation (Figure 34 presents this configuration).

Impact on Flood Liability

Figure 34 presents the peak flood level impact in the 20% and 1% AEP events. In the 20% AEP event, peak flood levels are reduced by 0.02 m at neighbouring properties and up to 0.09 m in Greenlees Park. Peak flood levels downstream are increased by up to 0.04 m within Greenlees Park and on Ian Parade. Flood levels are reduced by up to 0.03 m in the 1% AEP event with notably no peak flood level increases downstream.

The option was simulated for a range of flood events with results presented in Error! Reference source not found. below. The table show that that Option FM19 provides minor benefits to the depth of flooding at individual properties as indicated by the reduction in event damage. Of note is the increase in event damages in the 0.5% AEP event which is due to decreases in affectation in the more common flood events. A reduction in AAD of $8,000 is expected with the implementation of this option.

Table 32: Economic Impacts of Option FM19

Design Event (AEP)	Number of Properties No Longer Flooded Over Ground	Number of Properties No Longer Flooded Over Floor	Reduction in Event Damages
PMF	0	0	$6,000
0.2%	0	0	$4,000
0.5%	0	0	+$12,000[1]
1%	0	0	$18,000
2%	0	0	$28,000
5%	0	0	$66,000
10%	1	0	$56,000
20%	0	0	$6,000
		Average Annual Damages Reduction	$8,000

[1]This number represents an increase with the implementation of Option FM19

Cost Estimate

A preliminary cost estimate for Option FM19 estimated that this measure would cost $970,000. Further cost estimate details area presented in Appendix C. This cost estimate is indicative only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment.

Benefit / Cost Ratio Analysis

This option's reduction in Average Annual Damages, the Net Present Value (NPV) of this reduction (assuming 30 year design life and 5% discount rate) and the benefit-cost ratio are as follows:

- Average Annual Damage reduction: $8,000
- NPV of reduction: $116,000
- Cost estimate of option: $970,000
- Benefit-Cost Ratio: 0.12

The benefit-cost ratio is 0.12, which means the cost of Option FM19 is over eight times more than its expected benefit, and it cannot be justified on economic grounds alone.

Social and Environmental Impacts

The proposed works are not expected to have significant adverse environmental impacts.

The reduction in risk to life provides intangible benefits including reduced disruption, social stresses, trauma and impacts on emergency personnel and health care facilities.

Community Acceptance

This measure was assessed after residents noted the flood liability of the area. Given the benefit and minimal negative impact, it is likely that the general community would be supportive of this measure. Support may slightly decline once the residents consider the disruption to traffic, pedestrians and park users during the construction phase.

Recommendation: Option FM19 is recommended as a long term measure in the Floodplain Risk management Plan due to the reductions in peak flood levels achieved in Jesse Stewart Reserve.

7.3.3.14 Lowering of Brewer Street near Pamela Place (FM18)

As an additional option to the shortlisted measures, the lowering of Brewer Street near Pamela Place was assessed. At the intersection, there is a gutter of around 2.3 mAHD on the north side of Brewer Street, a road crest of 2.63 mAHD on Brewer Street, and then lower levels to the south, into the park. The sag in Brewer Street and the higher road crest create a topographic low point where flooding has been observed. The area receives significant flow from the west which then discharges into the park. The option consists of lowering the road crest to 2.4 mAHD over a ~7 m width. The option was tested for the 20% AEP and 1% AEP. In the latter there was no significant change to flood levels as the park backwaters into the sag point. In the 20% AEP, there was 0.05 m reduction in flood level. While not insignificant, there is still around 0.4 m depth of runoff and the flooding issue would remain largely unchanged. The results indicate that the road crest is slightly exacerbating flooding but is not the dominant cause of flooding at the location. Measures that address the overland flow rates, i.e. FM02, have a similar reduction in flooding at the site. It is also noted that lowering the road would slightly increase road flooding at the location, and in certain floods, may lead to more flooding from the park.

Further investigation of the cost and feasibility of the option may demonstrate that it is viable. The main constraints with the option are 1) safe road grading must be maintained 2) limited effect on flood behaviour, if the road is lowered to 2.4 mAHD, 3) high cost (below ground services and other local features would affect cost) and 4) adverse impact in rare flood events, when there is increased flooding from the park backwatering. Residents in the area feel strongly that even a small benefit offered by the option would make it worthwhile. It is therefore recommended that Council further investigate the feasibility of the measure including drafting of potential road sections, with DBYD or survey of below ground services, to determine the maximum lowering possible, and quantifying the flood impact in the 20% AEP and a more common flood event (e.g. 50% AEP).

Recommendation: The cost and feasibility of the option is recommended to be investigated further.

7.3.4 Multi-Criteria Assessment

The assessment of various flood modification measures is presented in Table 33. The measures are evaluated against various criteria and are scored in order to compare their relative advantages and disadvantages.

This evaluation enables options to be prioritised and is a useful tool for decision-makers and other stakeholders. It should be noted that scoring and ranking is only used for an indicative comparison and is not intended to act as a final verdict on the options.

The results of the analysis are presented in Table 33. Each criteria corresponds to a column and has been scored between -3 (lowest score) and 3 (highest score).

Table 33: Multi-criteria Assessment

Ref.	Mitigation Measure	Impact on road flooding	Impact on property flooding	Impact on risk to life	Technical Feasibility	Community Acceptance	Economic Value	Environmental Impact	Total Score	Rank
FM01	Macnamara Avenue Drainage Upgrade	1	1	1	-1	1	-2	-1	0	8
FM02	Davidson Avenue Drainage Upgrade (benefit extends to Brewer Street)	1	2	1	-1	1	-2	-1	1	5
FM04	Clearing of debris along main flowpaths	1	1	1	-1	2	0	1	5	2
FM06	Coles Street Drainage Upgrade	1	1	1	-3	1	-2	-1	-2	9
FM07	Queen Elizabeth Park Drainage Upgrade	1	1	1	-1	1	-3	-1	-1	10
FM08	Shackel Avenue Drainage Upgrade	1	1	1	-1	1	-2	-1	0	8
FM14	Cascading berms in Goddard Park, Queen Elizabeth and Rothwell Park	1	1	-1	-1	1	2	-1	2	4
FM16	Improve Conveyance along Davidson Avenue, Majors Bay Road and Brewer Street Intersection	1	1	1	1	3	2	-1	8	1
FM17	Cascading Berms in Central Park	2	2	-2	-1	1	3	-1	4	3
FM18	Lowering of Brewer Street near Pamela Place	-1	1	0	1	1	-1	0	1	5
FM19	Lowering Greenlees Avenue and Greenlees Park	1	1	1	1	1	-3	-1	1	5

The total score is highest for Option FM16 which has benefits across the range of criteria excluding environmental factors as this measure will require clearing of low-lying vegetation. The lowest scoring measure was found to be Option FM09 which provides significant benefits to flood affection however is extremely expensive to implement, technically not feasible and will have significant environmental impacts.

8. FLOODPLAIN RISK MANAGEMENT PLAN

8.1 Plan Objectives

The objective of a Floodplain Risk Management Plan is to manage existing and future flood risk the Exile Bay Catchment with the NSW FRMM (2023).

The Plan aims to achieve the following overarching objectives:

- Reduce the flood hazard and risk to people and property, now and in the future;
- Protect, maintain and where possible enhance the floodplain environment; and
- Ensure floodplain risk management decisions integrate social, economic and environmental considerations.

8.2 Recommended Flood Management Measures

The flood management measures recommended for implementation are presented in Table 34. The measures have been prioritised with high, medium and low classifications as defined below:

- High – can be undertaken in the short term (<12 month) with minimal cost and/or have the potential to provide significant reductions in flood risk;
- Medium – can be undertaken in the medium term (1 to 5 years), require input from other studies or investigations, provide reductions in flood risk but could be expensive;
- Low – measures that are unlikely to be feasible to implement in the next 5 years or that are likely subject to significant financial constraints.

Responsibility for implementation and cost estimates are also presented, along with the relevant section of this report which provides details of each option.

Table 34: Flood Risk Management Plan

Flood Management Measure	Section	Priority	Preliminary Estimates	Responsibility
Property Modification Measure				
Clarify use of Flood Risk Precincts in the DCP	7.1.2	Medium	Council cost estimate	Council
Voluntary Purchase	7.1.3	Medium	Council cost estimate	Council
Flood Proofing	7.1.5	Medium	-	Property Owners
Response Modification Measures				
Local Flood Plan	7.2.5	High	SES cost estimate	NSW SES
Flood Modification Measures				
FM01 - Macnamara Avenue Drainage Upgrade	7.3.3.1	Low	$4.5 million	Council
FM02 - Davidson Avenue Drainage Upgrade	7.3.3.2	Low	$6.8 million	Council
FM04 - Clearing of debris along main flowpaths	7.3.3.4	High	Council cost estimate	Council / Property Owners
FM06 - Coles Street Drainage Upgrade	7.3.3.5	Low	$2.2 million	Council
FM07 - Queen Elizabeth Park Drainage Upgrade	7.3.3.6	Low	$2.5 million	Council
FM08 - Shackel Avenue Drainage Upgrade	7.3.3.7	Low	$400,000	Council
FM14 - Cascading berms in Goddard Park, Queen Elizabeth Park and Rothwell Park	7.3.3.10	Medium	$500,000	Council
FM16 - Improve conveyance along Davidson Avenue, Majors Bay Road and Brewer Street Intersection	7.3.3.11	High	$500,000	Council
FM17 - Cascading berms in Central Park	7.3.3.12	Medium	$250,000	Council
FM19 - Lowering Greenlees Avenue and Greenlees Park	7.3.3.13	Low	$1 million	Council
FM18 - Investigate lowering of Brewer Street near Pamela Place	7.3.3.14	Medium	Council cost estimate	Council

REFERENCES

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3. City of Canada Bay, *Development Control Plan*, City of Canada Bay, August 2023

4. Howells L, McLuckie D, Collings G, Lawson N, *Defining the Floodway – Can one Size Fit All?*, Lawson and Treloar, 2003.

5. Municipality of Concord, *Stormwater Drainage capacity assessment within the Municipality of Concord*, E. S. Rowe & Ennie, July 1973

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7. Department of Planning and Environment – NSW Government, *Flood Risk Management Manual*, Department of Planning and Environment, February 2022.

8. Australian Construction Handbook, 2023, Rawlinsons Publishing.

FIGURES

APPENDIX A

Glossary of Key Terminology (Reference 6)

annual exceedance probability (AEP)	the chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. Eg, if a peak flood discharge of 500 m3/s has an AEP of 5%, it means that there is a 5% chance (that is one-in-20 chance) of a 500 m3/s or larger events occurring in any one year (see ARI). (see Table 35, Appendix A)
Australian Height Datum (AHD)	a common national surface level datum approximately corresponding to mean sea level.
average annual damage (AAD)	depending on its size (or severity), each flood will cause a different amount of flood damage to a flood prone area. AAD is the average damage per year that would occur in a nominated development situation from flooding over a very long period of time.
average recurrence interval (ARI)	the long-term average number of years between the occurrence of a flood as big as or larger than the selected event. For example, floods with a discharge as great as or greater than the 20 year ARI flood event will occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event.
catchment	the land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location.
consent authority	the council, government agency or person having the function to determine a development application for land use under the EP&A Act. The consent authority is most often the council, however legislation or an EPI may specify a Minister or public authority (other than a council), or the Director General of DIPNR, as having the function to determine an application.
development	is defined in Part 4 of the EP&A Act infill development: refers to the development of vacant blocks of land that are generally surrounded by developed properties and is permissible under the current zoning of the land. Conditions such as minimum floor levels may be imposed on infill development new development: refers to development of a completely different nature to that associated with the former land use. Eg, the urban subdivision of an area previously used for rural purposes. New developments involve re-zoning and typically require major extensions of existing urban services, such as roads, water supply, sewerage and electric power. redevelopment: refers to rebuilding in an area. Eg, as urban areas age, it may become necessary to demolish and reconstruct buildings on a

	relatively large scale. Redevelopment generally does not require either re-zoning or major extensions to urban services.
disaster plan (DISPLAN)	a step by step sequence of previously agreed roles, responsibilities, functions, actions and management arrangements for the conduct of a single or series of connected emergency operations, with the object of ensuring the coordinated response by all agencies having responsibilities and functions in emergencies.
discharge	the rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second (m3/s). Discharge is different from the speed or velocity of flow, which is a measure of how fast the water is moving for example, metres per second (m/s).
effective warning time	the time available after receiving advice of an impending flood and before the floodwaters prevent appropriate flood response actions being undertaken. The effective warning time is typically used to move farm equipment, move stock, raise furniture, evacuate people and transport their possessions.
emergency management	a range of measures to manage risks to communities and the environment. In the flood context it may include measures to prevent, prepare for, respond to and recover from flooding.
flash flooding	flooding which is sudden and unexpected. It is often caused by sudden local or nearby heavy rainfall. Often defined as flooding which peaks within six hours of the causative rain.
flood	relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage (refer Section C6) before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.
flood awareness	Awareness is an appreciation of the likely effects of flooding and a knowledge of the relevant flood warning, response and evacuation procedures.
flood education	flood education seeks to provide information to raise awareness of the flood problem so as to enable individuals to understand how to manage themselves and their property in response to flood warnings and in a flood event. It invokes a state of flood readiness.
flood fringe areas	the remaining area of flood prone land after floodway and flood storage areas have been defined.
flood liable land	is synonymous with flood prone land (ie) land susceptible to flooding by the PMF event. Note that the term flood liable land covers the whole floodplain, not just that part below the FPL (see flood planning area).

flood mitigation standard	the average recurrence interval of the flood, selected as part of the floodplain risk management process that forms the basis for physical works to modify the impacts of flooding.
floodplain	area of land which is subject to inundation by floods up to and including the probable maximum flood event, that is, flood prone land.
floodplain risk management options	the measures that might be feasible for the management of a particular area of the floodplain. Preparation of a floodplain risk management plan requires a detailed evaluation of floodplain risk management options.
floodplain risk management plan	a management plan developed in accordance with the principles and guidelines in this manual. Usually includes both written and diagrammatic information describing how particular areas of flood prone land are to be used and managed to achieve defined objectives.
flood plan (local)	A sub-plan of a disaster plan that deals specifically with flooding. They can exist at state, division and local levels. Local flood plans are prepared under the leadership of the SES.
flood planning area	the area of land below the FPL and thus subject to flood related development controls. The concept of flood planning area generally supersedes the "flood liable land" concept in the 1986 Manual.
flood planning levels (FPLs)	are the combinations of flood levels (derived from significant historical flood events or floods of specific AEPs) and freeboards selected for floodplain risk management purposes, as determined in management studies and incorporated in management plans. FPLs supersede the "standard flood event" in the 1986 manual.
flood proofing	a combination of measures incorporated in the design, construction and alteration of individual buildings or structures subject to flooding, to reduce or eliminate flood damages.
flood prone land	land susceptible to flooding by the PMF event. Flood prone land is synonymous with flood liable land.
flood readiness	Readiness is an ability to react within the effective warning time.
flood risk	potential danger to personal safety and potential damage to property resulting from flooding. The degree of risk varies with circumstances across the full range of floods. Flood risk in this manual is divided into 3 types, existing, future and continuing risks. They are described below: existing flood risk: the risk a community is exposed to as a result of its location on the floodplain. future flood risk: the risk a community may be exposed to as a result of new development on the floodplain. continuing flood risk: the risk a community is exposed to after floodplain risk management measures have been implemented. For a town

	protected by levees, the continuing flood risk is the consequences of the levees being overtopped. For an area without any floodplain risk management measures, the continuing flood risk is simply the existence of its flood exposure.
flood storage areas	those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood. The extent and behaviour of flood storage areas may change with flood severity, and loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation. Hence, it is necessary to investigate a range of flood sizes before defining flood storage areas.
floodway areas	those areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood levels.
freeboard	provides reasonable certainty that the risk exposure selected in deciding on a particular flood chosen as the basis for the FPL is actually provided. It is a factor of safety typically used in relation to the setting of floor levels, levee crest levels, etc. (See Section K5). Freeboard is included in the flood planning level.
habitable room	in a residential situation: a living or working area, such as a lounge room, dining room, rumpus room, kitchen, bedroom or workroom. in an industrial or commercial situation: an area used for offices or to store valuable possessions susceptible to flood damage in the event of a flood.
hazard	a source of potential harm or a situation with a potential to cause loss. In relation to this manual the hazard is flooding which has the potential to cause damage to the community.
hydraulics	term given to the study of water flow in waterways; in particular, the evaluation of flow parameters such as water level and velocity.
hydrograph	a graph which shows how the discharge or stage/flood level at any particular location varies with time during a flood.
hydrology	term given to the study of the rainfall and runoff process; in particular, the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of floods.
local overland flooding	inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam.
local drainage	smaller scale problems in urban areas. They are outside the definition of major drainage in this glossary.

mainstream flooding	inundation of normally dry land occurring when water overflows the natural or artificial banks of a stream, river, estuary, lake or dam.
major drainage	councils have discretion in determining whether urban drainage problems are associated with major or local drainage. For the purposes of this manual major drainage involves: • the floodplains of original watercourses (which may now be piped, channelised or diverted), or sloping areas where overland flows develop along alternative paths once system capacity is exceeded; and/or • water depths generally in excess of 0.3m (in the major system design storm as defined in the current version of Australian Rainfall and Runoff). These conditions may result in danger to personal safety and property damage to both premises and vehicles; and/or • major overland flowpaths through developed areas outside of defined drainage reserves; and/or • the potential to affect a number of buildings along the major flow path.
mathematical/computer models	the mathematical representation of the physical processes involved in runoff generation and stream flow. These models are often run on computers due to the complexity of the mathematical relationships between runoff, stream flow and the distribution of flows across the floodplain.
merit approach	the merit approach weighs social, economic, ecological and cultural impacts of land use options for different flood prone areas together with flood damage, hazard and behaviour implications, and environmental protection and well being of the State's rivers and floodplains. The merit approach operates at two levels. At the strategic level it allows for the consideration of social, economic, ecological, cultural and flooding issues to determine strategies for the management of future flood risk which are formulated into council plans, policy, and EPIs. At a site specific level, it involves consideration of the best way of conditioning development allowable under the floodplain risk management plan, local flood risk management policy and EPIs.
minor, moderate and major flooding	both the SES and the BoM use the following definitions in flood warnings to give a general indication of the types of problems expected with a flood: minor flooding: causes inconvenience such as closing of minor roads and the submergence of low level bridges. The lower limit of this class of flooding on the reference gauge is the initial flood level at which landholders and townspeople begin to be flooded. moderate flooding: low-lying areas are inundated requiring removal of stock and/or evacuation of some houses. Main traffic routes may be covered.

	major flooding: appreciable urban areas are flooded and/or extensive rural areas are flooded. Properties, villages and towns can be isolated.
modification measures	measures that modify either the flood, the property or the response to flooding.
peak discharge	the maximum discharge occurring during a flood event.
probable maximum flood	the PMF is the largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation, and where applicable, snow melt, coupled with the worst flood producing catchment conditions. Generally, it is not physically or economically possible to provide complete protection against this event. The PMF defines the extent of flood prone land, that is, the floodplain. The extent, nature and potential consequences of flooding associated with a range of events rarer than the flood used for designing mitigation works and controlling development, up to and including the PMF event should be addressed in a floodplain risk management study.
probable maximum precipitation	the PMP is the greatest depth of precipitation for a given duration meteorologically possible over a given size storm area at a particular location at a particular time of the year, with no allowance made for long-term climatic trends (World Meteorological Organisation, 1986). It is the primary input to PMF estimation.
probability	a statistical measure of the expected chance of flooding (see AEP).
risk	chance of something happening that will have an impact. It is measured in terms of consequences and likelihood. In the context of the manual it is the likelihood of consequences arising from the interaction of floods, communities and the environment.
runoff	the amount of rainfall which actually ends up as streamflow, also known as rainfall excess.
stage	equivalent to water level (both measured with reference to a specified datum).
stage hydrograph	a graph that shows how the water level at a particular location changes with time during a flood. It must be referenced to a particular datum.
survey plan	a plan prepared by a registered surveyor.
water surface profile	a graph showing the flood stage at any given location along a watercourse at a particular time.

Table 35: ARR 2016 Preferred Terminology (Reference 2)

Frequency Descriptor	EY	AEP (%)	AEP (1 in x)	ARI
Very Frequent	12			
	6	99.75	1.002	0.17
	4	98.17	1.02	0.25
	3	95.02	1.05	0.33
	2	86.47	1.16	0.5
	1	63.21	1.58	1
Frequent	0.69	50	2	1.44
	0.5	39.35	2.54	2
	0.22	20	5	4.48
	0.2	18.13	5.52	5
	0.11	10	10	9.49
Rare	0.05	5	20	20
	0.02	2	50	50
	0.01	1	100	100
Very Rare	0.005	0.5	200	200
	0.002	0.2	500	500
	0.001	0.1	1000	1000
	0.0005	0.05	2000	2000
Extreme	0.0002	0.02	5000	5000
			↓	
			PMP/ PMPDF	

APPENDIX B

Community Consultation Newsletter and Questionnaire

Have Your Say on Flooding in Your Area
The Exile Bay Catchment Floodplain Risk Management Study and Plan

The Exile Bay Catchment Floodplain Risk Management Study & Plan

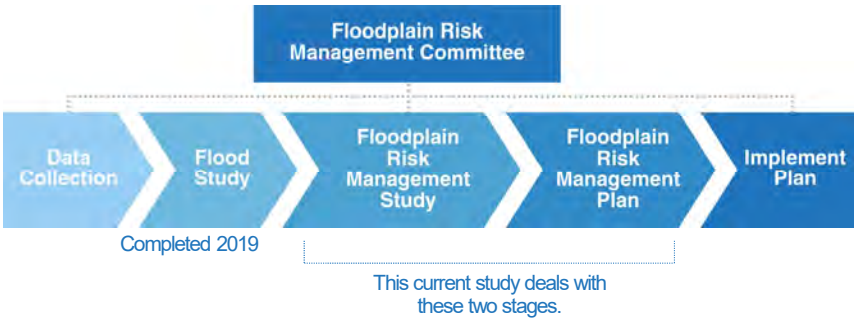
On behalf of City of Canada Bay, GRC Hydro are undertaking a Floodplain Risk Management Study & Plan Study in your area (the Exile Bay catchment). We would like to hear your experiences of flooding to better understand how flooding occurs in your area and what measures may improve the current flood situation.

This study and plan will identify and recommend appropriate actions to manage flooding in the Exile Bay catchment. This study will be used by Council to manage flood risks in your area.

What is the Floodplain Risk Management Program?

The Floodplain Risk Management Program, managed by the NSW Government, helps Councils make informed decisions about managing flood risk, implementing management plans to reduce flood risk and to provide essential information to the SES to deal with flood emergencies.

This program consists of five stages and the current study will undertake the third and fourth stages of this process; Floodplain Risk Management Study and Floodplain Risk Management Plan. This follows on from the flood study completed by Council in 2019. You can review the adopted flood study here: collaborate.canadabay.nsw.gov.au/exilebayfloodstudy

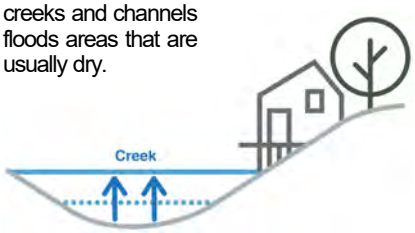


What is Flooding?

Flooding is often associated with inundation from large rivers; however, there are other flood mechanisms that can cause inundation. Your area is primarily affected by two types of flooding; overland flow flooding and mainstream flooding.

Overland flow flooding occurs when rainfall flows toward creeks and channels.

Mainstream flooding occurs when large volumes of water in creeks and channels floods areas that are usually dry.



What is a floodplain risk management study and plan?

A Floodplain Risk Management Study and Plan draws on the results of a Flood Study to identify, assess and compare various flood risk management options. It provides information and tools to assess the flood impacts of different management options and provides a plan for the implementation of the preferred options.

A FRMS&P draws on the results of the flood study to identify, assess and compare various flood risk management options. These options are aimed at improving the existing flood situation in your area. The FRMS&P provides information and tools to allow considered assessment of flood impacts of management options and provides a strategic plan for their implementation. Management options are typically categorised as property modification measures, response modification measures and flood modification measures.

GRC Hydro: Water Engineers and Hydrologists grchydro.com.au

Have Your Say on Flooding in Your Area
The Exile Bay Catchment Floodplain Risk Management Study and Plan

What is a FRMS&P used for?

A Floodplain Risk Management Study and Plan provides key information for Council, the SES and the community for effectively managing and mitigating flood risk.

For Council, FRMS&P's are a planning tool for future development in the LGA and implementing flood mitigation measures for existing development areas. Examples of applications for Council include:

- Identification and assessment of floodplain risk management measures for existing development areas aimed at reducing social, environmental and economic loss of flooding on development and the community; and
- Examination of Council's local flood risk management policies, strategies and planning instruments.

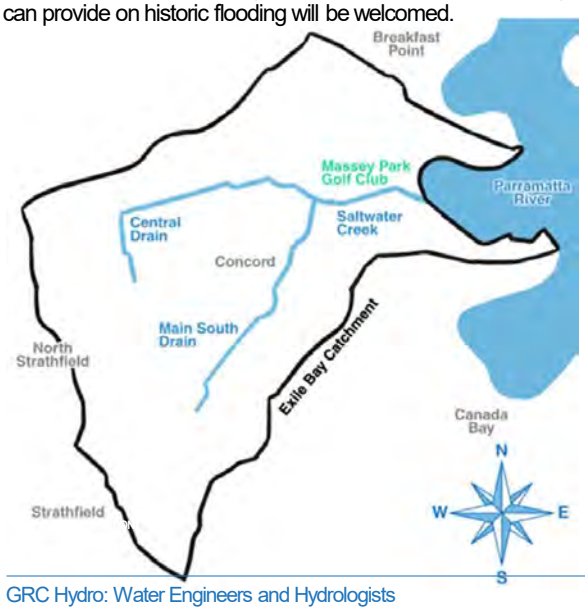
Information from the FRMS&P will assist the SES in its evacuation and logistics planning. The outcomes of the study will provide the SES with:

- a clear description of flood behaviour in the study area for a full range of flood events;
- a description of flood warning times for your area; and
- identification of critical evacuation issues in your area such as locations where road access is cut and the warning time before road access is cut.

The Study Area

The Exile Bay catchment covers a 3.5 square kilometre area with two key overland flow paths (the Main Southern Drain and the Central Drain) which meet at Saltwater Creek (adjacent to Massey Park Golf Club) and flows into the Parramatta River. These key features are shown in the map below.

Significant flood events occurred in your area in the early 1970s,1986 and 1988. Any information that the community can provide on historic flooding will be welcomed.



Why your feedback is important

GRC Hydro will be identifying areas that are significantly flood affected and assessing flood modification measures to relieve the flood risk at these locations. This involves using computer models developed in the Exile Bay Catchment Flood Study to assess flood mitigation measures. Community input and knowledge of measures that might mitigate flooding in your area is invaluable to this study.

How can you help us?

Your feedback is important in helping us get a complete picture of flood behaviour in your area (the Exile Bay catchment) and how this affects your community. There are a variety of ways you can share your experiences and knowledge with us. These are as follows:

01. Fill out the questionnaire included with this letter and send it back using the self-addressed envelope provided or email it to council@canadabay.nsw.gov.au

02. Fill out the questionnaire online by going to the website listed below or using your smartphone to navigate to the questionnaire using the QR code below.

QRCode:

Website:
collaborate.canadabay.nsw.gov.au/exilebayfloodstudy

03. For more information, please do not hesitate to contact the representatives nominated at the bottom of this page.

What happens next?

GRC Hydro will assess flood modification measures and produce a draft FRMS&P report for Council. It will be on Public Exhibition in xx 20xx.

Who can we contact?

If you have any further questions regarding the study or any further flood information/photos please attach them to your questionnaire or contact the following representatives.

Feiya He
Senior Engineer, GRC Hydro
exilebay@grchydro.com.au
02 9030 0342

Mark Leong
| Infrastructure Project Manager
City of Canada Bay
Mark.Leong@canadabay.nsw.gov.au
02 9911 6239

Please return your questionnaire by xx September 2023 to ensure that it is counted.

GRC Hydro: Water Engineers and Hydrologists grchydro.com.au

Have Your Say on Flooding in Your Area
The Exile Bay Catchment Floodplain Risk Management Study and Plan Questionnaire

Contact Details

Name _____

Address: _____

Phone Number: _____

Email: _____

Can we contact you for more information? ◯ Yes ◯ No

Would you like to receive Council's monthly newsletter? ◯ Yes ◯ No

Your Property

What building type is your property?

◯ Residential (House/Terrace) ◯ Residential (Apartment)

◯ Commercial ◯ Industrial

Business Name:

How long have you lived or worked at this property? ____ Years ____ Months

Flood Exacerbation

Have you noticed anything that has made flooding worse in your area?

◯ Yes ◯ No

For example, have blocked drainage structures or changes near your property made flooding worse? Information such as dates, maximum extent, top water level and photos of flooding are very helpful.

Have Your Say on Flooding in Your Area

The Exile Bay Catchment Floodplain Risk Management Study and Plan Questionnaire

Flood Management Options

The current study is assessing a range of measures aimed at managing the current flood risk. The study is looking for input from residents to better understand local preferences for floodplain management.

Which of the following options do you prefer for managing flood risk? (tick one or multiple boxes based on preference)

- ◯ Construct detention basin(s) to reduce peak flood flow rates / store overland flows
- ◯ Improve overland flow paths to increase their capacity
- ◯ Upgrade stormwater drains to increase their capacity to handle flood events
- ◯ Impose greater flood-related development controls and increase strategic flood planning
- ◯ Increase flood awareness and education in the community
- ◯ Upgrade flood warning, evacuation planning and emergency response measures
- ◯ Other suggestions (describe below)

_____

_____

_____

_____

_____

_____

Other Comments

If you have other comments which could assist us in the development of the Exile Bay Catchment Floodplain Risk Management Study & Plan, please write them in the space below.

_____

_____

_____

Please return your questionnaire by xx September 2023 to ensure that it is counted.
If your information does not fit in the space provided, please email it to **exilebay@grchydro.com.au**

GRC Hydro: Water Engineers and Hydrologists grchydro.com.au

APPENDIX C

Preliminary Cost Estimations

Cost Estimate - FM01 Macnamara Avenue Drainage Upgrade					
No.	**Item**	**Unit rate ($)**	**Amount**	**Units**	**Cost**
1	**Pre-construction Costs**				
1.1	Site establishment		1		$ -
1.2	Provision of sediment and erosion control, geotechnical supervision		1		$ -
1.3	Detailed Design and Survey (Construction and WAE)		1		$ -
		Assume 20% of works cost			$ 579,342.57
2	**Construction**				
2.1	Pull up and dispose existing road surface	3.8	4224	m^2	$ 16,051.20
2.2	Excavation of fill (soft rock)	239	6758	m^3	$ 1,615,257.60
2.3	Supply and install of 0.525 m diameter pipe	380	119	m	$ 45,220.00
	Supply and install of 0.6 m diameter pipe	430	97	m	$ 41,710.00
	Supply and install of 0.75 m diameter pipe	650	241	m	$ 156,650.00
	Supply and install of 1.05 m diameter pipe	1152.5	103	m	$ 118,707.50
	Supply and install of 1.2 m diameter pipe	1450	179	m	$ 259,550.00
2.4	Disposal of displaced pipe volume fill	325	451	m^3	$ 146,669.02
2.5	Drainage pit, assume 1 per 50 m	3800	17	each	$ 64,600.00
2.5	Backfilling, compaction and reinstate disturbed road pavement with bitumin surface	40	4224	m^2	$ 168,960.00
2.6	Adjustment of existing services (assume 10% works cost)				$ 263,337.53
3	Contingency (assume 20% works cost)				$ 579,342.57
				Subtotal	$ 4,055,397.99
Note: these costs are indicitive only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment				GST	$ 405,539.80
				Total	$ 4,460,937.79

Cost Estimate - FM02 Davidson Avenue Drainage Upgrade					
No.	**Item**	**Unit rate ($)**	**Amount**	**Units**	**Cost**
1	**Pre-construction Costs**				
1.1	Site establishment		1		$ -
1.2	Provision of sediment and erosion control, geotechnical supervision		1		$ -
1.3	Detailed Design and Survey (Construction and WAE)		1		$ -
		Assume 20% of works cost			$ 881,930.43
2	**Construction**				
2.1	Pull up and dispose existing road surface	3.8	7482	m^2	$ 28,431.60
2.2	Excavation of fill (soft rock)	239	6490	m^3	$ 1,551,110.00
2.3	Supply and install of 0.3 m diameter pipe	215	38	m	$ 8,170.00
	Supply and install of 0.375 m diameter pipe	255	18	m	$ 4,590.00
	Supply and install of 0.45 m diameter pipe	325	45	m	$ 14,625.00
	Supply and install of 0.75 m diameter pipe	650	12	m	$ 7,800.00
	Supply and install of 1.2 m diameter pipe	1450	1093	m	$ 1,584,850.00
2.4	Disposal of displaced pipe volume fill	325	1253	m^3	$ 407,318.07
2.5	Drainage pit, assume 1 per 50 m	3800	27	each	$ 102,600.00
2.5	Backfilling, compaction and reinstate disturbed road pavement with bitumin surface	40	7482	m^2	$ 299,280.00
2.6	Adjustment of existing services (assume 10% works cost)				$ 400,877.47
3	Contingency (assume 20% works cost)				$ 881,930.43
				Subtotal	$ 6,173,512.99
Note: these costs are indicitive only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment				GST	$ 617,351.30
				Total	$ 6,790,864.28

Cost Estimate - FM06 Coles Street Drainage Upgrade					
No.	**Item**	**Unit rate ($)**	**Amount**	**Units**	**Cost**
1	**Pre-construction Costs**				
1.1	Site establishment		1		$ -
1.2	Provision of sediment and erosion control, geotechnical supervision		1		$ -
1.3	Detailed Design and Survey (Construction and WAE)		1		$ -
		Assume 20% of works cost			$ 292,480.03
2	**Construction**				
2.1	Pull up and dispose existing road surface	3.8	2629	m^2	$ 9,990.20
2.2	Excavation of fill (soft rock)	239	3887	m^3	$ 928,993.00
2.3	Supply and install of 0.6 m diameter pipe	430	503	m	$ 216,290.00
2.4	Disposal of displaced pipe volume fill	325	142	m^3	$ 46,221.47
2.5	Drainage pit, assume 1 per 50 m	3800	6	each	$ 22,800.00
2.5	Backfilling, compaction and reinstate disturbed road pavement with bitumin surface	40	2629	m^2	$ 105,160.00
2.6	Adjustment of existing services (assume 10% works cost)				$ 132,945.47
3	Contingency (assume 20% works cost)				$ 292,480.03
				Subtotal	$ 2,047,360.19
Note: these costs are indicitive only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment				GST	$ 204,736.02
				Total	$ 2,252,096.21

Cost Estimate - FM07 Queen Elizabeth Park Drainage Upgrade					
No.	**Item**	**Unit rate ($)**	**Amount**	**Units**	**Cost**
1	**Pre-construction Costs**				
1.1	Site establishment		1		$ -
1.2	Provision of sediment and erosion control, geotechnical supervision		1		$ -
1.3	Detailed Design and Survey (Construction and WAE)		1		$ -
		Assume 20% of works cost			$ 318,535.17
2	**Construction**				
2.1	Pull up and dispose existing road surface	3.8	3079	m^2	$ 11,700.20
2.2	Excavation of fill (soft rock)	239	2858	m^3	$ 683,062.00
2.3	Supply and install of 0.375 m diameter pipe	255	6	m	$ 1,530.00
	Supply and install of 0.45 m diameter pipe	325	77	m	$ 25,025.00
	Supply and install of 0.75 m diameter pipe	650	201	m	$ 130,650.00
	Supply and install of 1.35 m diameter pipe	1725	173	m	$ 298,425.00
2.4	Disposal of displaced pipe volume fill	325	349	m^3	$ 113,534.93
2.5	Drainage pit, assume 1 per 50 m	3800	16	each	$ 60,800.00
2.5	Backfilling, compaction and reinstate disturbed road pavement with bitumin surface	40	3079	m^2	$ 123,160.00
2.6	Adjustment of existing services (assume 10% works cost)				$ 144,788.71
3	Contingency (assume 20% works cost)				$ 318,535.17
				Subtotal	$ 2,229,746.17
Note: these costs are indicitive only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment				GST	$ 222,974.62
				Total	$ 2,452,720.79

Cost Estimate - FM08 Shackel Avenue Drainage Upgrade						
No.	**Item**	**Unit rate ($)**	**Amount**	**Units**	**Cost**	
1	**Pre-construction Costs**					
1.1	Site establishment		1		$	-
1.2	Provision of sediment and erosion control, geotechnical supervision		1		$	-
1.3	Detailed Design and Survey (Construction and WAE)		1		$	-
		Assume 20% of works cost			$	50,755.18
2	**Construction**					
2.1	Pull up and dispose existing road surface	3.8	614	m^2	$	2,333.20
2.2	Excavation of fill (soft rock)	239	322	m^3	$	76,958.00
2.3	Supply and install of 0.45 m diameter pipe	325	123	m	$	39,975.00
2.4	Disposal of displaced pipe volume fill	325	20	m^3	$	6,357.75
2.5	Drainage pit, assume 1 per 50 m	3800	5	each	$	19,000.00
2.5	Backfilling, compaction and reinstate disturbed road pavement with bitumin surface	40	614	m^2	$	24,560.00
2.6	Adjustment of existing services (assume 50% works cost)				$	84,591.97
3	Contingency (assume 20% works cost)				$	50,755.18
				Subtotal	$	355,286.29
Note: these costs are indicitive only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment				GST	$	35,528.63
				Total	$	390,814.92

Cost Estimate - FM09 Catchment Wide Trunk Drainage Upgrade					
No.	**Item**	**Unit rate ($)**	**Amount**	**Units**	**Cost**
1	**Pre-construction Costs**				
1.1	Site establishment		1		$ -
1.2	Provision of sediment and erosion control, geotechnical supervision		1		$ -
1.3	Detailed Design and Survey (Construction and WAE)		1		$ -
		Assume 20% of works cost			$ 85,072,947.35
2	**Construction**				
2.1	Pull up and dispose existing road surface	3.8	56050	m^2	$ 212,990.00
2.2	Excavation of fill (soft rock)	239	60000	m^3	$ 14,340,000.00
2.3	Supply and install of 0.1 m diameter pipe	200	82	m	$ 16,400.00
	Supply and install of 0.3 m diameter pipe	215	10568	m	$ 2,272,120.00
	Supply and install of 0.375 m diameter pipe	255	9410	m	$ 2,399,550.00
	Supply and install of 0.45 m diameter pipe	325	44009	m	$ 14,302,925.00
	Supply and install of 0.525 m diameter pipe	380	215	m	$ 81,700.00
	Supply and install of 0.6 m diameter pipe	430	5618	m	$ 2,415,740.00
	Supply and install of 0.68 m diameter pipe	550	15	m	$ 8,250.00
	Supply and install of 0.75 m diameter pipe	650	78708	m	$ 51,160,200.00
	Supply and install of 0.9 m diameter pipe	855	7073	m	$ 6,047,415.00
	Supply and install of 1 m diameter pipe	1055	40	m	$ 42,200.00
	Supply and install of 1.05 m diameter pipe	1155	9183	m	$ 10,606,365.00
	Supply and install of 1.2 m diameter pipe	1450	80267	m	$ 116,387,150.00
	Supply and install of 1.35 m diameter pipe	1725	43638	m	$ 75,275,550.00
	Supply and install of 1.5 m diameter pipe	2000	7634	m	$ 15,268,000.00
	Supply and install of 1.6 m diameter pipe	2400	13	m	$ 31,200.00
	Supply and install of 1.8 m diameter pipe	3000	9	m	$ 27,000.00
2.4	Disposal of displaced pipe volume fill	325	224463	m^3	$ 72,950,460.21
2.5	Drainage pit, assume 1 per 50 m	3800	160	each	$ 608,000.00
2.5	Backfilling, compaction and reinstate disturbed road pavement with bitumin surface	40	56050	m^2	$ 2,242,000.00
2.6	Adjustment of existing services (assume 10% works cost)				$ 38,669,521.52
3	Contingency (assume 20% works cost)				$ 85,072,947.35
				Subtotal	$ 595,510,631.43
Note: these costs are indicitive only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment				GST	$ 59,551,063.14
				Total	$ 655,061,694.57

Cost Estimate - FM14 Cascading berms in Goddard Park, Queen Elizabeth Park and Rothwell Park					
No.	**Item**	**Unit rate ($)**	**Amount**	**Units**	**Cost**
1	**Pre-construction Costs**				
1.1	Site establishment		1		$ -
1.2	Provision of sediment and erosion control, geotechnical supervision		1		$ -
1.3	Detailed Design and Survey (Construction and WAE)		1		$ -
		Assume 20% of works cost			$ 62,356.20
2	**Construction**				
2.1	Excavation of fill	$8.85	2908.3	m^3	$ 25,738.11
2.2	Haulage of fill (assumed <10 km), placement, compaction and shaping	$65.70	2908.3	m^3	$ 191,072.74
2.3	Trim filling to batter	$3.25	5545.3	m^2	
2.4	Top soil placement	$10.60	5545.3	m^2	$ 58,779.85
2.5	Hydro mulch, sprayed grass seed compound	$3,650.00	0.6	ha	$ 2,024.02
2.6	Geotextile layer for embankment	1.05	5545.3	m^2	$ 5,822.53
2.7	Adjustment of existing services (assume 10% works cost)				$ 28,343.73
3	Contingency (assume 20% works cost)				$ 62,356.20
				Subtotal	$ 436,493.37
Note: these costs are indicitive only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment				GST	$ 43,649.34
				Total	$ 480,142.71

Estimate - FM16 Improve Conveyance along Davidson Avenue, Majors Bay Road and Brewer Street Intersec					
No.	**Item**	**Unit rate ($)**	**Amount**	**Units**	**Cost**
1	**Pre-construction Costs**				
1.1	Site establishment		1		$ -
1.2	Provision of sediment and erosion control, geotechnical supervision		1		$ -
1.3	Detailed Design and Survey (Construction and WAE)		1		$ -
		Assume 20% of works cost			$ 65,577.19
2	**Construction**				
2.1	Excavation of fill	$8.85	106.4	m^3	$ 941.82
2.2	Construct kerb and guttering	$181.50	400.0	m	$ 72,600.00
2.3	Backfilling, compaction and reinstate disturbed road pavement with bitumin surface	40	2031	m^2	$ 81,240.00
2.4	Top soil filled into beds, spread and levelled	$71.50	128.1	m^2	$ 9,161.16
2.5	Adjustment of existing services (assume 100% works cost)				$ 163,942.98
3	Contingency (assume 20% works cost)				$ 65,577.19
				Subtotal	$ 459,040.33
Note: these costs are indicitive only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment				GST	$ 45,904.03
				Total	$ 504,944.36

Cost Estimate - FM17 Cascading Berms in Central Park					
No.	**Item**	**Unit rate ($)**	**Amount**	**Units**	**Cost**
1	**Pre-construction Costs**				
1.1	Site establishment		1		$ -
1.2	Provision of sediment and erosion control, geotechnical supervision		1		$ -
1.3	Detailed Design and Survey (Construction and WAE)		1		$ -
		Assume 20% of works cost			$ 31,519.86
2	**Construction**				
2.1	Excavation of fill	$8.85	1477.6	m^3	$ 13,077.09
2.2	Haulage of fill (assumed <10 km), placement, compaction and shaping	$65.70	1477.6	m^3	$ 97,080.77
2.3	Trim filling to batter	$3.25	2756.1	m^2	
2.4	Top soil placement	$10.60	2756.1	m^2	$ 29,214.39
2.5	Hydro mulch, sprayed grass seed compound	$3,650.00	0.3	ha	$ 1,005.97
2.6	Geotextile layer for embankment	1.05	2756.1	m^2	$ 2,893.88
2.7	Adjustment of existing services (assume 10% works cost)				$ 14,327.21
3	Contingency (assume 20% works cost)				$ 31,519.86
				Subtotal	$ 220,639.03
Note: these costs are indicitive only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment				GST	$ 22,063.90
				Total	$ 242,702.93

Cost Estimate - FM19 Lowering Greenlees Avenue and Greenlees Park					
No.	**Item**	**Unit rate ($)**	**Amount**	**Units**	**Cost**
1	**Pre-construction Costs**				
1.1	Site establishment		1		$ -
1.2	Provision of sediment and erosion control, geotechnical supervision		1		$ -
1.3	Detailed Design and Survey (Construction and WAE)		1		$ -
		Assume 20% of works cost			$ 122,691.85
2	**Construction of embankment**				
2.1	Excavation of fill	$8.85	231.9	m^3	$ 2,051.93
2.2	Haulage of fill (assumed <10 km), placement, compaction and shaping	$65.70	231.9	m^3	$ 15,232.94
2.3	Trim filling to batter	$3.25	458.3	m^2	
2.4	Top soil placement	$10.60	458.3	m^2	$ 4,858.19
2.5	Hydro mulch, sprayed grass seed compound	$3,650.00	0.05	ha	$ 167.29
2.6	Geotextile layer for embankment	1.05	458.3	m^2	$ 481.24
3	**Lowering Roadway and Park**				
3.1	Excavation of fill	$8.85	299.6	m^3	$ 2,651.61
3.2	Construct kerb and guttering	$181.50	160.0	m	$ 29,040.00
3.3	Top soil placement	$10.60	5992.3	m^2	$ 63,518.84
3.4	Backfilling, compaction and reinstate disturbed road pavement with bitumin surface	40	796	m^2	$ 31,840.00
3.5	Hydro mulch, sprayed grass seed compound	$3,650.00	0.60	ha	$ 2,187.21
3.6	Top soil filled into beds, spread and levelled	$71.50	5992.3	m^2	$ 428,452.58
3.7	Adjustment of existing services (assume 10% works cost)				$ 55,769.02
4	Contingency (assume 20% works cost)				$ 122,691.85
				Subtotal	$ 881,634.54
Note: these costs are indicitive only and should not be relied on for reasons other than the purposes of this preliminary feasibility assessment				GST	$ 88,163.45
				Total	$ 969,798.00

APPENDIX D

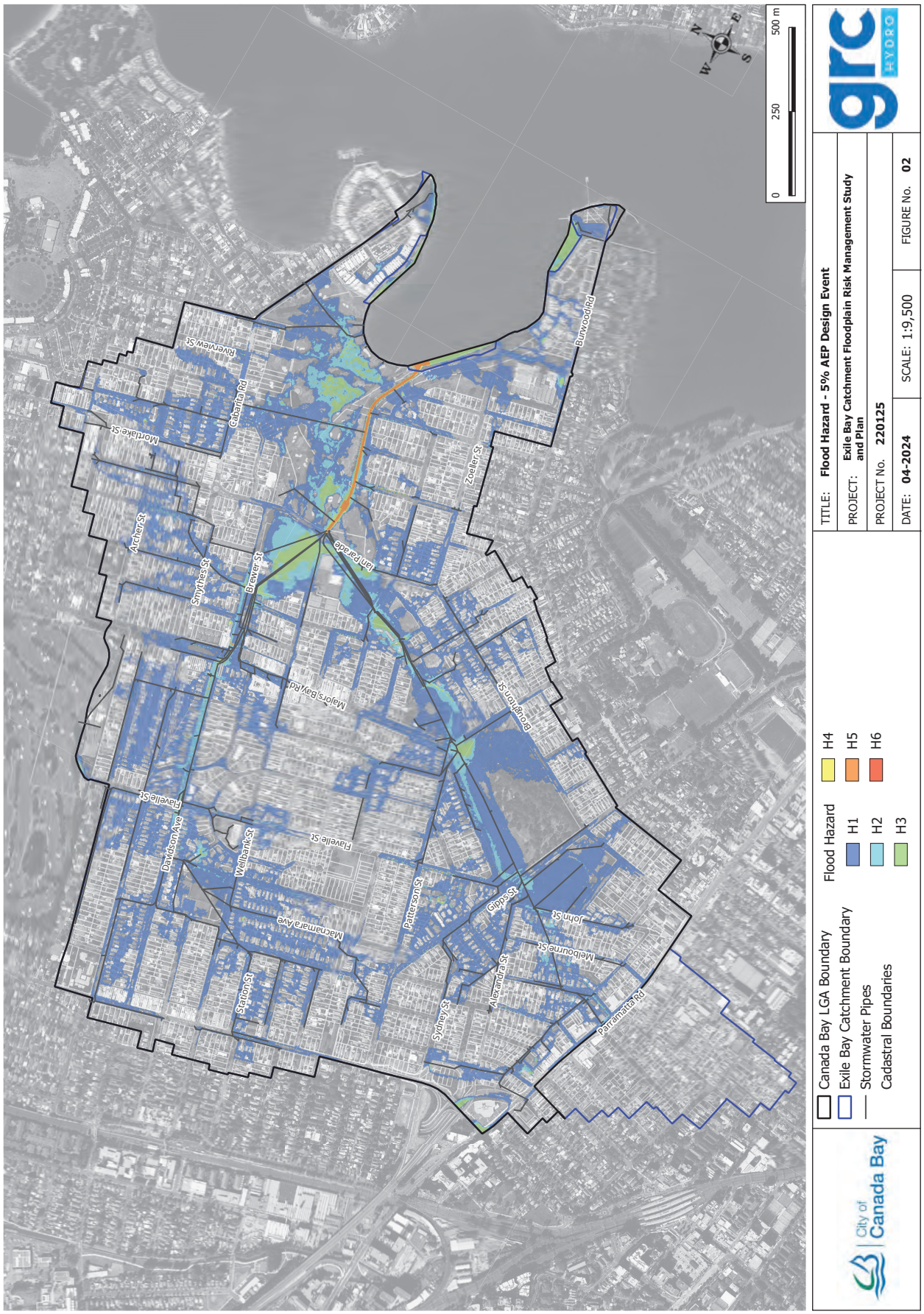
Public Exhibition Topics

Topic	Response
Concerns about pit blockage and debris worsening flooding	Debris such as leaves and rubbish can have a localised effect on flood levels, when drainage pits are blocked. However, in an area with significant flooding, the pit and pipe network will often take only a small proportion (e.g. 10-20%) of the total flow, meaning that complete blockage of pits would not dramatically change flood behaviour. We acknowledge that this localised effect can be significant in some areas and Council does periodically clear leaf litter and clean drainage inlets. The challenge is that in the best case scenario, Council have cleaned a street's drainage and leaf litter the day before a storm hits, however, even in this scenario, significant leaf and other litter will wash down to drainage pits during the storm and cause blockage.
Concern about the purpose of the study, as the area is not floodplain	Most of the study area has been assessed for overland flow flooding. This can occur in hilly areas well away from creeks and rivers. It can also cause significant flooding on roads or properties, even with quite small catchments. Similar studies are carried out across the wider Sydney area by other Councils.
Respondent is not flooded	Several respondents noted they had not experienced flooding. This information is useful for the study as it allows us to compare against the flood model estimates, and investigate any discrepancies. Most properties in the catchment have likely not experienced flooding at their property.
Use of the latest ARR Climate Change Factors	One respondent noted the need to use the latest climate change factors released as part of ARR version 4.2. These factors generally result in higher flood levels. With that said, sensitivity to increased rainfall in Exile Bay catchment was not particularly high. The reason they were not used is that the study had already progressed past the design flood modelling when they were released. However, any future studies, or studies by Council where flooding is a critical factor, can use the updated factors.
Respondent experiences property flooding and unsure about what they can do	Unfortunately the Floodplain Risk Management Study is a catchment wide assessment and mitigation measures are aimed at reducing flood risk via controls on new development, and structural mitigation measures aimed at reducing flood risk in flooding hotspots where many properties are flooded, rather than offering measures aimed at a specific property. Options for concerned residents, in the opinion of GRC Hydro, are to 1) review the flood mitigation measures recommended in the report for if they offer any benefit (noting that none of the measures 'solve' or completely remove flooding), 2) to review the shortcomings or constraints of options as described in the report, 3) request a flood information certificate from Council so that you have detailed information on the estimated flood behaviour at your property and 4) if works on the building may alleviate flooding, consider discussing with a builder or engineer.

Topic	Response
Potential for increased density of development to increase flooding due to reduced infiltration	A number of residents are concerned that flooding is increasing in severity due to loss of permeable areas (e.g. gardens) due to ongoing higher density development. While loss of pervious areas can worsen flooding if left unmanaged, it is not expected to be occurring in the catchment, given that Council require new developments to account for any loss of infiltration via the installation of an Onsite Detention system. This drains runoff to a tank or similar, which then attenuates flow leaving the lot and reduces the peak flow to a 'pre-development' flow rate. Calculations done by a stormwater or civil engineer are used to size the system appropriately.
Would like to know more information about flooding at their property	Residents who are seeking more detailed information about flooding in the vicinity of their property should apply to Council for a flood certificate, as the Exile Bay FRMS pertains to catchment-wide flooding and does not map flooding at a property scale.
Question why there are more flood events in recent years than in the preceding period (roughly 2010-2020)	GRC Hydro are aware of catchments that have experienced more frequent flooding in the last five years than the preceeding 10 years, and while this analysis has not been undertaken for Exile Bay, it is plausible the same has happened here. It is not unusual for flood events, i.e. very heavy rainfall events, to be clustered together in wet sequences of weather, such as in 2022 when Sydney's annual rainfall was more than double of its average. Likewise dryer weather sequences will see some catchments experience little to no flooding. The rainfall events of the last five years have been very heavy but not statistically exceptional, i.e. it is not the case that multiple 1% AEP rainfalls have occurred.
Concern that the study's maps being published will increase insurance premiums	While insurance premiums have risen across NSW over the last few years, fortunately, this is unlikely to be related to Council publishing flood maps or designating properties as being subject to flood planning controls. Insurance companies use their own modelling and information about flooding rather than waiting on Council studies. Waverley Council looked into the concern in some detail and reported "Council undertook research which concluded that there was no clear correlation between flood risk related planning controls and mapping and increased insurance premiums and that a variety of factors influence insurance premiums provided by insurers."
Potential for Saltwater Creek channel to reduce Edwards park flooding	The Saltwater Creek channel drains flow from Edwards Park and the wider catchment, into the harbour. The creek lies below sea level and has a flat grade, due to the area being largely reclaimed land (i.e. formerly was coastal wetlands with mangroves or similar). This means that drainage of the area is difficult and that changes to the channel, when tested previously, have had minimal effect on flooding.

Topic	Response
Loss of amenity due to mitigation works in the parks	The feedback is noted and this constraint (loss of amenity) is significant. Parks in the area are used by a wide population and the works would impact on use of the park. Please note that no works are directly greenlit by this FRMS, it is the first step in testing feasibility of flood mitigation works, and subsequent studies would investigate in more details things like loss of amenity and drainage of the area outside of flood events. Subsoil drainage and stormwater pits and pipes can be used to avoid prolonged saturated soils.
Concern that no mitigation options covered a particular area	Some respondents queried why the list of mitigation measures did not contain any for a particular area. The mitigation options were chosen by GRC in collaboration with Council based on 1) where flood modelling showed the areas of highest risk in the catchment are 2) Council's experience of known flooding issues and 3) input from the community via a questionnaire in August 2023, where all suggested measures were added to a longlist, which is set out in the report.
Strong interest in upgrading stormwater drainage to alleviate flooding. Residents stated that the past flooding events highlight longstanding drainage problems that were only resolved through major infrastructure fixes.	Many residents requested that Council upgrade the pit and pipe network to reduce flooding, by piping the overland flow they have observed on roads and properties. Such upgrades were a focus of the tested mitigation measures, but ultimately all such upgrades were shown to have low or negligible impact on flood events. The reason is that exceptionally large pipes (and pits) would be needed to convey the majority of a flood flow, that passes down a road with significant catchment, and the cost quickly becomes unfeasible. This is the case across Sydney and why the road network forms part of the drainage system. Upgrades that are recommended in the FRMS will have the most benefit in small flood events and will not dramatically change flood behaviour in rarer events.
Planning and Policy Concerns: Residents questioned the long-term flood planning as uncertain and disconnected from realistic government cycles and priorities.	Flood planning in the catchment is a combination of local and state government processes. Flood planning controls are set out by Council in the DCP and LEP, which are up to date and apply to all new development that occurs via a DA. The effect of this is relatively fast - new buildings in flood-affected areas are required to be built to be sufficiently protected from flooding. In contrast, infrastructure works can take years to be built. They are often very costly for Council and so they typically apply for funding from the state government, via a grants program. The program receives applications from across NSW and allocates funds based on the severity of the flooding issue, and the measure's benefit-cost ratio, among many other factors. If funding is received for a particular measure, further studies and detailed design is needed before construction can begin, which may take several years in some instances. This means the overall process can appear slow, especially if multiple floods occur before anything is built.

Topic	Response
Residents raised queries that some areas have limited evacuation routes, raising safety concerns during flood events.	In a large flood, many roads have hazardous flooding, however, evacuation is not recommended for the large majority of the catchment, as shelter-in-place (i.e. remaining at home) presents less risk than driving on roads with high intensity rainfall occurring. Evacuation is required on large creek and river systems where hazardous flooding occurs inside dwellings, or an area is isolated for days or more.
Residents commented that the draft report is too technical and lengthy, making it inaccessible to many residents.	The report contains a number of sections that are of a technical nature and are used by various engineers and planners across Council, state government and the private sector. Unfortunately these parts of the report make it quite lengthy and impenetrable, to other audiences. Residents are recommended to read the executive summary and the description of particular mitigation options that may be relevant to them. Council may also consider preparing a separate document aimed at a general audience, consisting of a 10-15 page booklet using plain language, that summarises the report findings.
Residents sought clarity on project funding, cost and decision-making process.	Please see above description of the funding of mitigation measures. The report contains cost estimates of most mitigation measures, but these are preliminary only. Once a measure progresses to the next stage, which involves further design work, consultation and environmental assessment, there would typically be a more detailed cost estimate.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Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Stormwater Pipes
Cadastral Boundaries
Flood Hazard
H1
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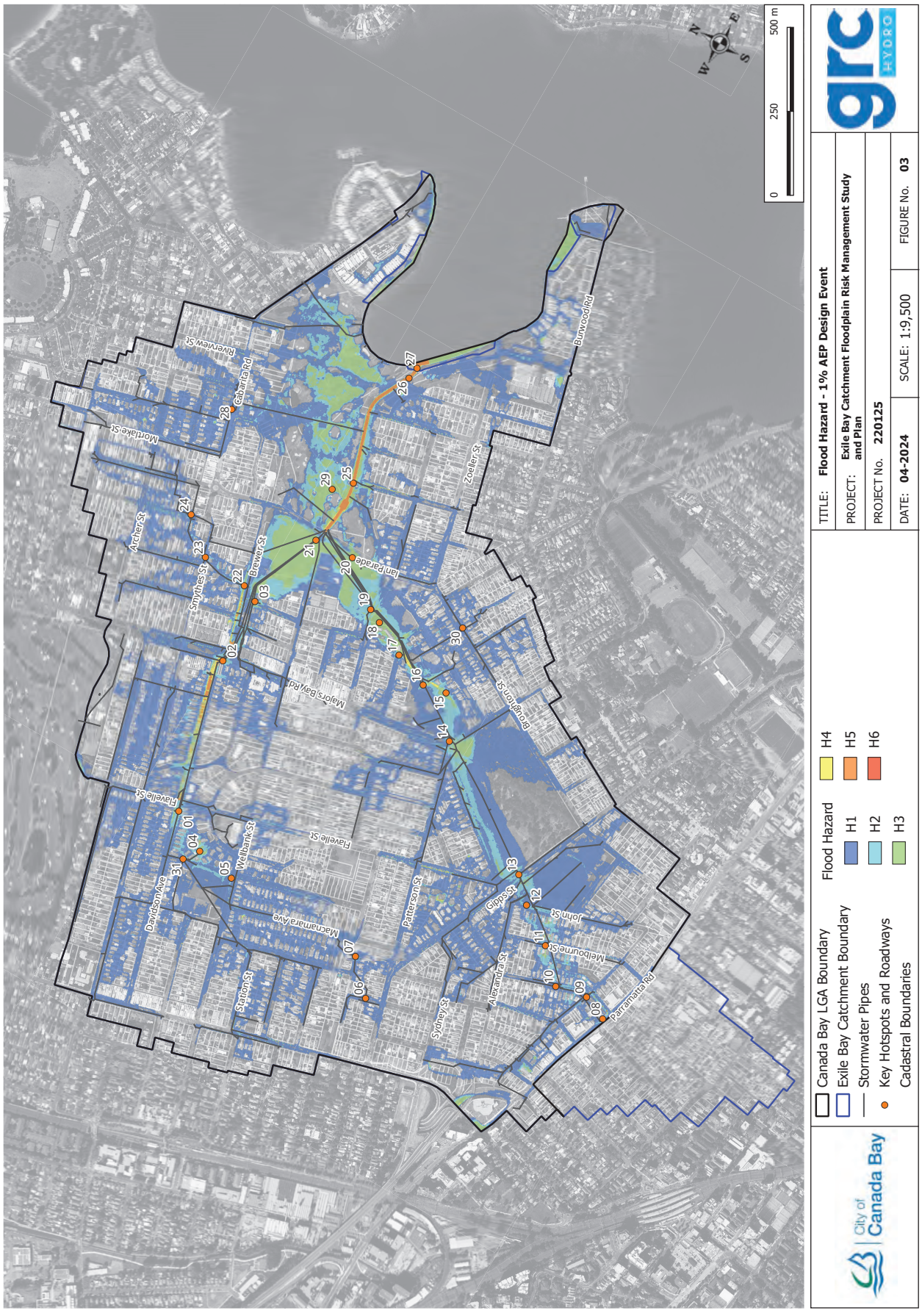
H6
TITLE: Flood Hazard - 5% AEP Design Event
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:9,500
FIGURE No. 02
City of Canada Bay
grc HYDRO
Burwood Rd
Zoeller St
Cabarita Rd
Rivenview St
Mortlake St
Archer St
Smythes St
Brewer St
Ian Parade
Majors Bay Rd
Broughton St
Flavelle St
Davidson Ave
Wellbank St
Patterson St
Gipps St
John St
Melbourne St
Alexandra St
Sydney St
Parramatta Rd
Station St
Macnamara Ave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Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Stormwater Pipes
Key Hotspots and Roadways
Cadastral Boundaries
Flood Hazard
H1
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H3
H4
H5
H6
TITLE: Flood Hazard - 1% AEP Design Event
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:9,500
FIGURE No. 03
City of Canada Bay
grc HYDRO
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Cabarita Rd
Rivenview St
Mortlake St
Archer St
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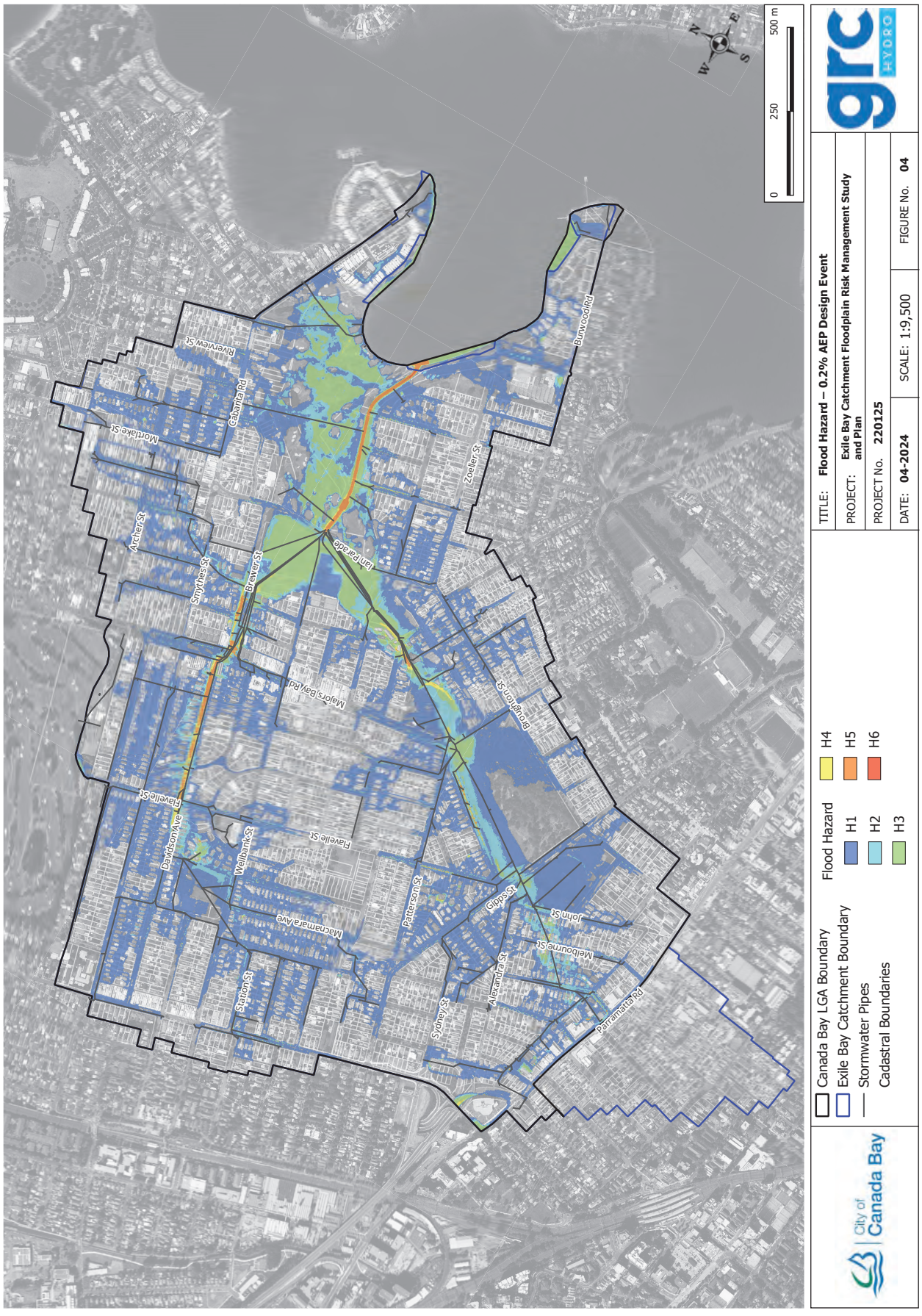
Alexandra St
Cipps St
John St
Melbourne St
Parramatta Rd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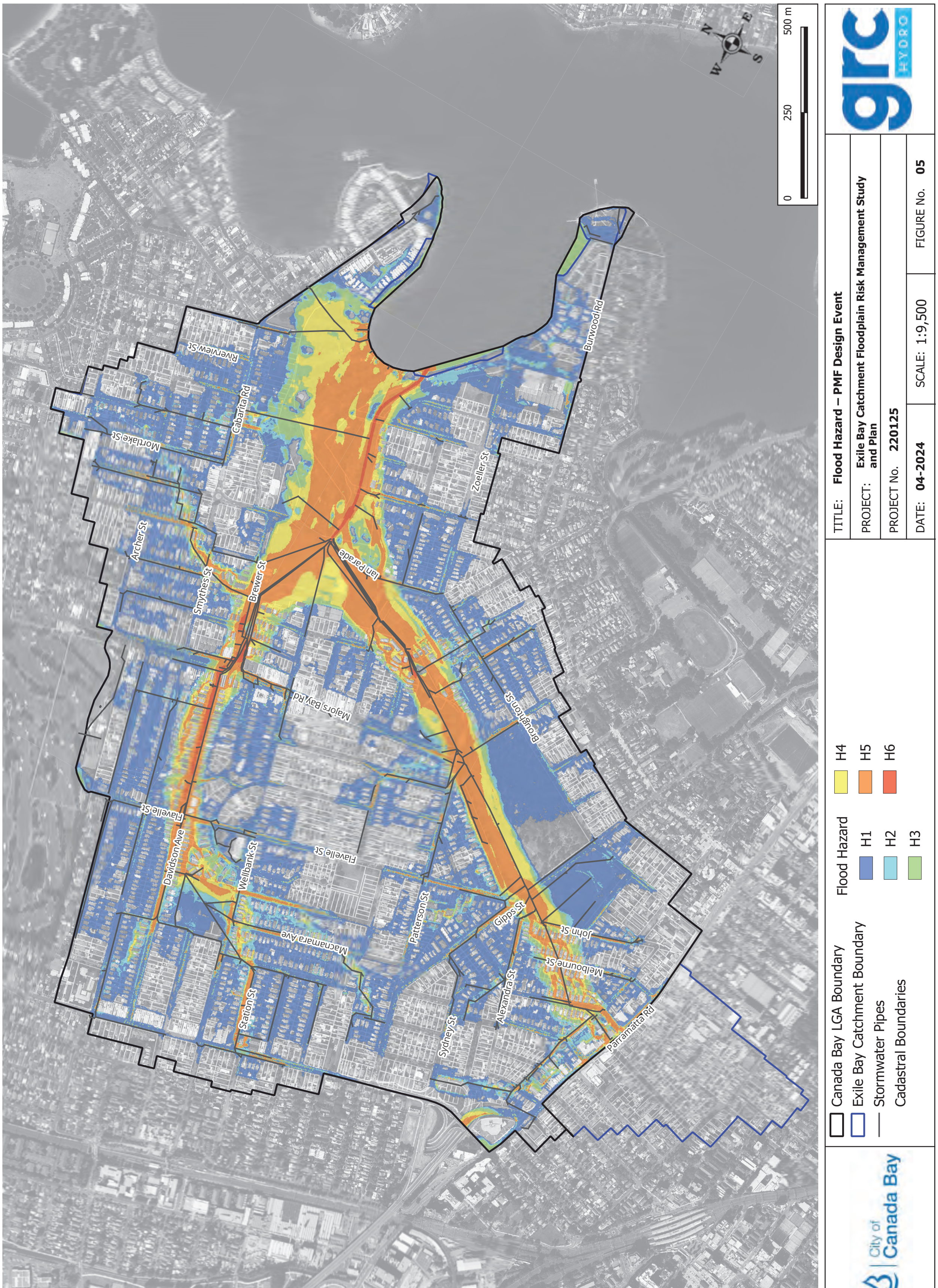
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Stormwater Pipes
Cadastral Boundaries
Flood Hazard
H1
H2
H3
H4
H5
H6
City of Canada Bay
TITLE: Flood Hazard – 0.2% AEP Design Event
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:9,500
FIGURE No. 04
grc HYDRO


TITLE: Flood Hazard – PMF Design Event
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:9,500
FIGURE No. 05
grc HYDRO
City of Canada Bay
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Stormwater Pipes
Cadastral Boundaries
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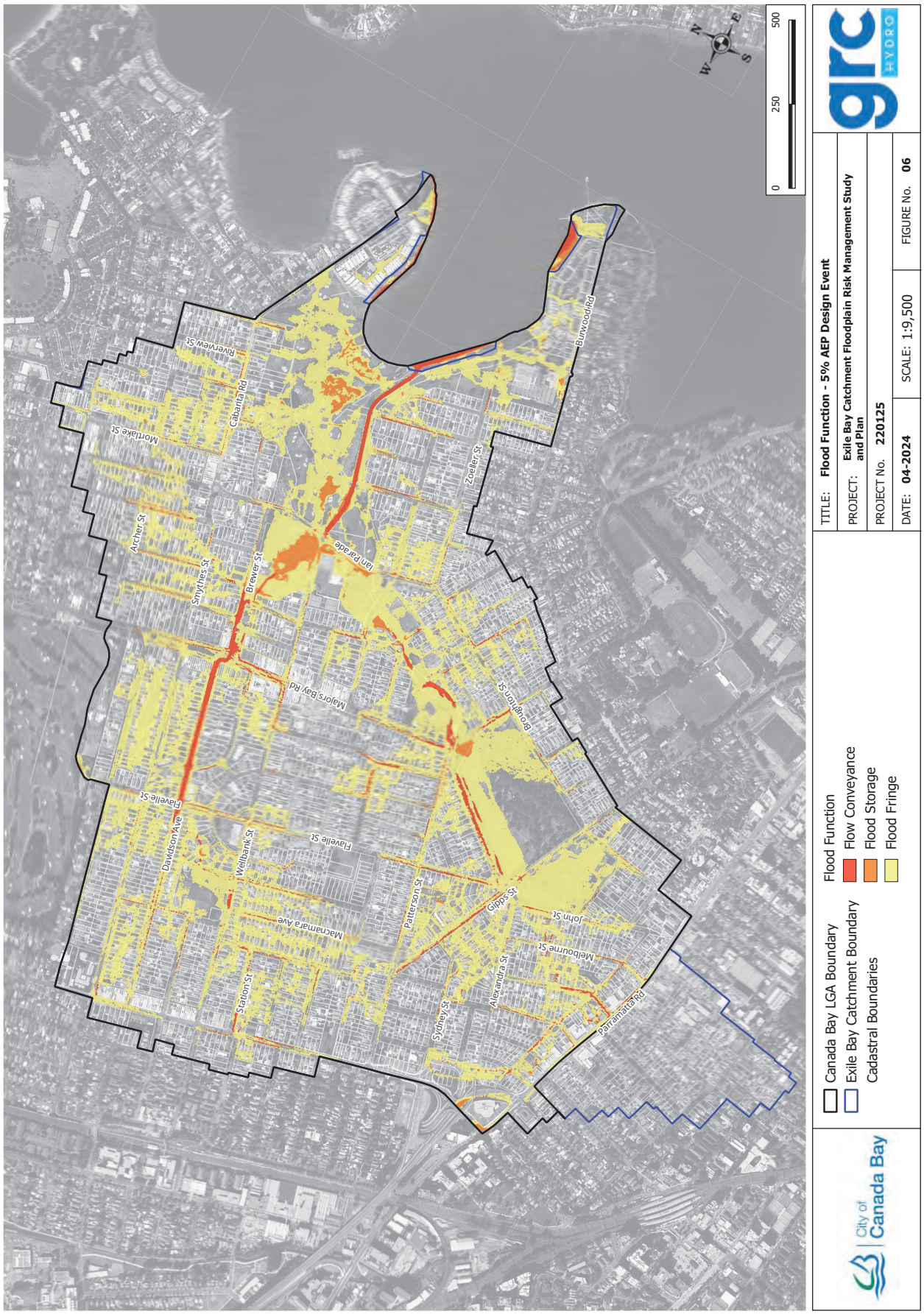
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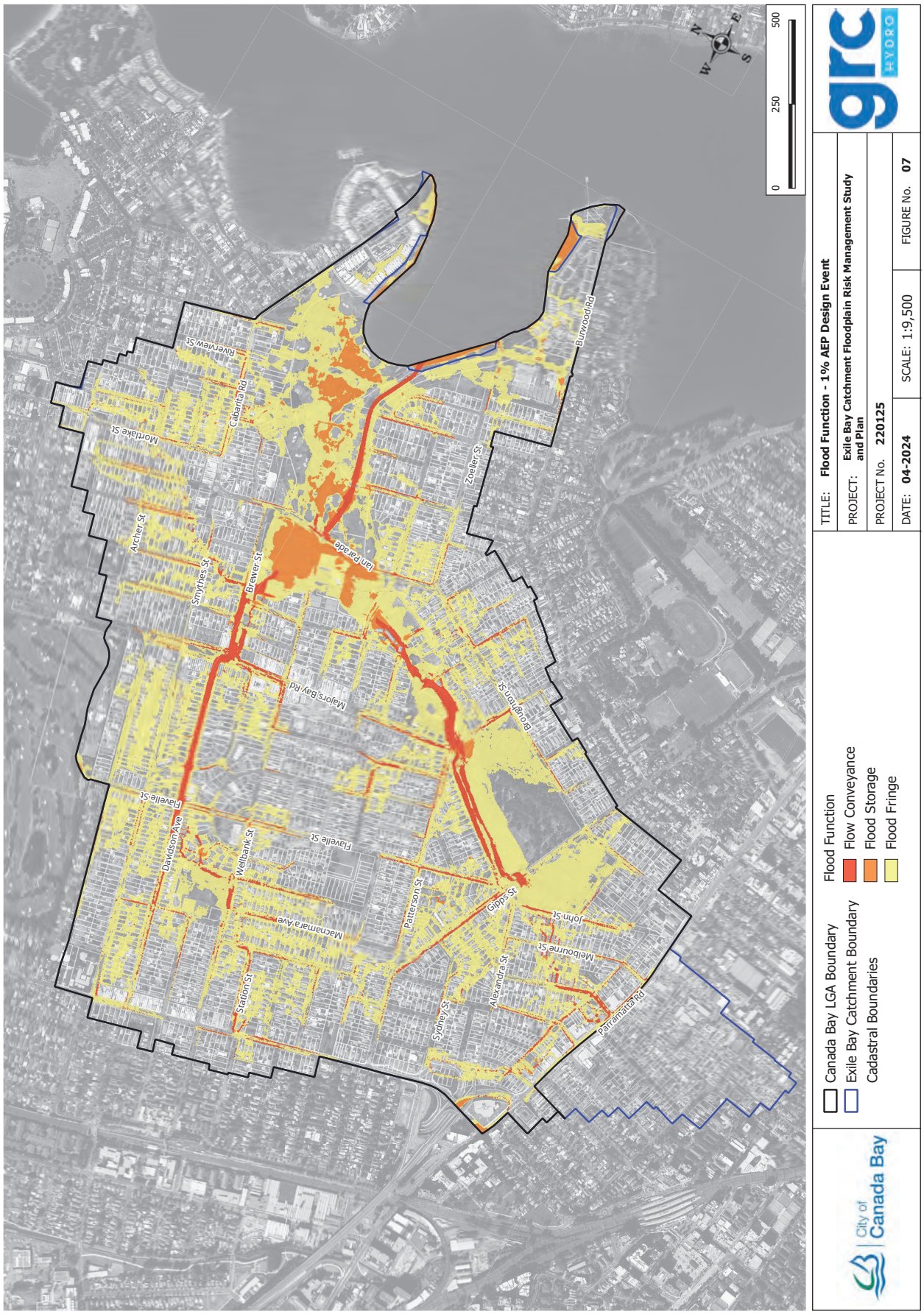
Alexandra St
Sydney St
Station St
Parramatta Rd
Burwood Rd
Zoeller St
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Flood Function
Flow Conveyance
Flood Storage
Flood Fringe
TITLE: Flood Function - 5% AEP Design Event
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:9,500
FIGURE No. 06
City of Canada Bay
grc HYDRO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Dawdson Ave
Wellbank St
Macnamara Ave
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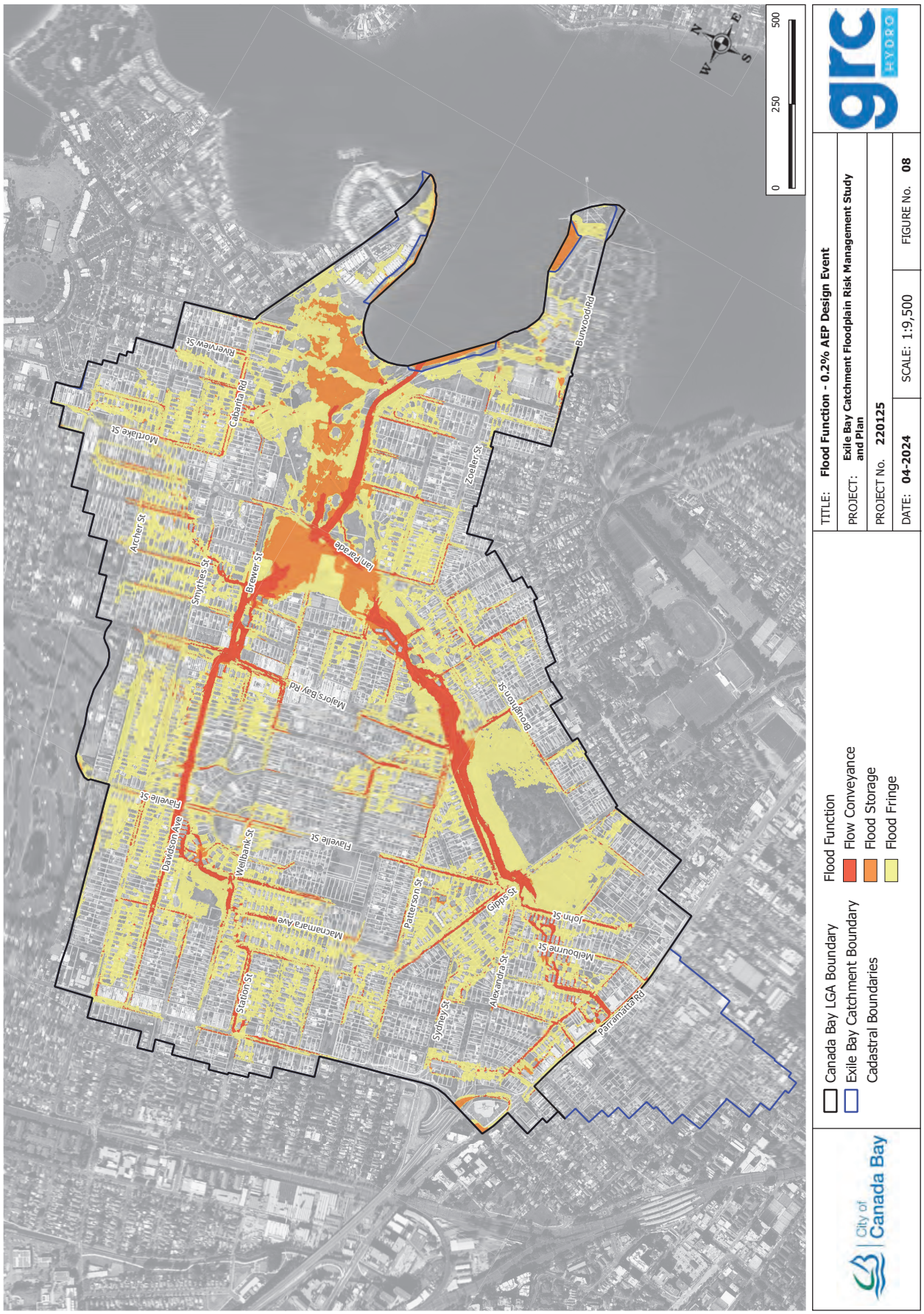
Patterson St
Sydney St
Alexandra St
Gipps St
John St
Melbourne St
Parramatta Rd
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Flood Function
Flow Conveyance
Flood Storage
Flood Fringe
TITLE: Flood Function - 1% AEP Design Event
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:9,500
FIGURE No. 07
City of Canada Bay
grc HYDRO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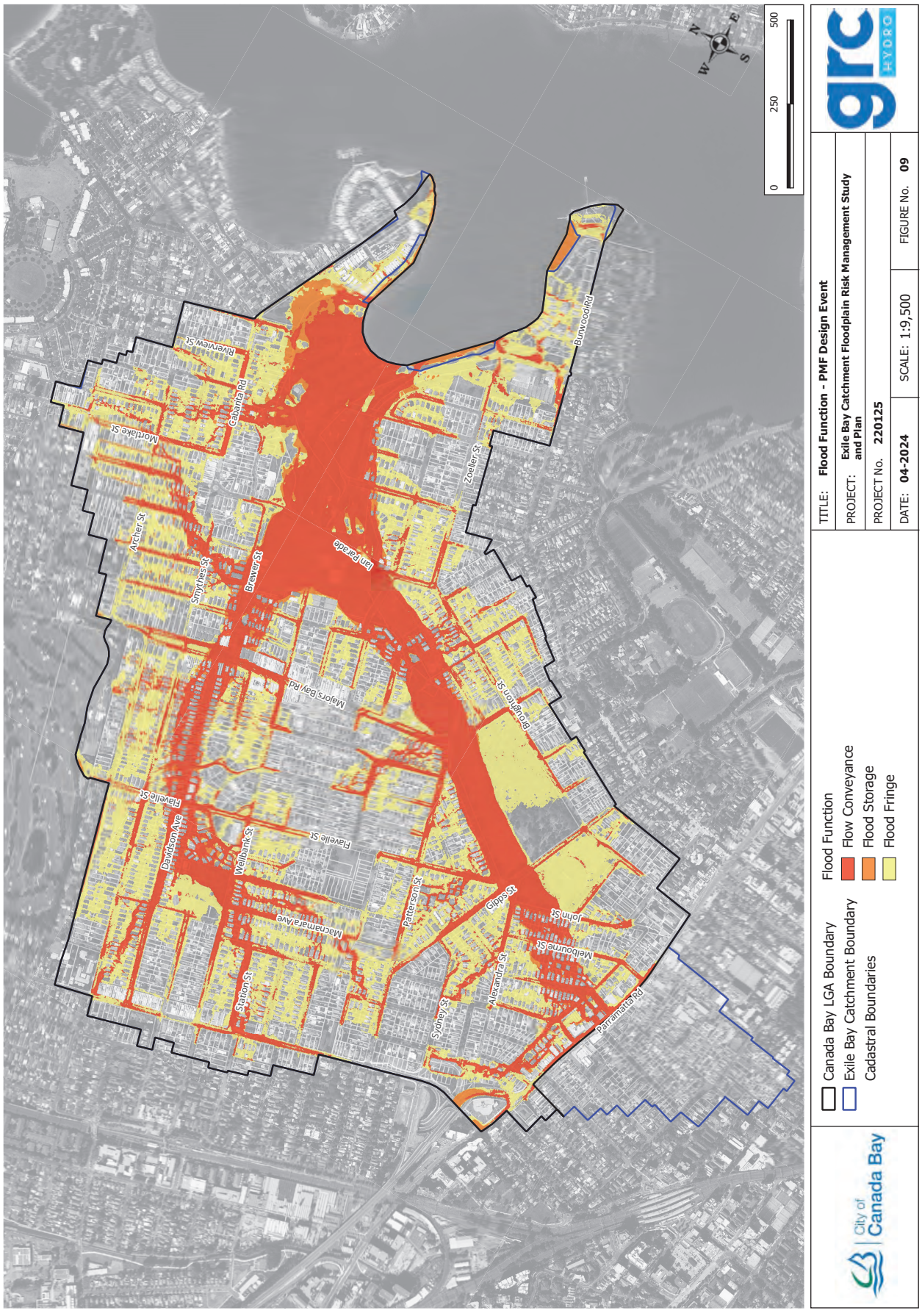
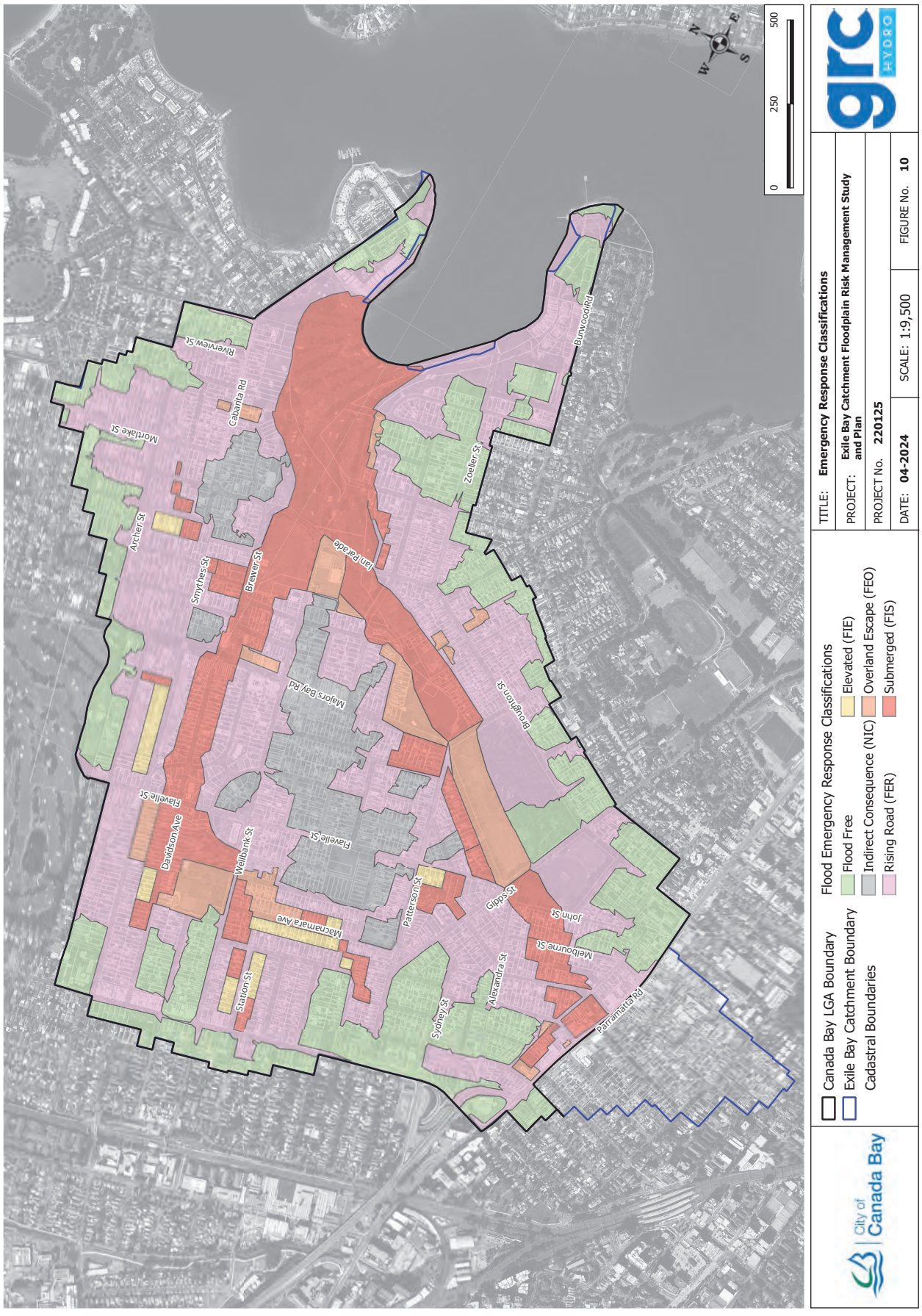
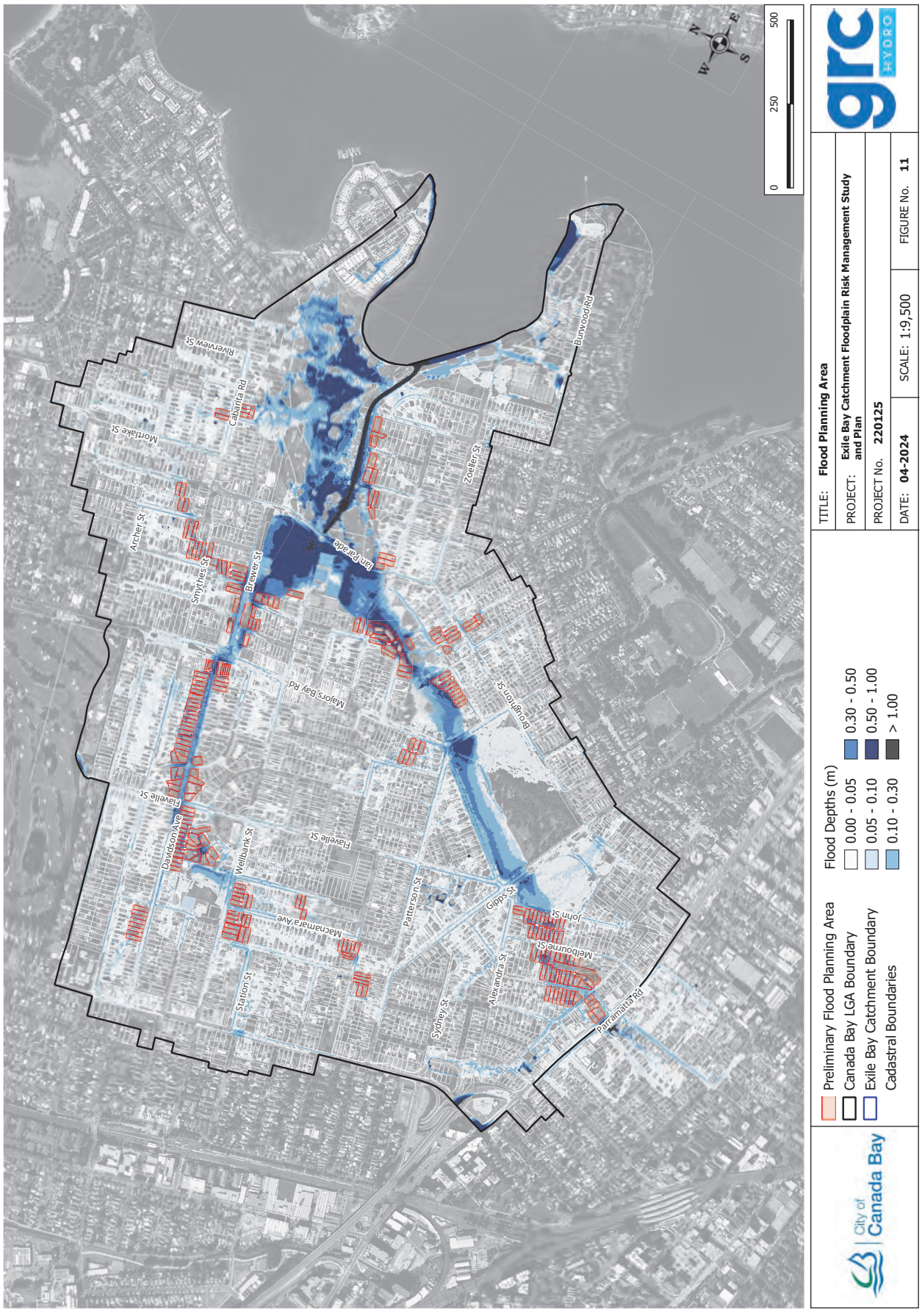
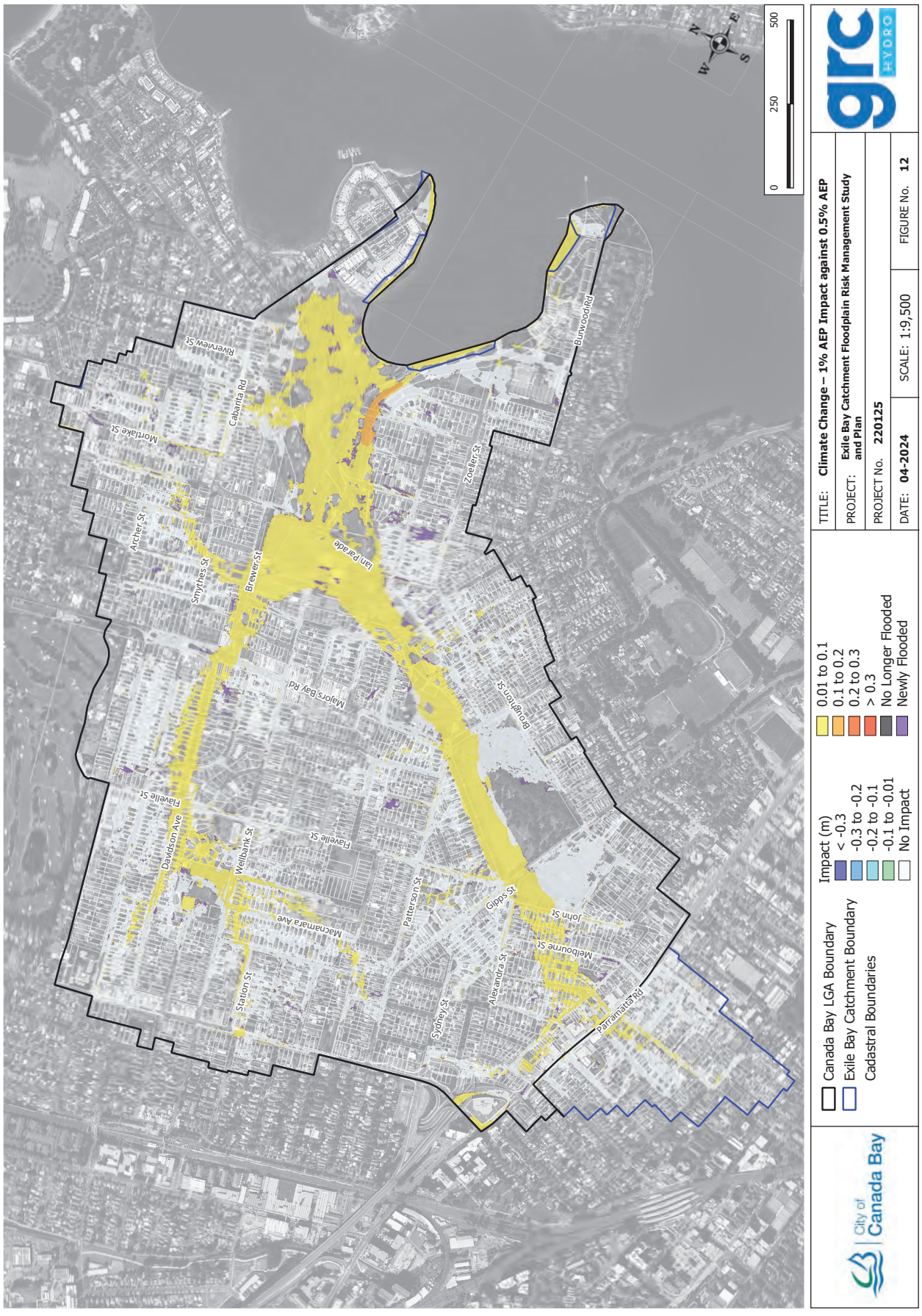
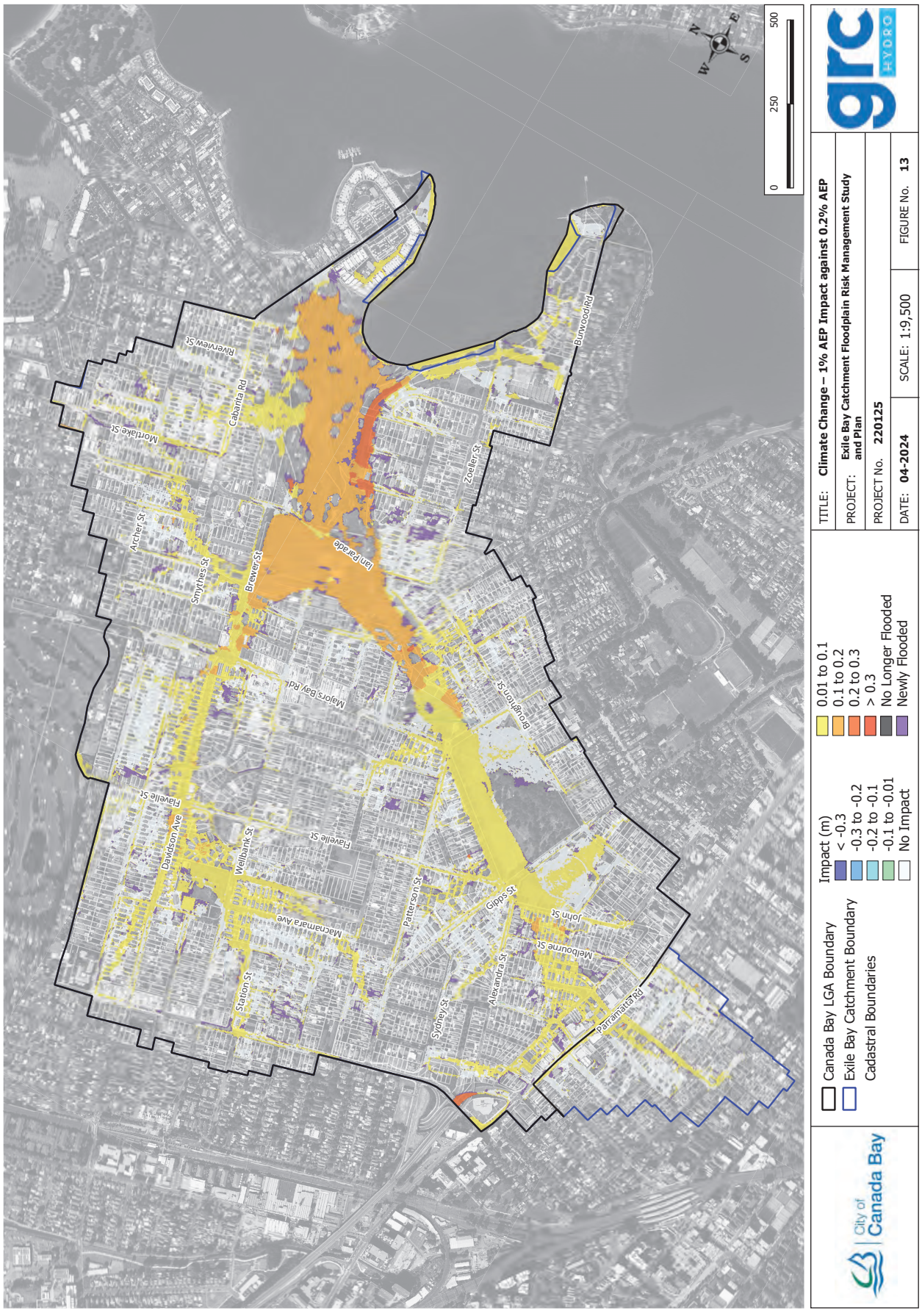
Melbourne St
Alexandra St
Sydney St
Parramatta Rd
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Flood Function
Flow Conveyance
Flood Storage
Flood Fringe
TITLE: Flood Function - 0.2% AEP Design Event
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:9,500
FIGURE No. 08
City of Canada Bay
grc HYDRO

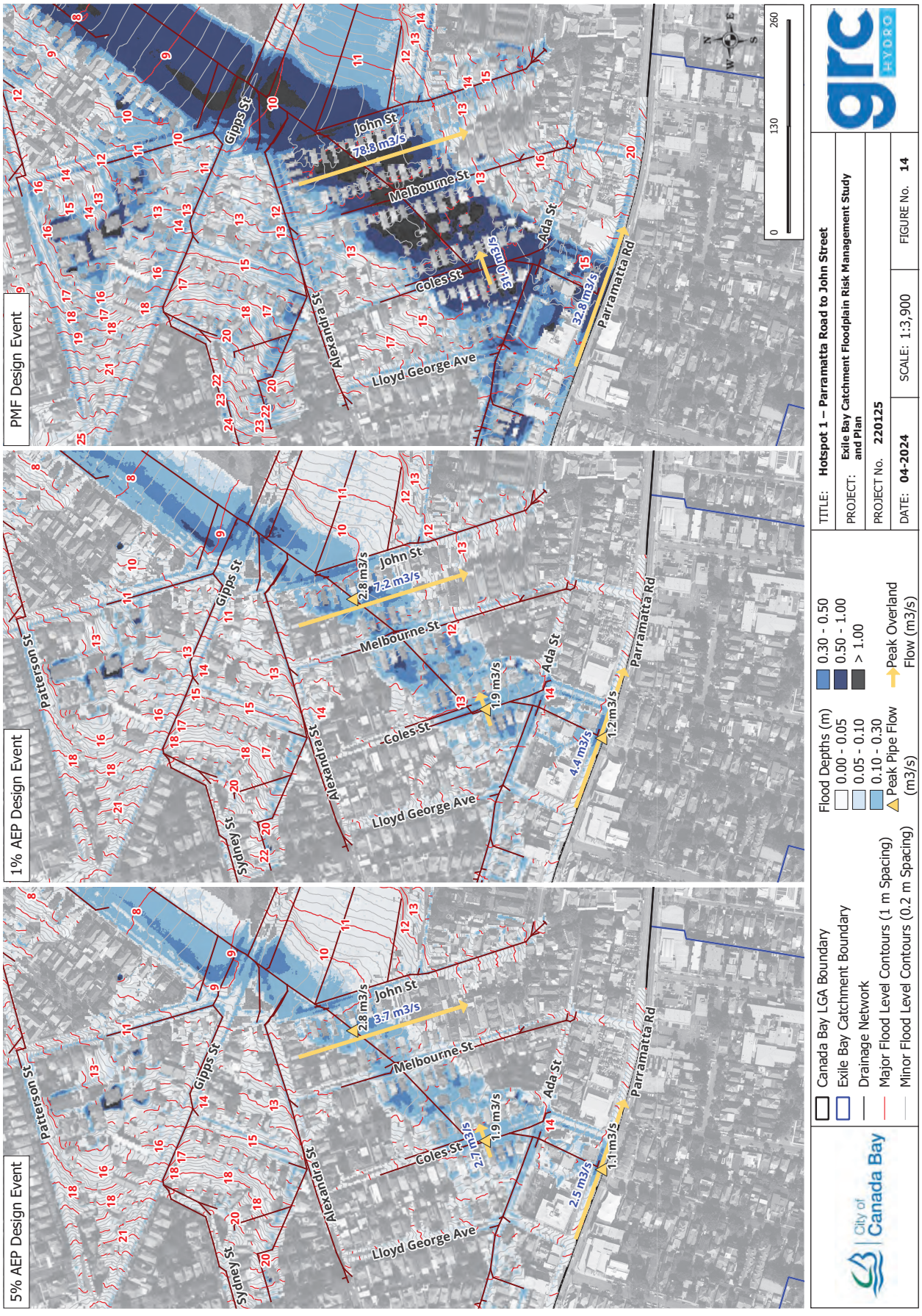

0
250
500
N
E
S
W
Burwood Rd
Riverview St
Cabarita Rd
Mortlake St
Archer St
Smythes St
Brewer St
Ian Parade
Majors Bay Rd
Broughton St
Zoeller St
Flavelle St
Dawdson Ave
Welbank St
Macnamara Ave
Patterson St
Gipps St
John St
Melbourne St
Alexandra St
Sydney St
Parramatta Rd
Saxton St
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Flood Function
Flow Conveyance
Flood Storage
Flood Fringe
TITLE: Flood Function - PMF Design Event
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:9,500
FIGURE No. 09
City of Canada Bay
grc HYDRO

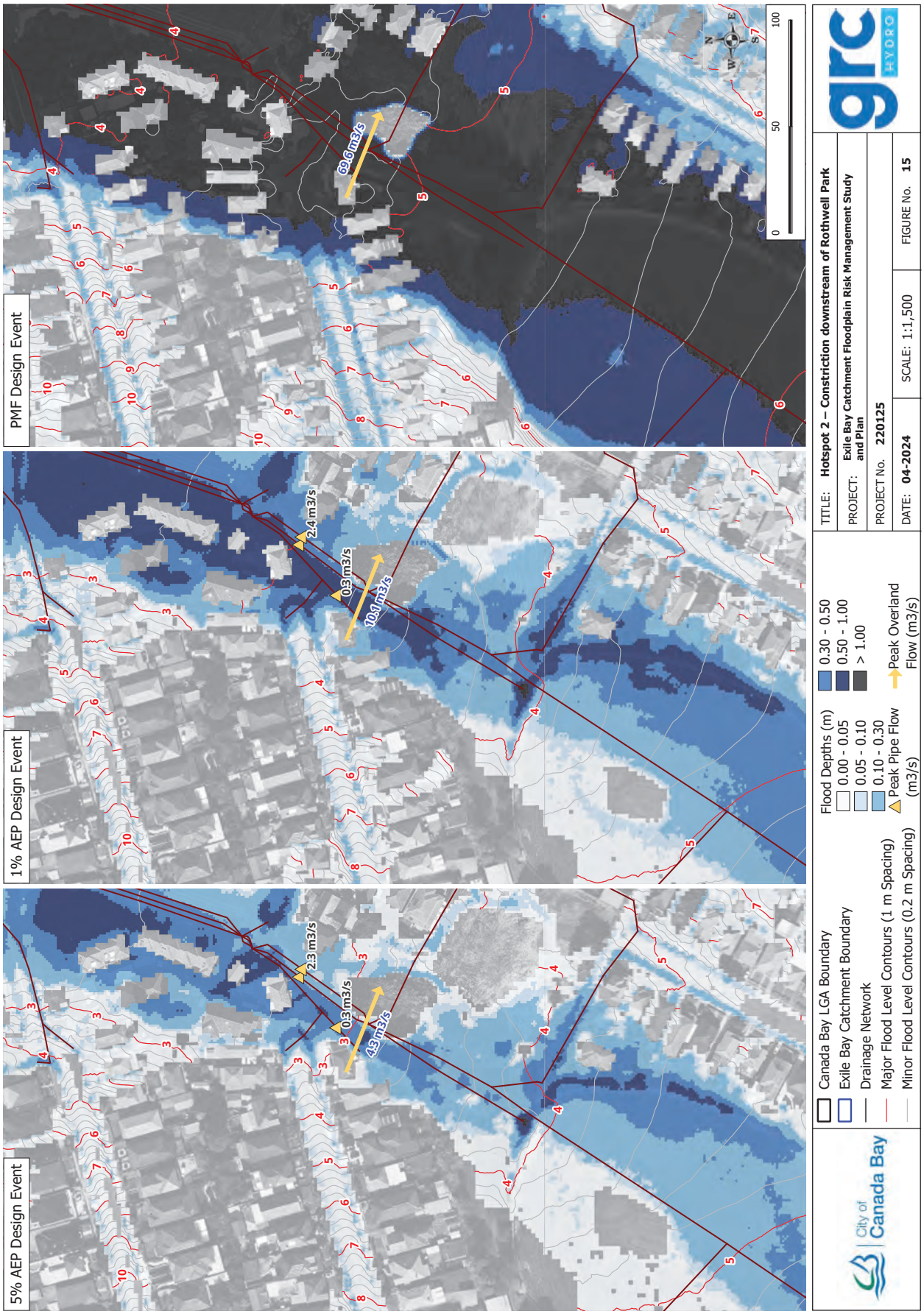

0
250
500
N
E
S
W
Riverview St
Cabarita Rd
Mortlake St
Archer St
Smythes St
Brewer St
Ian Parade
Majors Bay Rd
Flavelle St
Davidson Ave
Welbank St
Macnamara Ave
Station St
Patterson St
Sydney St
Alexandra St
Gipps St
John St
Melbourne St
Parramatta Rd
Broughton St
Zoeller St
Burwood Rd
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Flood Emergency Response Classifications
Flood Free
Elevated (FIE)
Indirect Consequence (NIC)
Overland Escape (FEO)
Rising Road (FER)
Submerged (FIS)
City of Canada Bay
TITLE: Emergency Response Classifications
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:9,500
FIGURE No. 10
grc HYDRO

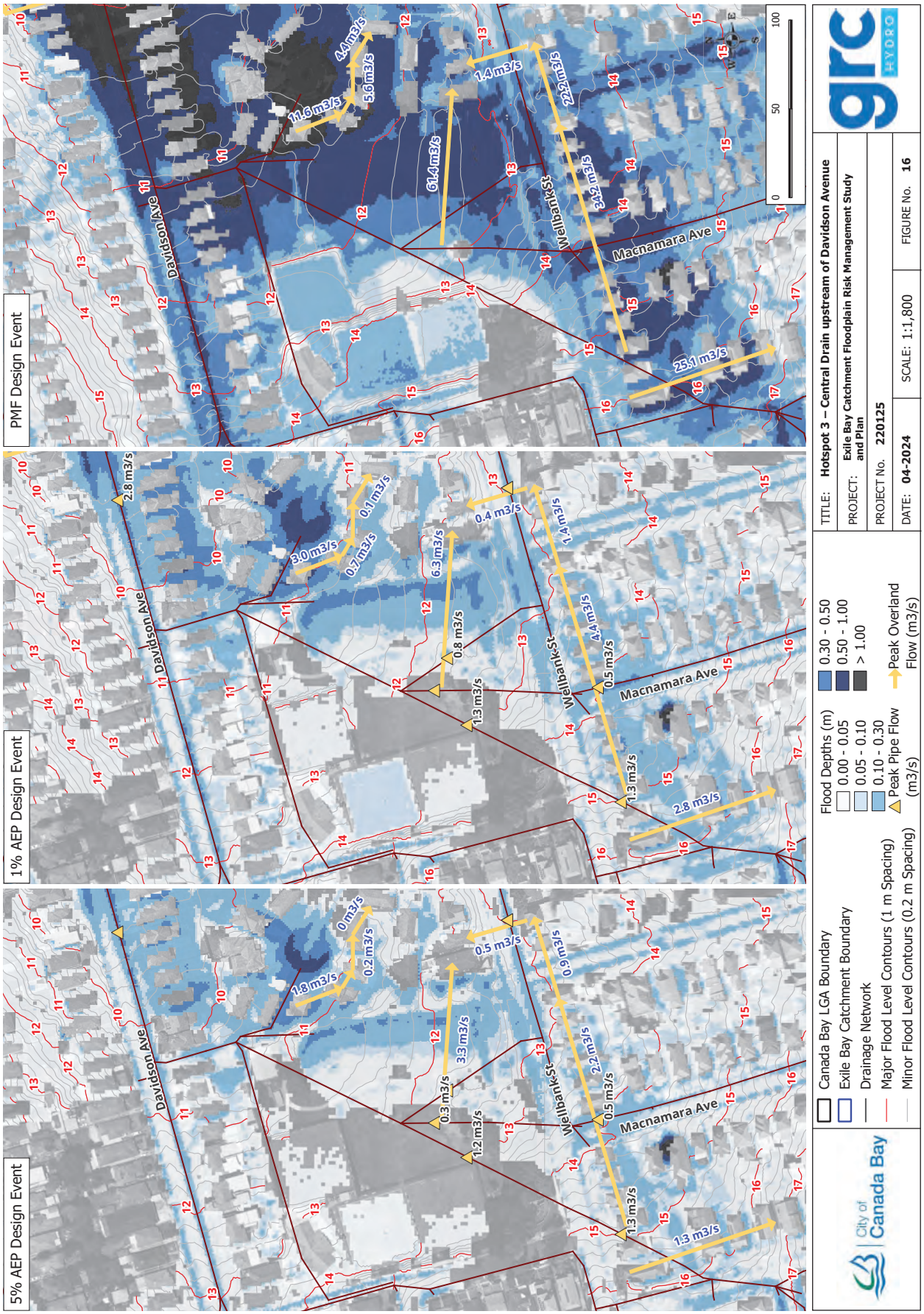

0
250
500
Riverview St
Cabarita Rd
Mortlake St
Archer St
Smythes St
Brewer St
Ian Parade
Majors Bay Rd
Flavelle St
Dawdson Ave
Wellbank St
Macnamara Ave
Station St
Patterson St
Sydney St
Gipps St
Alexandra St
John St
Melbourne St
Parramatta Rd
Broughton St
Zoeller St
Burwood Rd
Preliminary Flood Planning Area
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Flood Depths (m)
0.00 - 0.05
0.05 - 0.10
0.10 - 0.30
0.30 - 0.50
0.50 - 1.00
> 1.00
City of Canada Bay
TITLE: Flood Planning Area
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:9,500
FIGURE No. 11
grc HYDRO

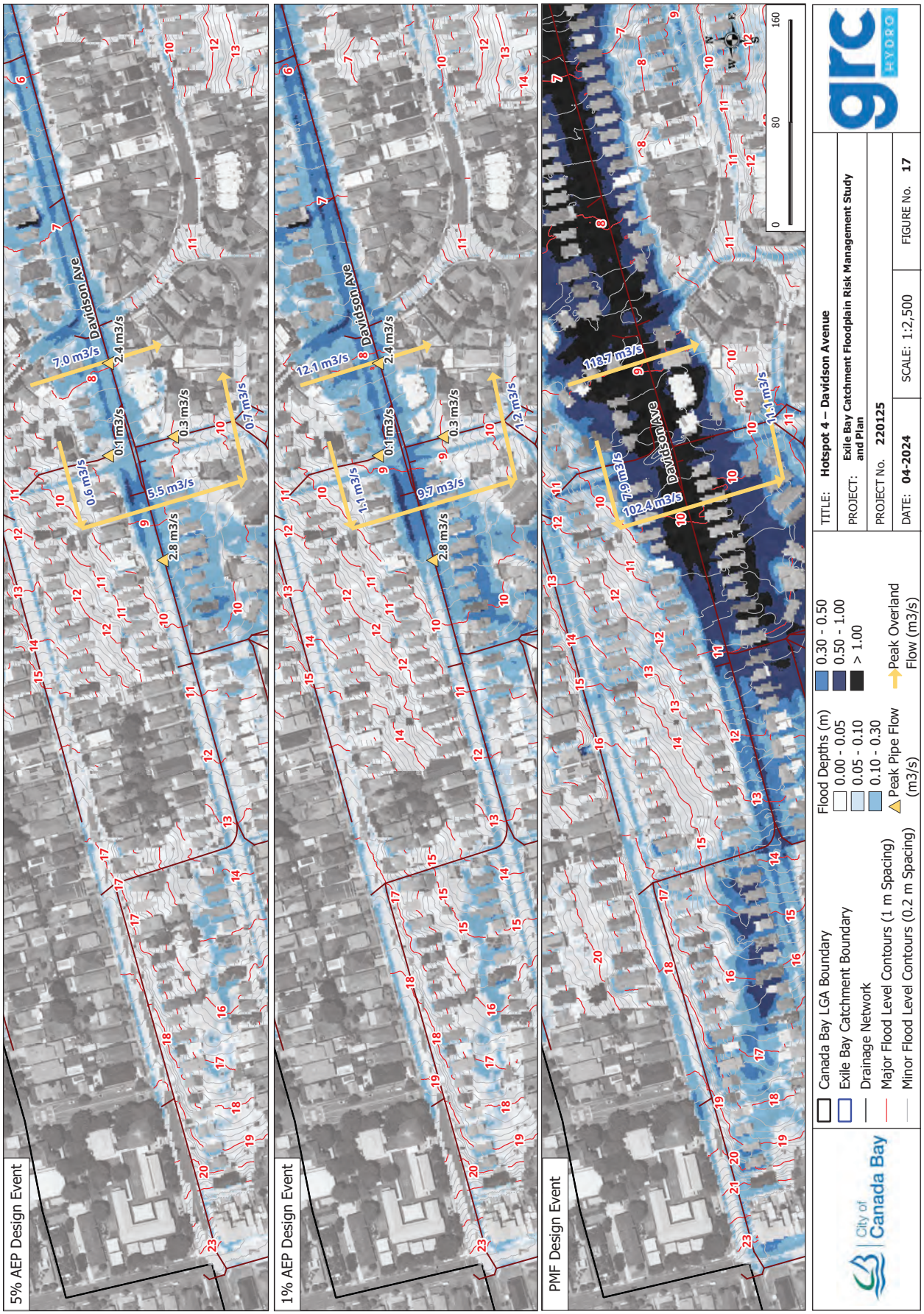

0
250
500
N
E
S
W
Riverview St
Cabarita Rd
Mortlake St
Archer St
Smythes St
Brewer St
Ian Parade
Majors Bay Rd
Broughton St
Burwood Rd
Zoeller St
Flavelle St
Dawdson Ave
Wellbank St
Macnamara Ave
Station St
Patterson St
Sydney St
Alexandra St
Gipps St
John St
Melbourne St
Parramatta Rd
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Impact (m)
< -0.3
-0.3 to -0.2
-0.2 to -0.1
-0.1 to -0.01
No Impact
0.01 to 0.1
0.1 to 0.2
0.2 to 0.3
> 0.3
No Longer Flooded
Newly Flooded
City of Canada Bay
TITLE: Climate Change – 1% AEP Impact against 0.5% AEP
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:9,500
FIGURE No. 12
grc HYDRO

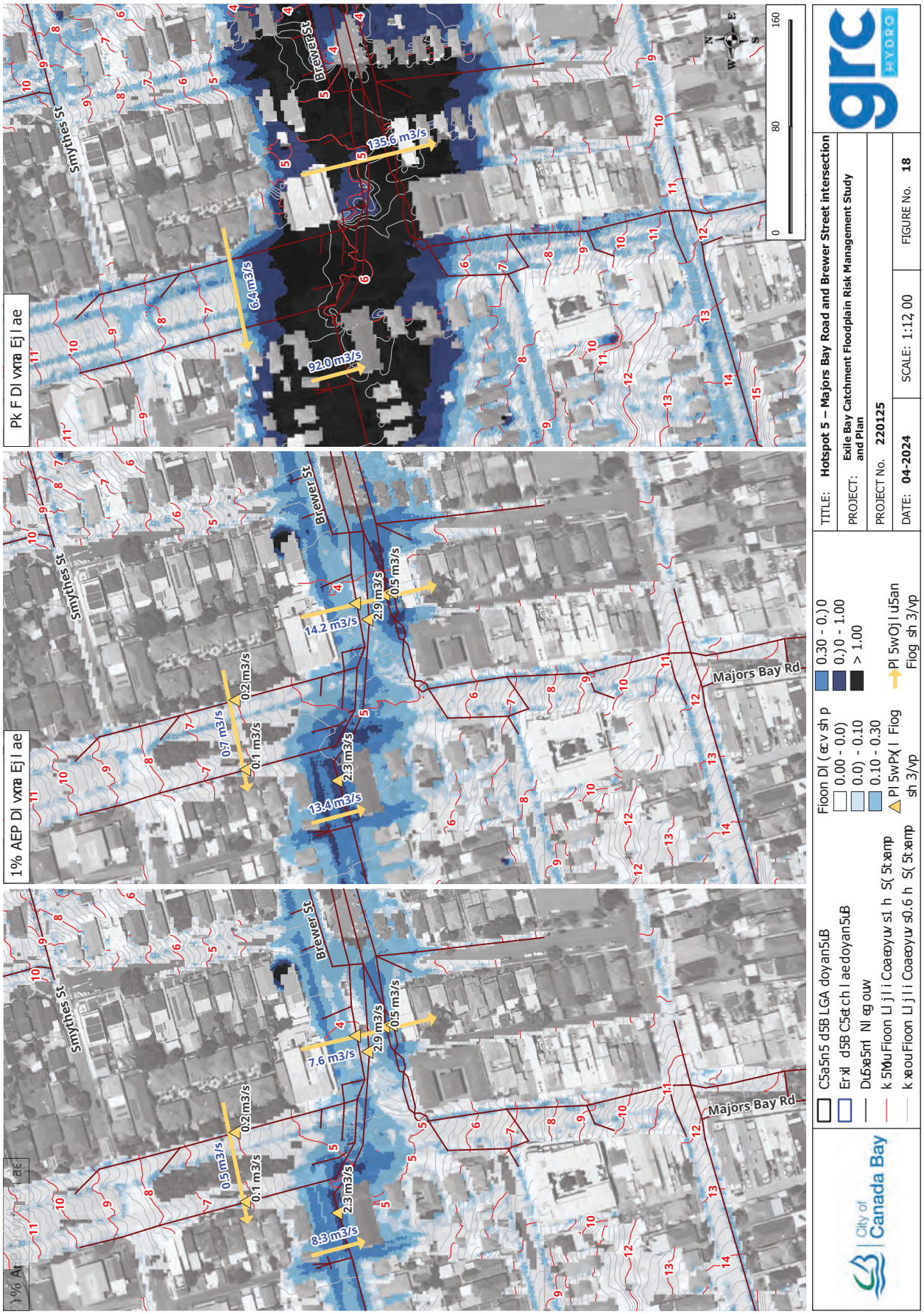

0
250
500
N
E
S
W
Riverview St
Cabarita Rd
Mortlake St
Archer St
Smythes St
Brewer St
Ian Parade
Majors Bay Rd
Flavelle St
Dawdson Ave
Wellbank St
Macnamara Ave
Station St
Patterson St
Sydney St
Alexandra St
Gipps St
John St
Melbourne St
Parramatta Rd
Broughton St
Burwood Rd
Zoeller St
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Impact (m)
< -0.3
-0.3 to -0.2
-0.2 to -0.1
-0.1 to -0.01
No Impact
0.01 to 0.1
0.1 to 0.2
0.2 to 0.3
> 0.3
No Longer Flooded
Newly Flooded
City of Canada Bay
TITLE: Climate Change – 1% AEP Impact against 0.2% AEP
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:9,500
FIGURE No. 13
grc HYDRO

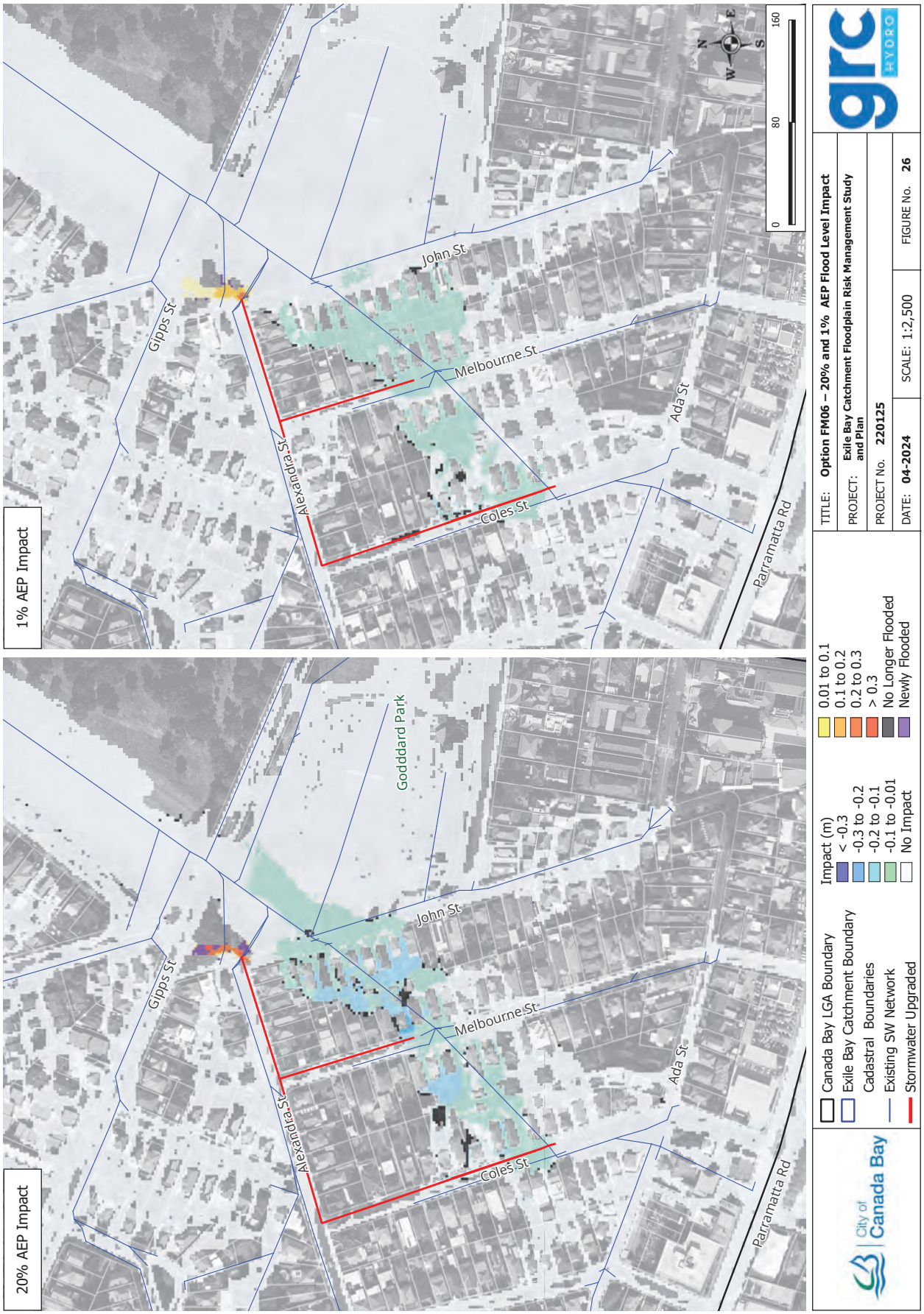

PMF Design Event
1% AEP Design Event
5% AEP Design Event
John St
Melbourne St
Coles St
Lloyd George Ave
Alexandra St
Gipps St
Patterson St
Sydney St
Ada St
Parramatta Rd
78.3 m3/s
31.0 m3/s
32.8 m3/s
7.2 m3/s
2.8 m3/s
1.9 m3/s
1.2 m3/s
4.4 m3/s
3.7 m3/s
2.7 m3/s
1.1 m3/s
2.5 m3/s
0
130
260
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Drainage Network
Major Flood Level Contours (1 m Spacing)
Minor Flood Level Contours (0.2 m Spacing)
Flood Depths (m)
0.00 - 0.05
0.05 - 0.10
0.10 - 0.30
0.30 - 0.50
0.50 - 1.00
> 1.00
Peak Pipe Flow (m3/s)
Peak Overland Flow (m3/s)
City of Canada Bay
TITLE: Hotspot 1 – Parramatta Road to John Street
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:3,900
FIGURE No. 14
grc HYDRO

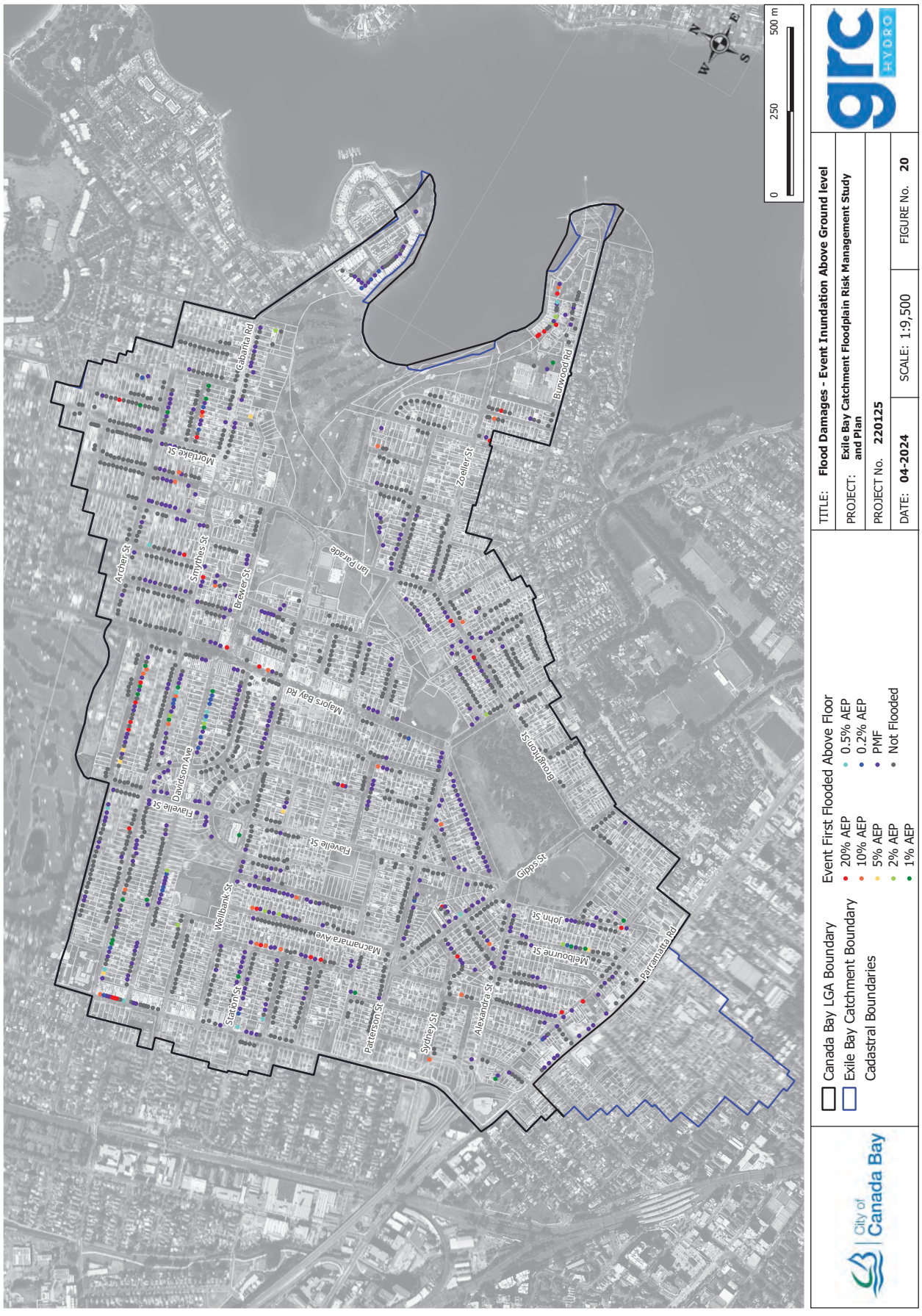

5% AEP Design Event
1% AEP Design Event
PMF Design Event
2.3 m3/s
0.3 m3/s
4.3 m3/s
2.4 m3/s
0.3 m3/s
10.1 m3/s
69.6 m3/s
0
50
100
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Drainage Network
Major Flood Level Contours (1 m Spacing)
Minor Flood Level Contours (0.2 m Spacing)
Flood Depths (m)
0.00 - 0.05
0.05 - 0.10
0.10 - 0.30
0.30 - 0.50
0.50 - 1.00
> 1.00
Peak Pipe Flow (m3/s)
Peak Overland Flow (m3/s)
City of Canada Bay
TITLE: Hotspot 2 – Constriction downstream of Rothwell Park
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:1,500
FIGURE No. 15
grc HYDRO

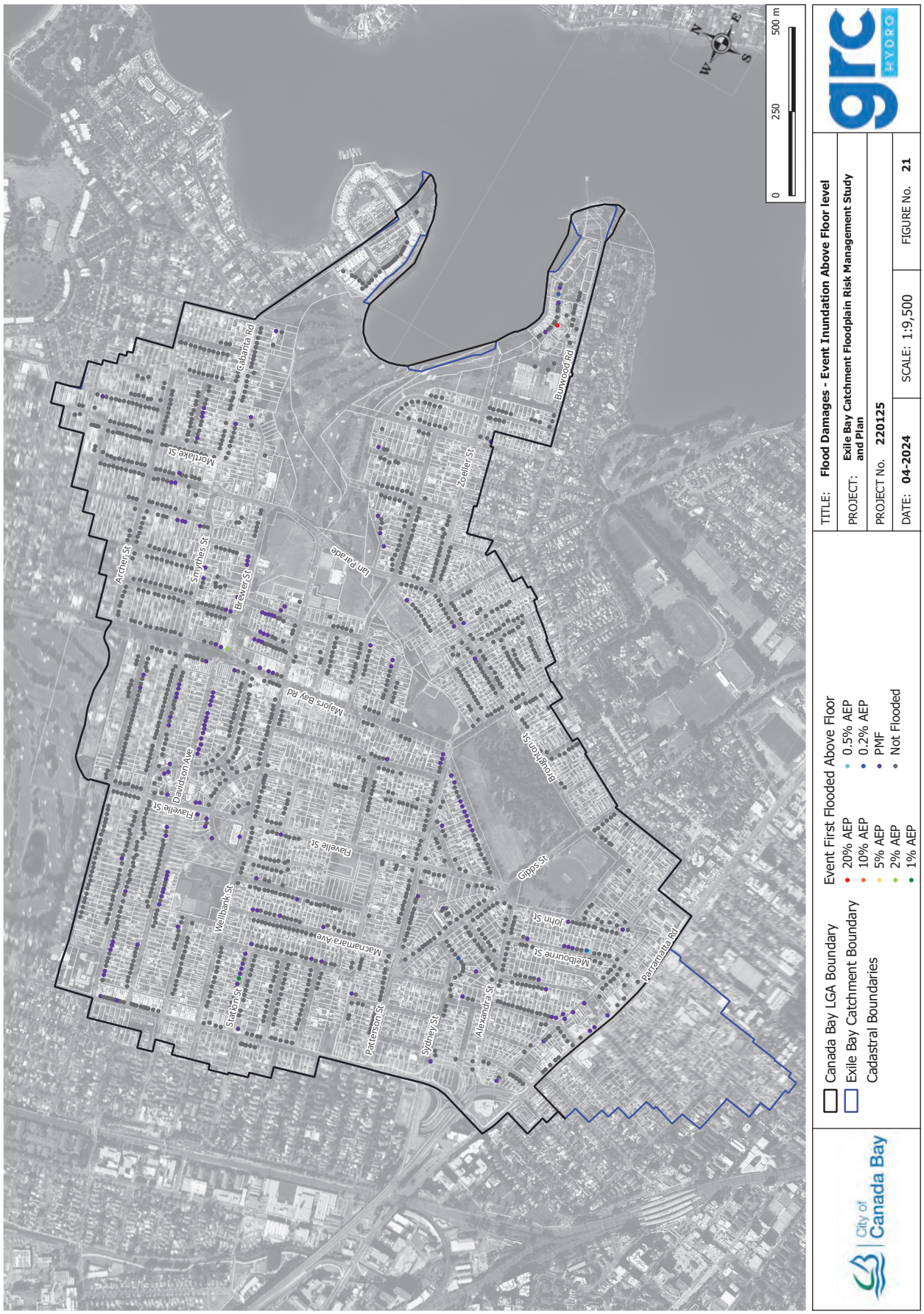

PMF Design Event
1% AEP Design Event
5% AEP Design Event
Davidson Ave
Wellbank St
Macnamara Ave
11.6 m3/s
4.4 m3/s
5.6 m3/s
61.4 m3/s
1.4 m3/s
22.2 m3/s
34.2 m3/s
25.1 m3/s
2.8 m3/s
3.0 m3/s
0.7 m3/s
0.1 m3/s
6.3 m3/s
0.4 m3/s
0.8 m3/s
1.3 m3/s
1.4 m3/s
4.4 m3/s
0.5 m3/s
1.3 m3/s
2.8 m3/s
1.8 m3/s
0 m3/s
0.2 m3/s
0.3 m3/s
3.3 m3/s
1.2 m3/s
0.5 m3/s
0.9 m3/s
2.2 m3/s
0.5 m3/s
1.3 m3/s
1.3 m3/s
0
50
100
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Drainage Network
Major Flood Level Contours (1 m Spacing)
Minor Flood Level Contours (0.2 m Spacing)
Flood Depths (m)
0.00 - 0.05
0.05 - 0.10
0.10 - 0.30
0.30 - 0.50
0.50 - 1.00
> 1.00
Peak Pipe Flow (m3/s)
Peak Overland Flow (m3/s)
City of Canada Bay
TITLE: Hotspot 3 – Central Drain upstream of Davidson Avenue
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:1,800
FIGURE No. 16
grc HYDRO

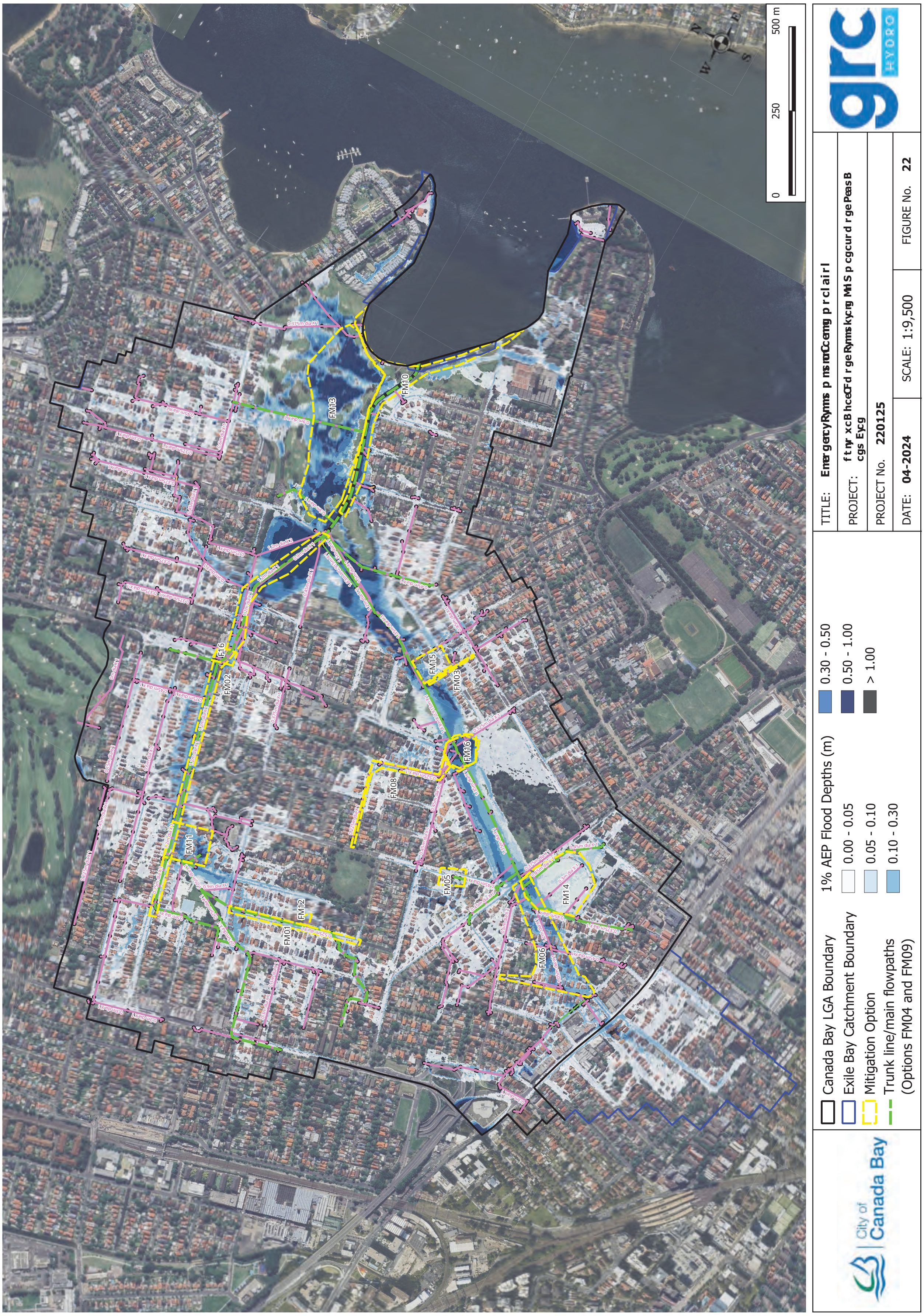

5% AEP Design Event
1% AEP Design Event
PMF Design Event
Davidson Ave
7.0 m3/s
2.4 m3/s
0.1 m3/s
0.3 m3/s
0.7 m3/s
0.6 m3/s
5.5 m3/s
2.8 m3/s
12.1 m3/s
1.1 m3/s
9.7 m3/s
1.2 m3/s
118.7 m3/s
7.9 m3/s
102.4 m3/s
11.1 m3/s
0
80
160
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Drainage Network
Major Flood Level Contours (1 m Spacing)
Minor Flood Level Contours (0.2 m Spacing)
Flood Depths (m)
0.00 - 0.05
0.05 - 0.10
0.10 - 0.30
0.30 - 0.50
0.50 - 1.00
> 1.00
Peak Pipe Flow (m3/s)
Peak Overland Flow (m3/s)
City of Canada Bay
TITLE: Hotspot 4 – Davidson Avenue
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:2,500
FIGURE No. 17
grc HYDRO

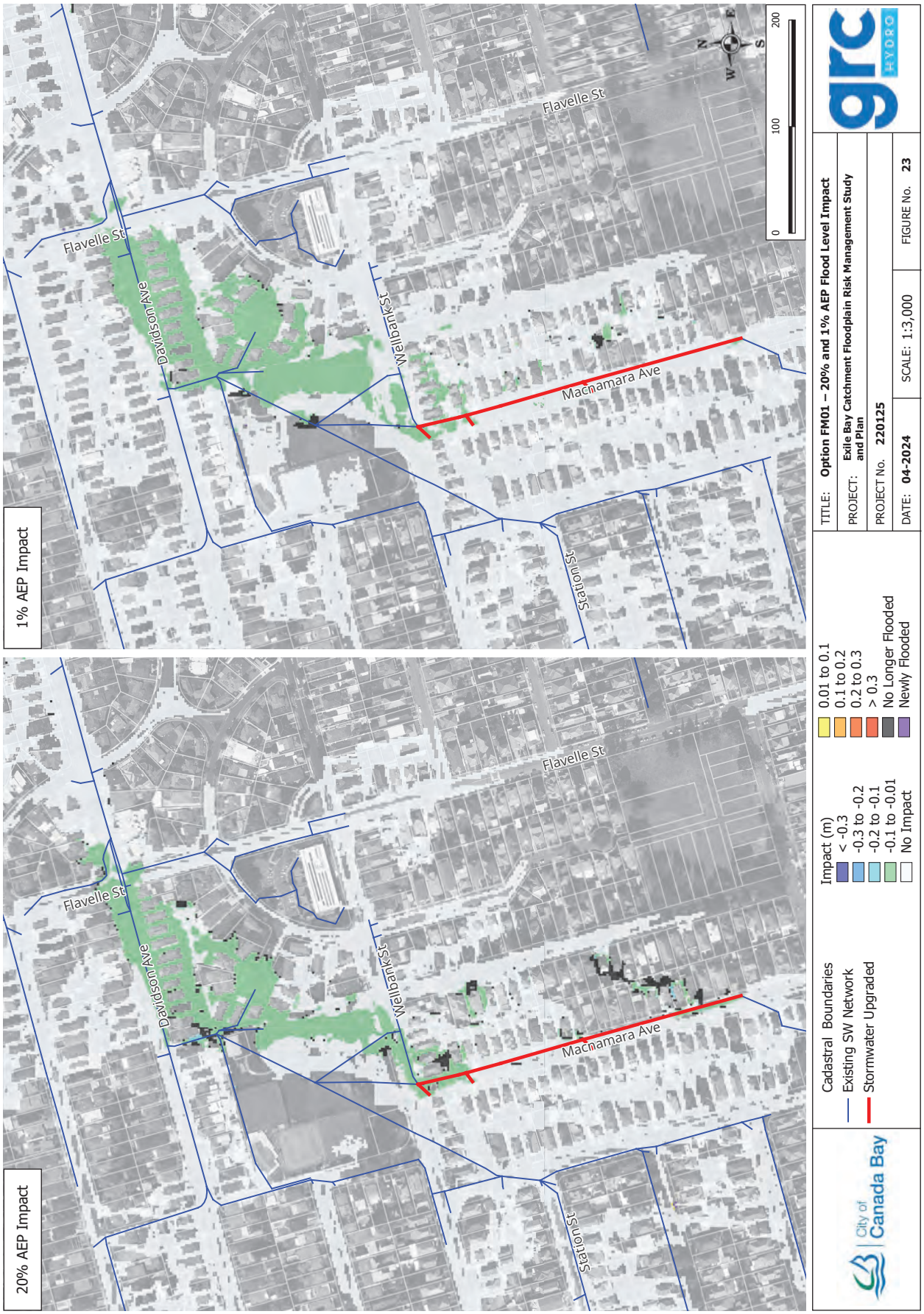

Pk F Dl vxra Ej l ae
1% AEP Dl vxra Ej l ae
Smythes St
Brewer St
Majors Bay Rd
6.4 m3/s
92.0 m3/s
135.6 m3/s
14.2 m3/s
2.9 m3/s
0.5 m3/s
0.2 m3/s
0.7 m3/s
0.1 m3/s
2.3 m3/s
13.4 m3/s
7.6 m3/s
0.5 m3/s
0.2 m3/s
0.5 m3/s
0.1 m3/s
2.3 m3/s
8.3 m3/s
0
80
160
TITLE: Hotspot 5 – Majors Bay Road and Brewer Street intersection
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:1,200
FIGURE No. 18
grc HYDRO
City of Canada Bay

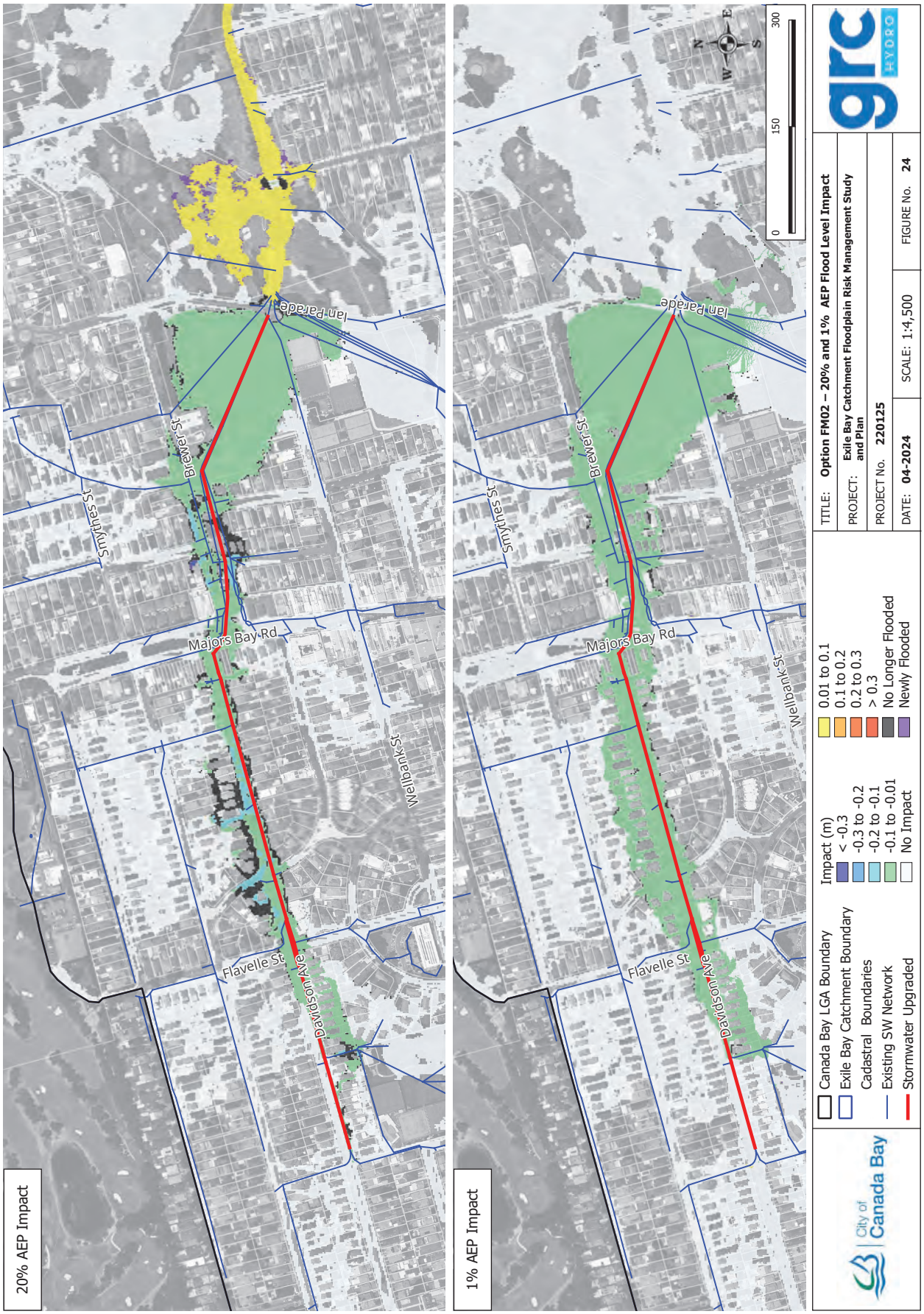

1% AEP Impact
20% AEP Impact
John St
Gipps St
Melbourne St
Ada St
Alexandra St
Coles St
Parramatta Rd
Godddard Park
N
E
S
W
0
80
160
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Existing SW Network
Stormwater Upgraded
Impact (m)
< -0.3
-0.3 to -0.2
-0.2 to -0.1
-0.1 to -0.01
No Impact
0.01 to 0.1
0.1 to 0.2
0.2 to 0.3
> 0.3
No Longer Flooded
Newly Flooded
City of Canada Bay
TITLE: Option FM06 – 20% and 1% AEP Flood Level Impact
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:2,500
FIGURE No. 26
grc HYDRO

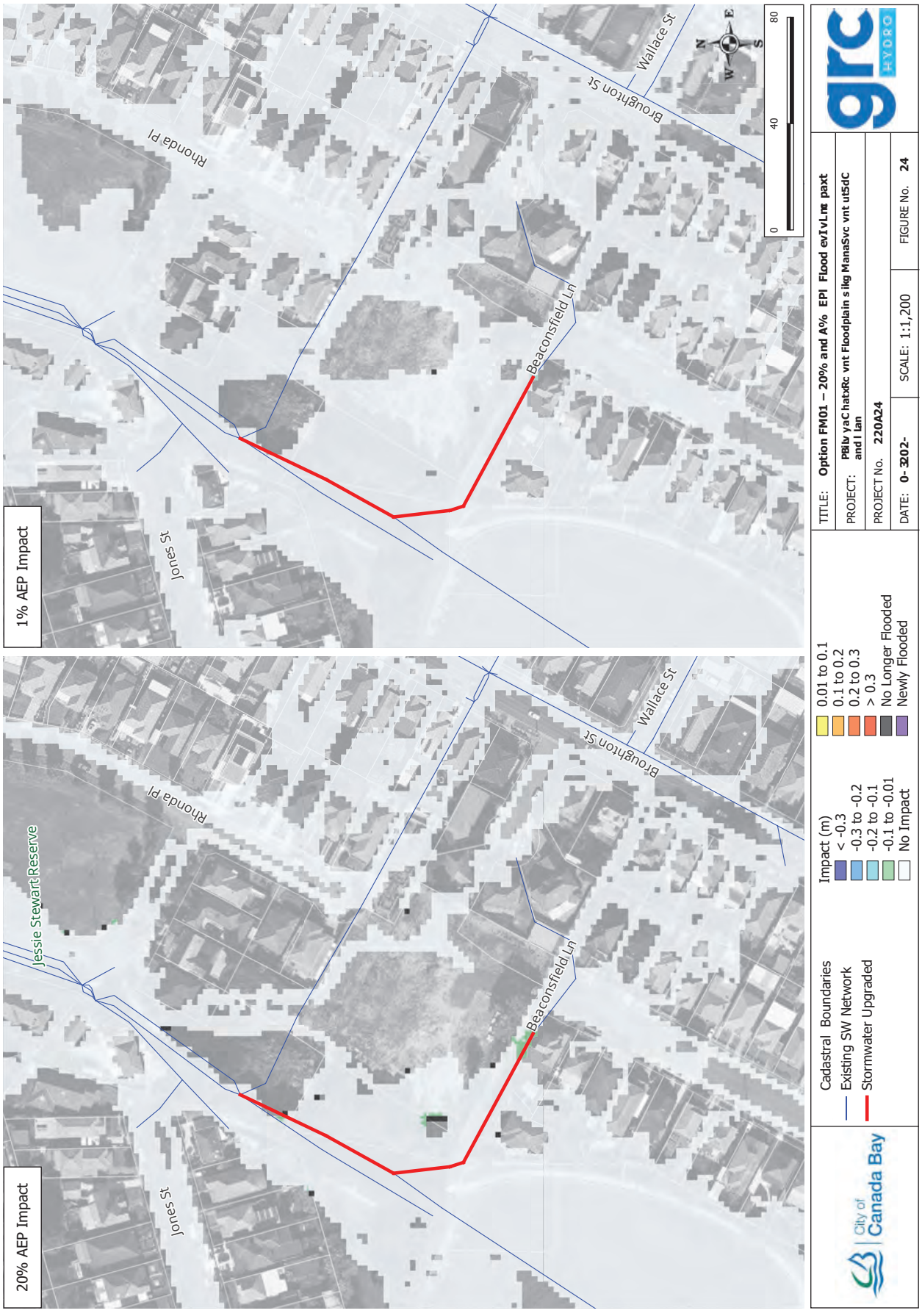

0
250
500 m
N
E
S
W
Gabarita Rd
Mortlake St
Archer St
Simmines St
Brewer St
Ian Parade
Majors Bay Rd
Davidson Ave
Flavelle St
Wellbank St
Macnamara Ave
Station St
Patterson St
Sydney St
Alexandra St
Zoeller St
Bunwood Rd
Broughton St
Gipps St
John St
Melbourne St
Parramatta Rd
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Event First Flooded Above Floor
20% AEP
10% AEP
5% AEP
2% AEP
1% AEP
0.5% AEP
0.2% AEP
PMF
Not Flooded
TITLE: Flood Damages - Event Inundation Above Ground level
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:9,500
FIGURE No. 20
City of Canada Bay
grc HYDRO

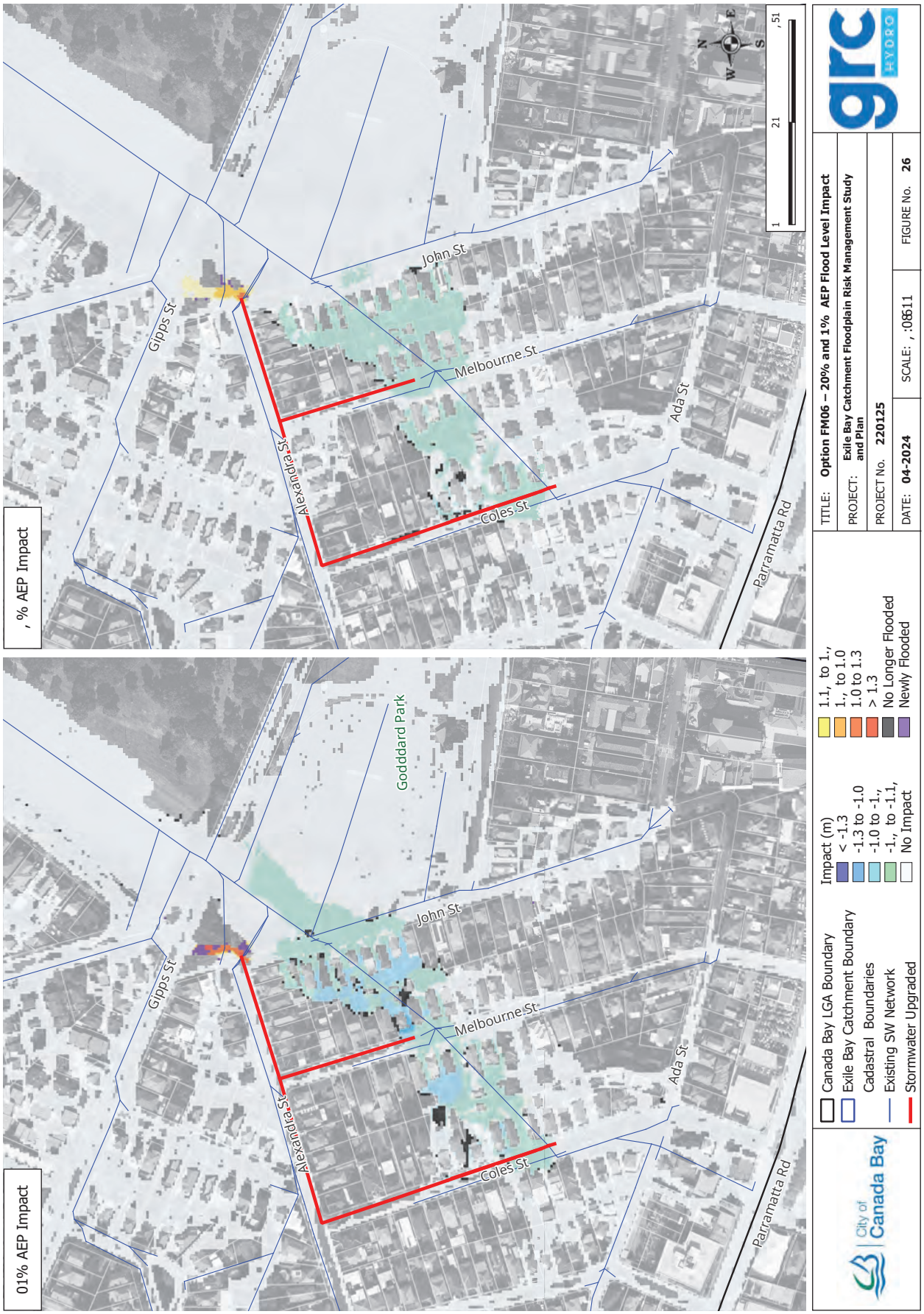

0
250
500 m
N
E
S
W
Gabarita Rd
Mortlake St
Archer St
Smythes St
Brewer St
Ian Parade
Majors Bay Rd
Davidson Ave
Flavelle St
Wellbank St
Macnamara Ave
Station St
Patterson St
Sydney St
Alexandra St
Zoeller St
Bunwood Rd
Broughton St
Gipps St
John St
Melbourne St
Parramatta Rd
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Event First Flooded Above Floor
20% AEP
10% AEP
5% AEP
2% AEP
1% AEP
0.5% AEP
0.2% AEP
PMF
Not Flooded
TITLE: Flood Damages - Event Inundation Above Floor level
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:9,500
FIGURE No. 21
City of Canada Bay
grc HYDRO

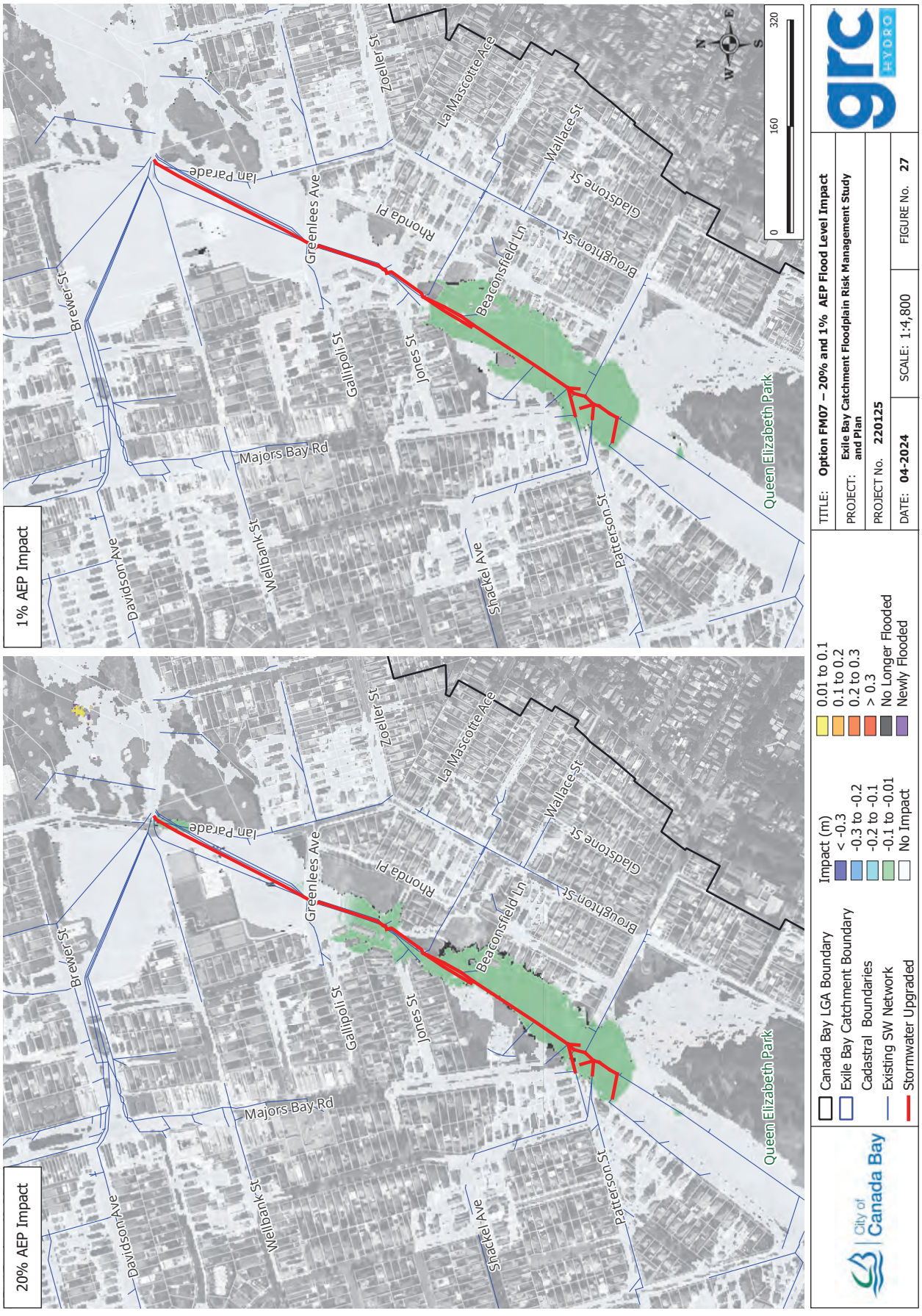

1% AEP Flood Depths (m)
0.00 - 0.05
0.05 - 0.10
0.10 - 0.30
0.30 - 0.50
0.50 - 1.00
> 1.00
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Mitigation Option
Trunk line/main flowpaths
(Options FM04 and FM09)
TITLE:
PROJECT:
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:9,500
FIGURE No. 22
0
250
500 m
FM01
FM02
FM03
FM05
FM06
FM08
FM10
FM11
FM12
FM13
FM14
FM15
FM16
City of Canada Bay
grc HYDRO

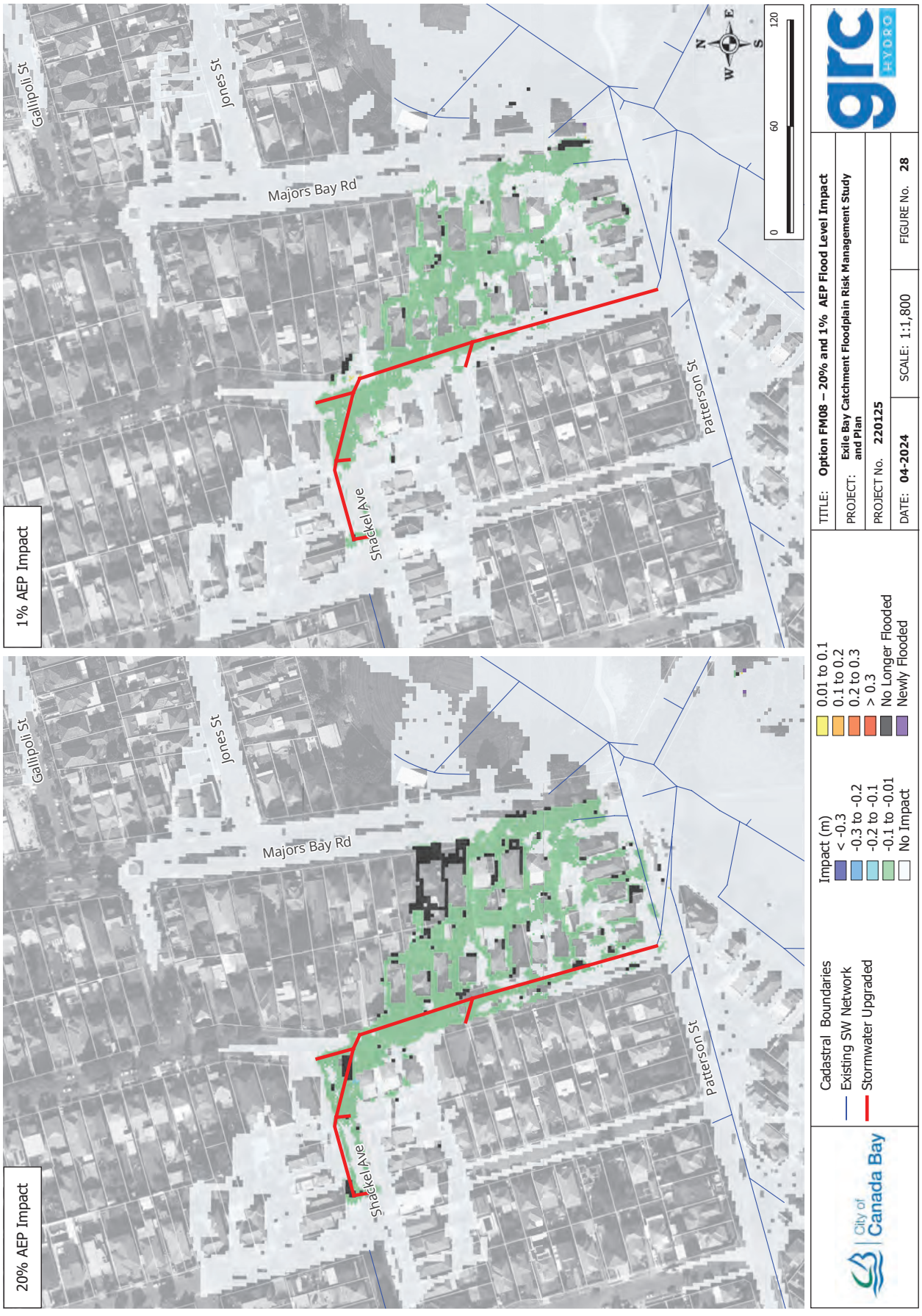

1% AEP Impact
20% AEP Impact
Flavelle St
Davidson Ave
Wellbank St
Macnamara Ave
Station St
0
100
200
N
E
S
W
Cadastral Boundaries
Existing SW Network
Stormwater Upgraded
Impact (m)
< -0.3
-0.3 to -0.2
-0.2 to -0.1
-0.1 to -0.01
No Impact
0.01 to 0.1
0.1 to 0.2
0.2 to 0.3
> 0.3
No Longer Flooded
Newly Flooded
City of Canada Bay
TITLE: Option FM01 – 20% and 1% AEP Flood Level Impact
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:3,000
FIGURE No. 23
grc HYDRO

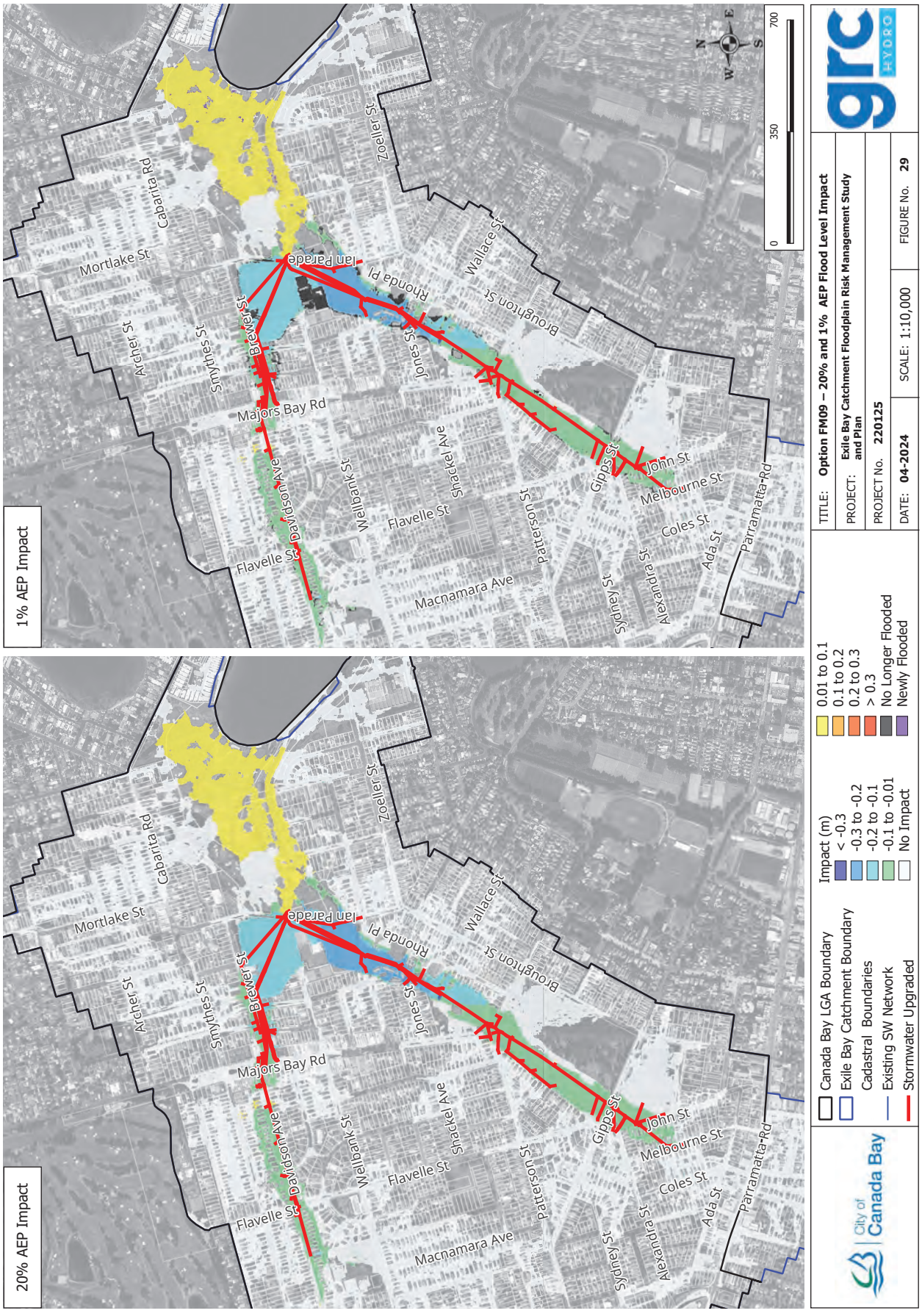

20% AEP Impact
1% AEP Impact
Ian Parade
Brewer St
Smythes St
Majors Bay Rd
Wellbank St
Flavelle St
Davidson Ave
0
150
300
N
E
S
W
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Existing SW Network
Stormwater Upgraded
Impact (m)
< -0.3
-0.3 to -0.2
-0.2 to -0.1
-0.1 to -0.01
No Impact
0.01 to 0.1
0.1 to 0.2
0.2 to 0.3
> 0.3
No Longer Flooded
Newly Flooded
City of Canada Bay
TITLE: Option FM02 – 20% and 1% AEP Flood Level Impact
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:4,500
FIGURE No. 24
grc HYDRO

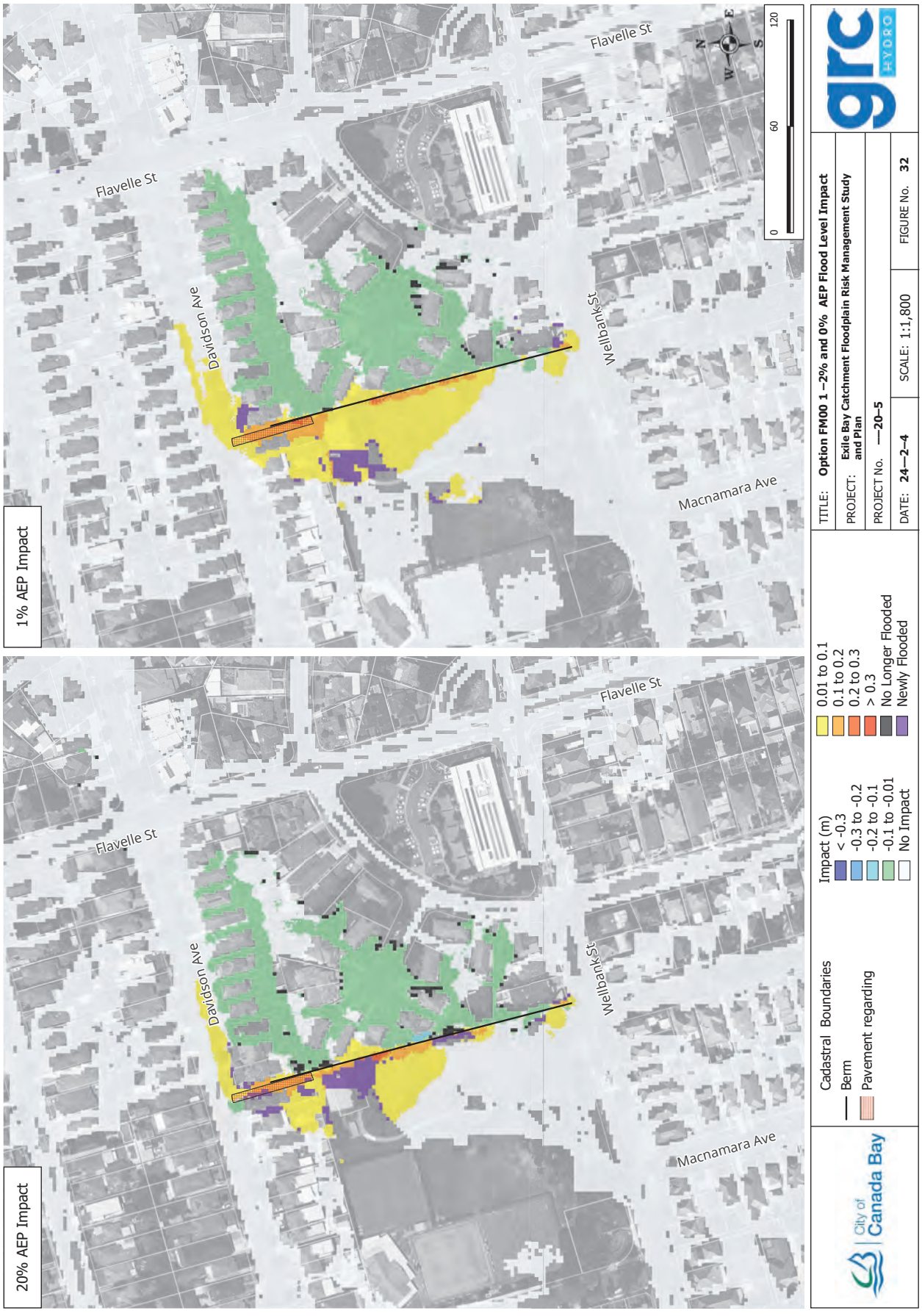

1% AEP Impact
20% AEP Impact
Rhonda Pl
Jones St
Beaconsfield Ln
Broughton St
Wallace St
Jessie Stewart Reserve
0
40
80
N
E
S
W
Cadastral Boundaries
Existing SW Network
Stormwater Upgraded
Impact (m)
< -0.3
-0.3 to -0.2
-0.2 to -0.1
-0.1 to -0.01
No Impact
0.01 to 0.1
0.1 to 0.2
0.2 to 0.3
> 0.3
No Longer Flooded
Newly Flooded
TITLE: Option FM01 – 20% and A% EPI Flood
PROJECT: PBilv yaC hatxRc vnt Floodplain s ilg ManaSvc vnt utSdC and l ian
PROJECT No. 220A24
DATE: 0-3202-
SCALE: 1:1,200
FIGURE No. 24
City of Canada Bay
grc HYDRO


, % AEP Impact
01% AEP Impact
John St
Gipps St
Melbourne St
Alexandra St
Coles St
Ada St
Parramatta Rd
Godddard Park
1
21
, 51
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Existing SW Network
Stormwater Upgraded
Impact (m)
< -1.3
-1.3 to -1.0
-1.0 to -1.,
-1., to -1.1,
No Impact
1.1, to 1.,
1., to 1.0
1.0 to 1.3
> 1.3
No Longer Flooded
Newly Flooded
City of Canada Bay
TITLE: Option FM06 – 20% and 1% AEP Flood Level Impact
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: , :0811
FIGURE No. 26
grc HYDRO

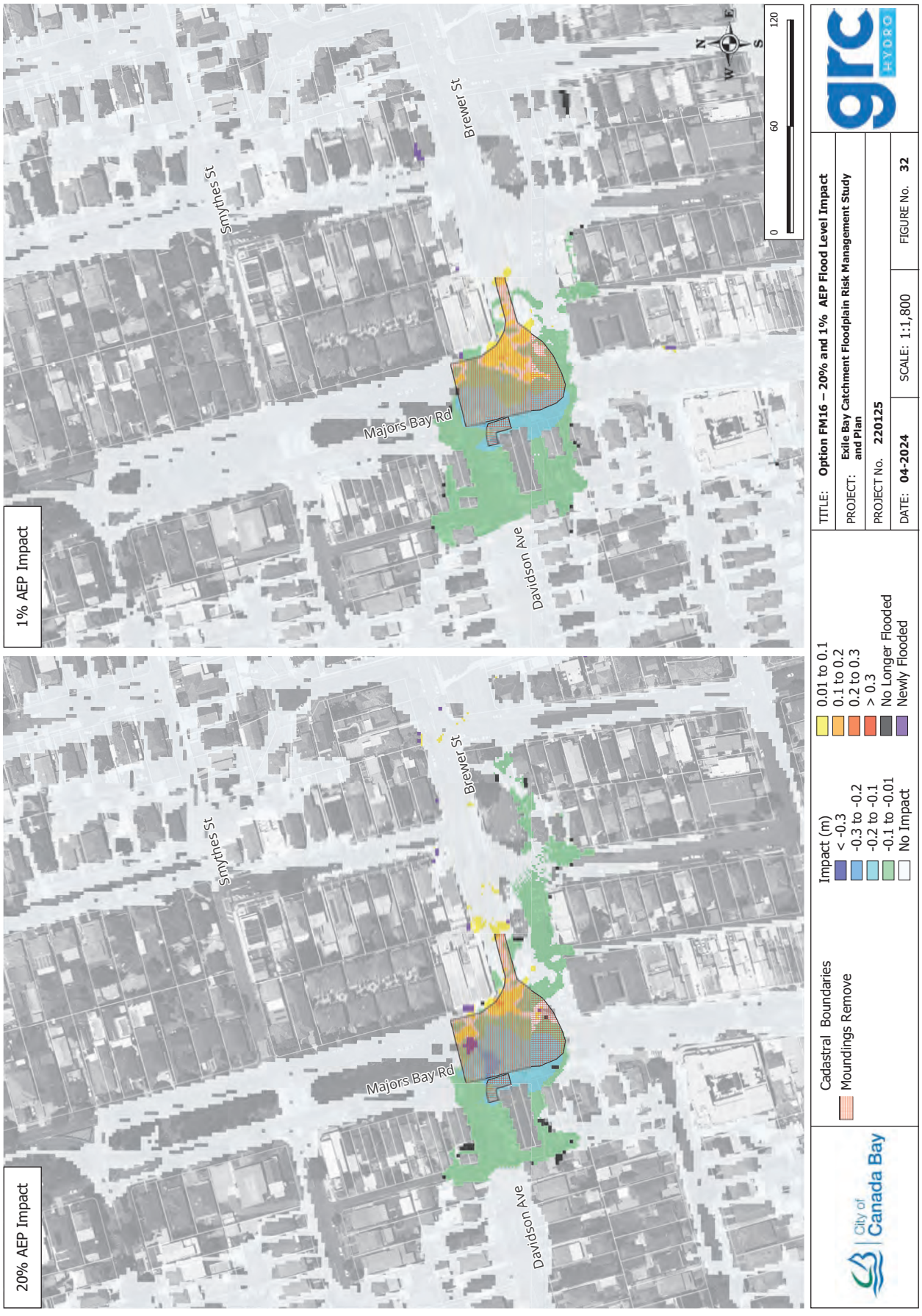

1% AEP Impact
20% AEP Impact
Ian Parade
Greenlees Ave
Rhonda Pl
Beaconsfield Ln
Brewer St
Davidson Ave
Wellbank St
Majors Bay Rd
Gallipoli St
Jones St
Zoeller St
La Mascotte Ave
Wallace St
Gladstone St
Broughton St
Shackel Ave
Patterson St
Queen Elizabeth Park
0
160
320
N
S
E
W
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Existing SW Network
Stormwater Upgraded
Impact (m)
< -0.3
-0.3 to -0.2
-0.2 to -0.1
-0.1 to -0.01
No Impact
0.01 to 0.1
0.1 to 0.2
0.2 to 0.3
> 0.3
No Longer Flooded
Newly Flooded
City of Canada Bay
TITLE: Option FM07 – 20% and 1% AEP Flood Level Impact
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:4,800
FIGURE No. 27
grc HYDRO

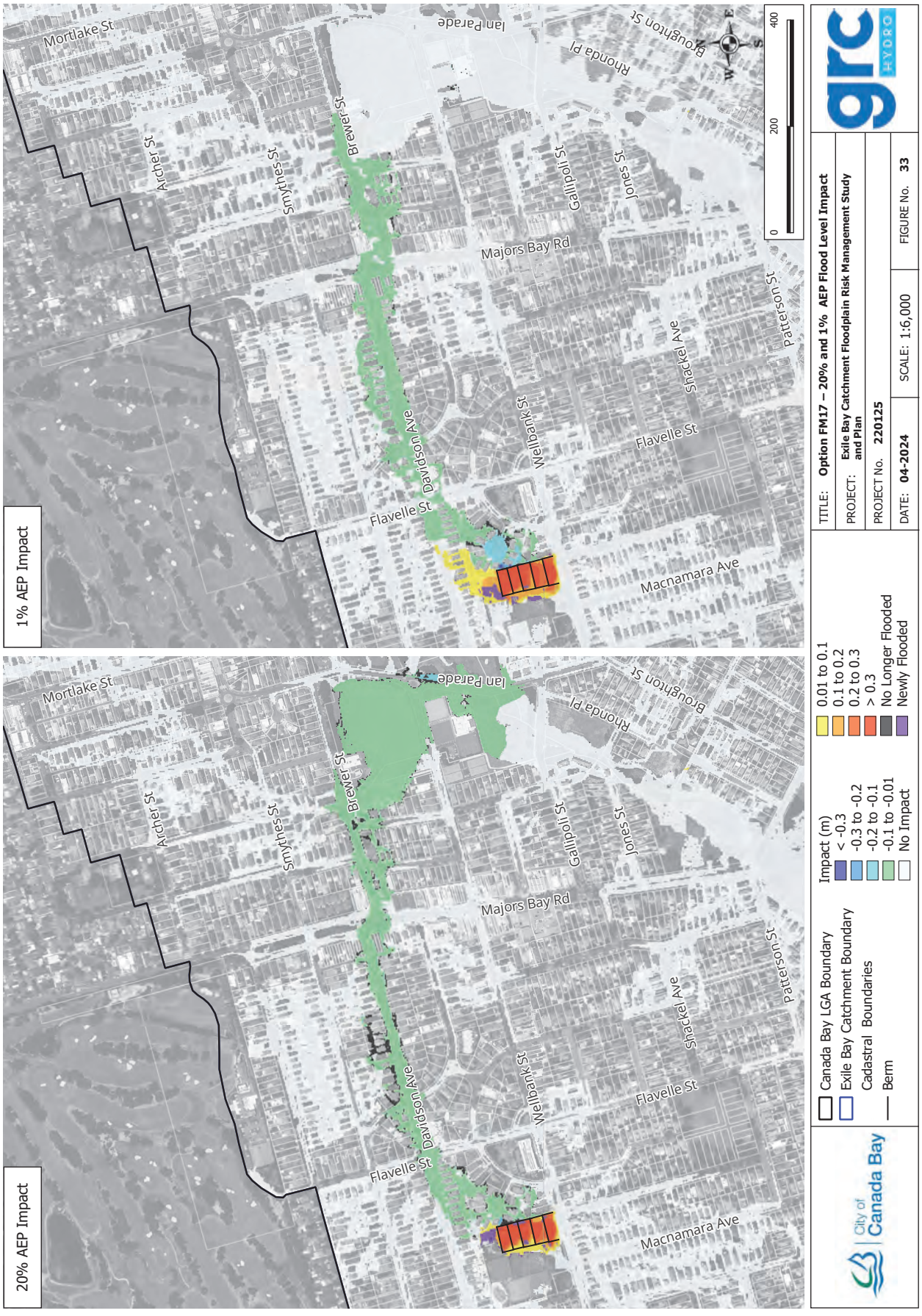

1% AEP Impact
20% AEP Impact
Gallipoli St
Jones St
Majors Bay Rd
Patterson St
Shackel Ave
N
E
S
W
0
60
120
Cadastral Boundaries
Existing SW Network
Stormwater Upgraded
Impact (m)
< -0.3
-0.3 to -0.2
-0.2 to -0.1
-0.1 to -0.01
No Impact
0.01 to 0.1
0.1 to 0.2
0.2 to 0.3
> 0.3
No Longer Flooded
Newly Flooded
City of Canada Bay
TITLE: Option FM08 – 20% and 1% AEP Flood Level Impact
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:1,800
FIGURE No. 28
grc HYDRO

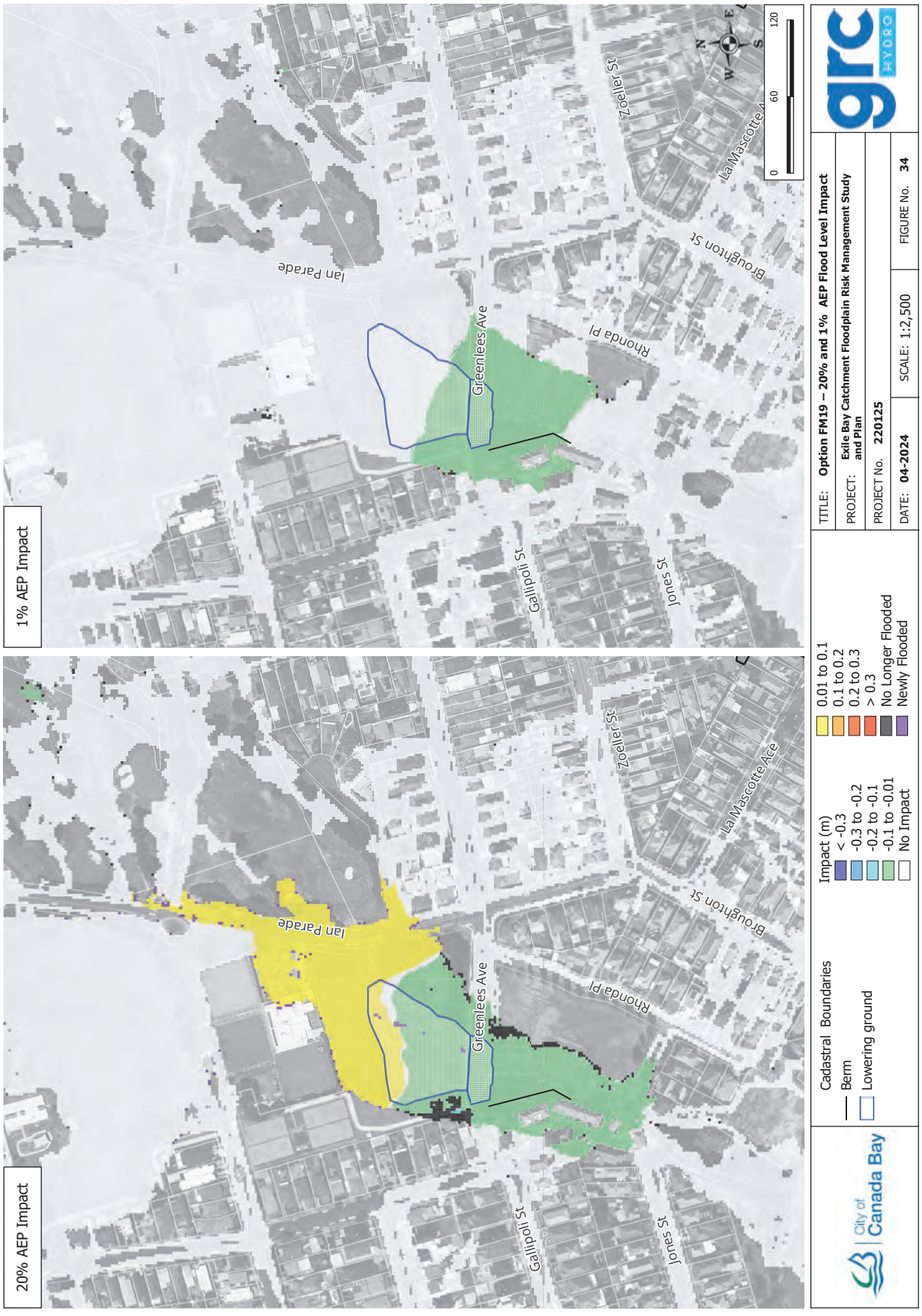

1% AEP Impact
20% AEP Impact
Mortlake St
Cabarita Rd
Archer St
Smythes St
Brewer St
Ian Parade
Rhonda Pl
Zoeller St
Wallace St
Broughton St
Jones St
Majors Bay Rd
Davidson Ave
Wellbank St
Flavelle St
Shackel Ave
Patterson St
Gipps St
John St
Melbourne St
Coles St
Ada St
Parramatta Rd
Sydney St
Alexandra St
Macnamara Ave
0
350
700
N
E
S
W
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Existing SW Network
Stormwater Upgraded
Impact (m)
< -0.3
-0.3 to -0.2
-0.2 to -0.1
-0.1 to -0.01
No Impact
0.01 to 0.1
0.1 to 0.2
0.2 to 0.3
> 0.3
No Longer Flooded
Newly Flooded
City of Canada Bay
TITLE: Option FM09 – 20% and 1% AEP Flood Level Impact
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:10,000
FIGURE No. 29
grc HYDRO


1% AEP Impact
20% AEP Impact
Flavelle St
Davidson Ave
Wellbank St
Macnamara Ave
0
60
120
N
E
S
W
Cadastral Boundaries
Berm
Pavement regarding
Impact (m)
< -0.3
-0.3 to -0.2
-0.2 to -0.1
-0.1 to -0.01
No Impact
0.01 to 0.1
0.1 to 0.2
0.2 to 0.3
> 0.3
No Longer Flooded
Newly Flooded
City of Canada Bay
TITLE: Option FM00 1 –2% and 0% AEP Flood Level Impact
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. —20–5
DATE: 24—2–4
SCALE: 1:1,800
FIGURE No. 32
grc HYDRO


1% AEP Impact
20% AEP Impact
Mortlake St
Cabarita Rd
Archer St
Smythes St
Brewer St
Ian Parade
Rhonda Pl
Zoeller St
La Mascotte Ave
Wallace St
Broughton St
Gallipoli St
Jones St
Majors Bay Rd
Davidson Ave
Wellbank St
Shackel Ave
Patterson St
Gipps St
John St
Melbourne St
Flavelle St
Coles St
0
300
600
N
W
E
S
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Berm
Impact (m)
< -0.3
-0.3 to -0.2
-0.2 to -0.1
-0.1 to -0.01
No Impact
0.01 to 0.1
0.1 to 0.2
0.2 to 0.3
> 0.3
No Longer Flooded
Newly Flooded
City of Canada Bay
TITLE: Option FM01 – 2% dnA 0a EPI FlooA ev1vLm pdxt
PROJECT: PBilv ydC hdtvRc vnt FlooApIdin s ikg MdndSvc vnt utSAC dnA I Idn
PROJECT No. 229024
DATE: 9/1-29/21
SCALE: 1:8,000
FIGURE No. 30
grc HYDRO


1% AEP Impact
20% AEP Impact
Smythes St
Brewer St
Majors Bay Rd
Davidson Ave
0
60
120
N
S
W
E
Cadastral Boundaries
Moundings Remove
Impact (m)
< -0.3
-0.3 to -0.2
-0.2 to -0.1
-0.1 to -0.01
No Impact
0.01 to 0.1
0.1 to 0.2
0.2 to 0.3
> 0.3
No Longer Flooded
Newly Flooded
City of Canada Bay
TITLE: Option FM16 – 20% and 1% AEP Flood Level Impact
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:1,800
FIGURE No. 32
grc HYDRO


1% AEP Impact
20% AEP Impact
Mortlake St
Archer St
Smythes St
Brewer St
Ian Parade
Rhonda Pl
Broughton St
Gallipoli St
Jones St
Majors Bay Rd
Patterson St
Shackel Ave
Wellbank St
Davidson Ave
Flavelle St
Macnamara Ave
0
200
400
Canada Bay LGA Boundary
Exile Bay Catchment Boundary
Cadastral Boundaries
Berm
Impact (m)
< -0.3
-0.3 to -0.2
-0.2 to -0.1
-0.1 to -0.01
No Impact
0.01 to 0.1
0.1 to 0.2
0.2 to 0.3
> 0.3
No Longer Flooded
Newly Flooded
TITLE: Option FM17 – 20% and 1% AEP Flood Level Impact
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:6,000
FIGURE No. 33
City of Canada Bay
grc HYDRO


1% AEP Impact
20% AEP Impact
Ian Parade
Greenlees Ave
Rhonda Pl
Broughton St
Zoeller St
La Mascotte Ave
Gallipoli St
Jones St
0
60
120
N
E
S
W
Cadastral Boundaries
Berm
Lowering ground
Impact (m)
< -0.3
-0.3 to -0.2
-0.2 to -0.1
-0.1 to -0.01
No Impact
0.01 to 0.1
0.1 to 0.2
0.2 to 0.3
> 0.3
No Longer Flooded
Newly Flooded
City of Canada Bay
TITLE: Option FM19 – 20% and 1% AEP Flood Level Impact
PROJECT: Exile Bay Catchment Floodplain Risk Management Study and Plan
PROJECT No. 220125
DATE: 04-2024
SCALE: 1:2,500
FIGURE No. 34
grc HYDRO

Attachment 1– Investment Report JULY 2025

INVESTMENT
REPORT
JULY 2025

INVESTMENT REPORT JULY 2025

Contents

Investment Report JULY 2025

July 2025 Investment Report

Statement of Cash Investments as of 31 July 2025

STATEMENT OF CASH INVESTMENTS							
Maturity Date	Bank/Issuer	Long Term Rating	Fair Value	Term	Interest	Issue Date	Investment Type
08/08/25	ING	A	$2,000,000.00	365	5.04%	08/08/24	Term Deposits
14/08/25	ANZ	AA-	$3,000,000.00	210	5.00%	16/01/25	Term Deposits
26/08/25	ING	A	$2,000,000.00	368	4.90%	23/08/24	Term Deposits
04/09/25	National Australia Bank (NAB)	AA-	$2,000,000.00	371	4.90%	29/08/24	Term Deposits
11/09/25	ING	A	$2,500,000.00	372	4.93%	04/09/24	Term Deposits
18/09/25	State Bank of India, Sydney Branch	BBB-	$2,500,000.00	154	4.85%	17/04/25	Term Deposits
25/09/25	ANZ	AA-	$2,000,000.00	287	5.06%	12/12/24	Term Deposits
02/10/25	National Australia Bank (NAB)	AA-	$3,000,000.00	99	4.30%	25/06/25	Term Deposits
09/10/25	National Australia Bank (NAB)	AA-	$2,500,000.00	105	4.25%	26/06/25	Term Deposits
16/10/25	ING	A	$2,000,000.00	364	5.03%	17/10/24	Term Deposits
23/10/25	National Australia Bank (NAB)	AA-	$3,000,000.00	120	4.30%	25/06/25	Term Deposits
30/10/25	ING	A	$2,000,000.00	366	5.10%	29/10/24	Term Deposits
30/10/25	Bank of Queensland	A-	$4,000,000.00	182	4.50%	01/05/25	Term Deposits
06/11/25	National Australia Bank (NAB)	AA-	$2,000,000.00	275	4.80%	04/02/25	Term Deposits
13/11/25	ANZ	AA-	$3,000,000.00	204	4.62%	23/04/25	Term Deposits
27/11/25	Bank of Queensland	A-	$3,000,000.00	155	4.30%	25/06/25	Term Deposits
03/12/25	National Australia Bank (NAB)	AA-	$3,000,000.00	139	4.15%	17/07/25	Term Deposits
04/12/25	ANZ	AA-	$2,000,000.00	301	4.78%	06/02/25	Term Deposits
10/12/25	State Bank of India, Sydney Branch	BBB-	$2,500,000.00	145	4.50%	18/07/25	Term Deposits
18/12/25	ANZ	AA-	$4,000,000.00	239	4.64%	23/04/25	Term Deposits
22/01/26	ANZ	AA-	$3,000,000.00	378	4.88%	09/01/25	Term Deposits
29/01/26	ANZ	AA-	$3,000,000.00	281	4.53%	23/04/25	Term Deposits
04/02/26	State Bank of India, Sydney Branch	BBB-	$2,000,000.00	195	4.35%	24/07/25	Term Deposits
05/02/26	National Australia Bank (NAB)	AA-	$2,000,000.00	366	4.72%	04/02/25	Term Deposits
12/02/26	Bank of Queensland	A-	$4,000,000.00	287	4.30%	01/05/25	Term Deposits
16/02/26	National Australia Bank (NAB)	AA-	$2,000,000.00	364	1.04%	16/02/21	Term Deposits
12/03/26	National Australia Bank (NAB)	AA-	$3,000,000.00	260	4.23%	25/06/25	Term Deposits
19/03/26	ANZ	AA-	$2,500,000.00	265	4.27%	27/06/25	Term Deposits
25/03/26	National Australia Bank (NAB)	AA-	$2,000,000.00	240	4.20%	28/07/25	Term Deposits
22/04/26	National Australia Bank (NAB)	AA-	$2,000,000.00	268	4.20%	28/07/25	Term Deposits
30/04/26	ANZ	AA-	$2,500,000.00	307	4.20%	27/06/25	Term Deposits
07/05/26	ING	A	$4,000,000.00	371	4.18%	01/05/25	Term Deposits
25/06/26	National Australia Bank (NAB)	AA-	$3,000,000.00	365	4.15%	25/06/25	Term Deposits
31/08/26	ING	A	$2,000,000.00	732	4.58%	29/08/24	Term Deposits
10/09/26	ING	A	$2,000,000.00	741	4.63%	30/08/24	Term Deposits
28/10/26	ING	A	$2,000,000.00	737	4.74%	21/10/24	Term Deposits
05/11/26	ING	A	$16,500,000.00	737	4.94%	29/10/24	Term Deposits
04/02/27	ING	A	$4,000,000.00	644	4.10%	01/05/25	Term Deposits
18/03/27	National Australia Bank (NAB)	AA-	$2,000,000.00	678	4.09%	09/05/25	Term Deposits
01/04/27	ING	A	$4,000,000.00	700	4.08%	01/05/25	Term Deposits
06/05/27	ING	A	$2,500,000.00	728	4.03%	08/05/25	Term Deposits
12/05/27	Rabobank Aus Limited	A	$2,000,000.00	730	4.22%	12/05/25	Term Deposits
20/05/27	National Australia Bank (NAB)	AA-	$2,000,000.00	741	4.07%	09/05/25	Term Deposits
11/05/28	Rabobank Aus Limited	A	$2,000,000.00	1095	4.37%	12/05/25	Term Deposits
20/11/25	Westpac	AA-	$1,500,000.00	185	1.87%	19/11/21	Tailored Deposit
17/02/26	Westpac	AA-	$2,500,000.00	274	2.24%	18/02/22	Tailored Deposit
24/02/26	Westpac	AA-	$2,000,000.00	274	2.31%	25/02/22	Tailored Deposit
03/03/26	Westpac	AA-	$2,000,000.00	273	2.22%	04/03/22	Tailored Deposit
17/10/25	Suncorp Covered	AAA	$1,000,000.00	92	4.59%	17/10/22	Floating Rate Notes
09/12/25	Macquarie Bank	A+	$2,000,000.00	182	4.20%	02/06/21	Floating Rate Notes
13/01/26	Commonwealth Bank	AA-	$1,500,000.00	183	4.62%	13/01/23	Floating Rate Notes
24/02/26	RACQ Bank	BBB+	$2,300,000.00	274	5.21%	24/02/23	Floating Rate Notes
15/05/26	Bendigo Adelaide Bank	A-	$1,000,000.00	365	5.05%	15/05/23	Floating Rate Notes
15/06/26	Teachers Mutual Bank	BBB+	$850,000.00	364	4.39%	16/06/21	Floating Rate Notes
19/08/26	ING Bank Covered	AAA	$500,000.00	457	4.21%	19/08/21	Floating Rate Notes
14/09/26	Macquarie Bank	A+	$1,600,000.00	455	4.56%	14/09/23	Floating Rate Notes
23/12/26	Commonwealth Bank	AA-	$2,000,000.00	548	4.07%	23/09/21	Floating Rate Notes
22/03/27	ING	A	$1,000,000.00	637	4.61%	22/03/24	Floating Rate Notes
14/05/27	Bendigo Adelaide Bank	A-	$800,000.00	730	4.79%	14/05/24	Floating Rate Notes
18/08/27	Commonwealth Bank	AA-	$1,100,000.00	821	4.83%	18/08/22	Floating Rate Notes
13/09/27	AMP	BBB+	$1,300,000.00	822	4.99%	13/09/24	Floating Rate Notes
01/11/27	Great Southern Bank	BBB+	$1,150,000.00	914	4.91%	01/11/24	Floating Rate Notes
13/01/28	Commonwealth Bank	AA-	$1,500,000.00	913	4.87%	13/01/23	Floating Rate Notes
19/01/28	Rabobank Aus Branch	A+	$1,000,000.00	912	4.86%	19/01/23	Floating Rate Notes
16/02/28	Westpac	AA-	$1,000,000.00	1005	4.78%	16/02/23	Floating Rate Notes
09/05/28	Bank of Queensland Covered	AAA	$1,250,000.00	1096	5.01%	09/05/23	Floating Rate Notes
17/08/28	Commonwealth Bank	AA-	$1,250,000.00	1186	4.76%	17/08/23	Floating Rate Notes
20/08/29	ING	A	$1,800,000.00	1553	4.81%	20/08/24	Floating Rate Notes
27/09/29	ANZ	AA-	$2,100,000.00	1553	4.54%	27/09/24	Floating Rate Notes
18/03/30	National Australia Bank (NAB)	AA-	$1,600,000.00	1734	4.53%	18/03/25	Floating Rate Notes
21/05/30	ANZ	AA-	$700,000.00	1826	4.66%	21/05/25	Floating Rate Notes
19/06/30	Westpac	AA-	$1,200,000.00	1826	4.52%	19/06/25	Floating Rate Notes
10/07/30	Rabobank Aus Branch	A+	$1,000,000.00	1826	4.60%	10/07/25	Floating Rate Notes
17/07/30	Macquarie Bank	A+	$1,100,000.00	1826	4.53%	17/07/25	Floating Rate Notes
18/08/25	Commonwealth Bank	AA-	$1,500,000.00	181	4.20%	18/08/22	Fixed Rate Bond
24/08/26	Suncorp Covered	AAA	$2,000,000.00	546	3.25%	20/04/22	Fixed Rate Bond
21/01/30	Westpac	AA-	$1,800,000.00	1645	4.95%	21/01/25	Fixed Rate Bond
21/05/30	ANZ	AA-	$500,000.00	1826	4.60%	21/05/25	Fixed Rate Bond
17/07/30	Macquarie Bank	A+	$1,000,000.00	1826	4.37%	17/07/25	Fixed Rate Bond
	AMP	BBB+	$11,500,000.00		4.50%		AMP
	AMP	BBB+	$500.00		2.25%		AMP
	Macquarie Bank	A+	$1,913,441.58		4.15%		Macquarie Bank
	Commonwealth Bank	AA-	$5,000,000.00		3.85%		CBA BOS
	31/07/25		$194,813,941.58		4.39%		
	TOTAL INVESTMENTS at 30/06/2025		$205,274,915.08				
	Net Increase/(Decrease) in Investments		($10,460,973.50)				

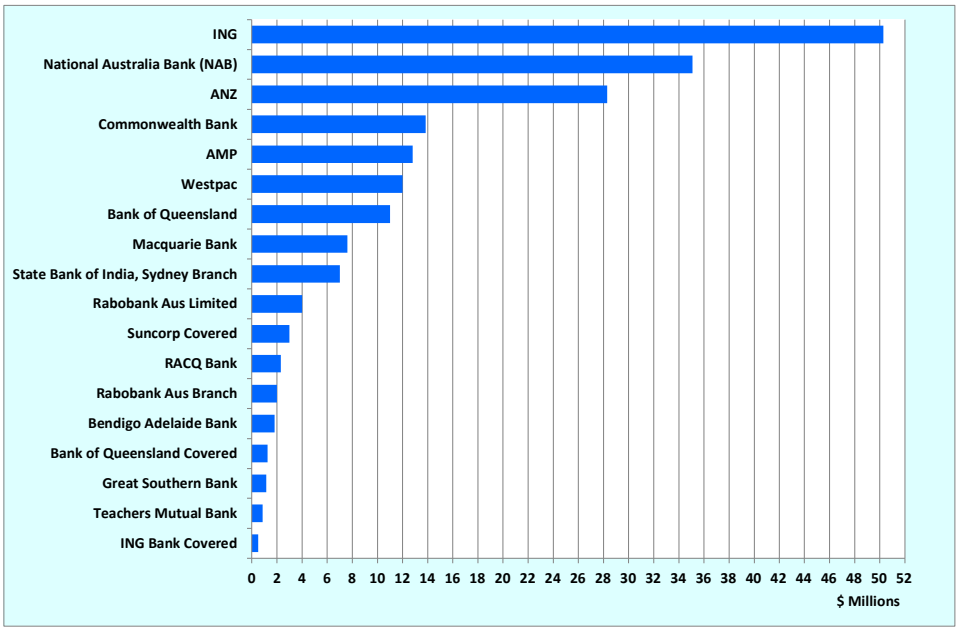
Certificate of the Responsible Accounting Officer

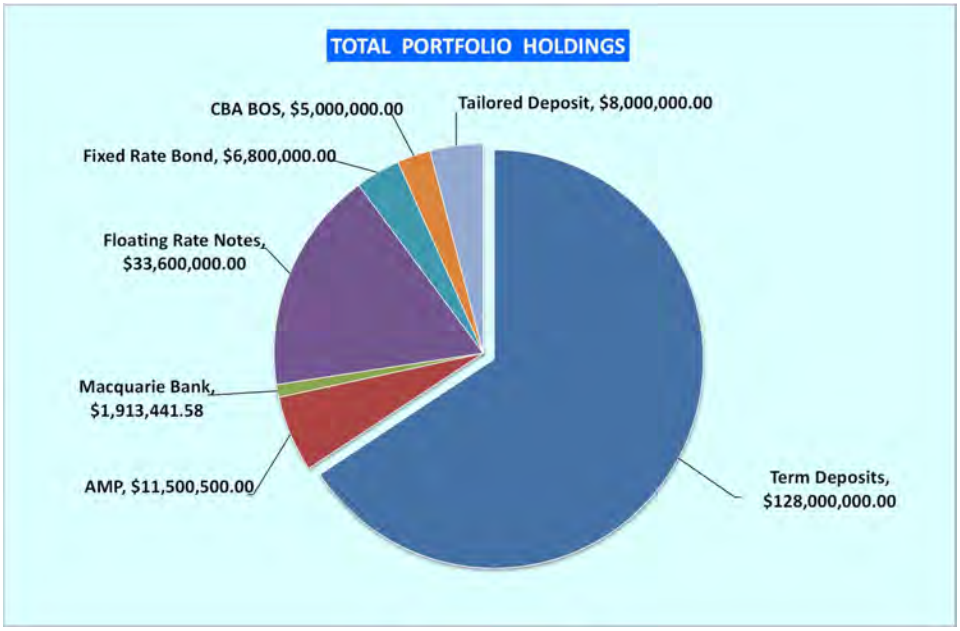
I certify that as at the date of this report, the investments listed have been made and are held in compliance with Council's Investment Policy and applicable legislation.

Evan Hutchings Date: 04 Aug 2025

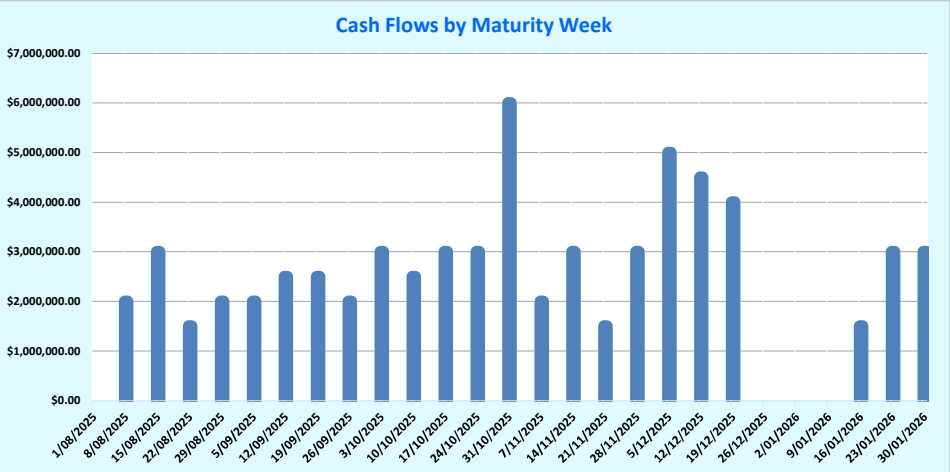
Investment Report JULY 2025

Total Investment Deposits by Institution as of 31 July 2025





Weekly cash flow forecast for 6 months as of 31 July 2025



Individual Counterparty Limits for Term Deposits, Fixed Rate Notes, Floating Rate TDs, and FRNs as per Council Investment Policy

LT Ratings	ADI	Policy Limit	% of Portfolio
AAA	ING Bank Covered	45%	0.26%
	Bank of Queensland Covered	45%	0.64%
	Suncorp Covered	45%	1.54%
AA-	ANZ	45%	14.53%
	Westpac	45%	6.16%
	National Australia Bank (NAB)	45%	18.02%
	Commonwealth Bank	45%	7.11%
A+	Rabobank Aus Branch	30%	1.03%
	Macquarie Bank	30%	3.91%
A	Rabobank Aus Limited	30%	2.05%
	ING	30%	25.82%
A-	Bank of Queensland	20%	5.65%
	Bendigo Adelaide Bank	20%	0.92%
BBB+	RACQ Bank	10%	1.18%
	Great Southern Bank	10%	0.59%
	AMP	10%	6.57%
	Teachers Mutual Bank	10%	0.44%
BBB-	State Bank of India, Sydney Branch	5%	3.59%
	Total Portfolio		**100%**

Investment Report JULY 2025

Counter Party Class Limits for Term Deposits, Fixed Rate Notes, Floating Rate TDs, and FRNs as per Council's Investment Policy (excluding At Call Deposits)

Type Long Term	Holdings	Policy Limit	% Portfolio
AAA	$4,750,000.00	45%	2.44%
AA-	$89,250,000.00	45%	45.81%
A+	$9,613,441.58	30%	4.93%
A	$54,300,000.00	30%	27.87%
A-	$12,800,000.00	20%	6.57%
BBB+	$17,100,500.00	10%	8.78%
BBB-	$7,000,000.00	5%	3.59%
NR	$0.00	0%	0.00%
Total	**$194,813,941.58**		**100%**

Investment Transactions during July 2025

Date	Transaction	Bank/Issuer	Type	Term	Int Rate	Amount	Interest Paid
30/06/2025	Balance	Investment Balance Fair Value				$205,274,915.08	
3/07/2025	Maturity	Bank of Queensland	Term Deposits	216	5.17%	($2,000,000.00)	$61,190.14
3/07/2025	Maturity	National Australia Bank (NAB)	Term Deposits	365	5.45%	($3,000,000.00)	$163,500.00
3/07/2025	Maturity	Bank of Queensland	Term Deposits	161	4.93%	($2,500,000.00)	$54,365.07
10/07/2025	Maturity	National Australia Bank (NAB)	Term Deposits	371	5.45%	($3,000,000.00)	$166,187.68
10/07/2025	Purchase	Rabobank Aus Branch	Floating Rate Notes	1826	4.60%	$1,000,000.00	
7/07/2025	Reset	National Australia Bank (NAB)	Term Deposits	377	5.45%	($3,000,000.00)	$164,395.89
7/07/2025	Reset	National Australia Bank (NAB)	Term Deposits	10	5.45%	$3,000,000.00	
14/07/2025	Reset	Commonwealth Bank	Floating Rate Notes	274	4.95%	($1,500,000.00)	$19,438.35
14/07/2025	Reset	Commonwealth Bank	Floating Rate Notes	183	4.62%	$1,500,000.00	
14/07/2025	Reset	Commonwealth Bank	Floating Rate Notes	1004	5.20%	($1,500,000.00)	$18,503.42
14/07/2025	Reset	Commonwealth Bank	Floating Rate Notes	913	4.87%	$1,500,000.00	
17/07/2025	Reset	Suncorp Covered	Floating Rate Notes	183	4.89%	($1,000,000.00)	$12,187.52
17/07/2025	Reset	Suncorp Covered	Floating Rate Notes	92	4.59%	$1,000,000.00	
17/07/2025	Purchase	Macquarie Bank	Fixed Rate Bond	1826	4.37%	$1,000,000.00	
17/07/2025	Purchase	Macquarie Bank	Floating Rate Notes	1826	4.53%	$1,100,000.00	
17/07/2025	Reset	National Australia Bank (NAB)	Term Deposits	10	5.45%	($3,000,000.00)	$4,479.46
17/07/2025	Reset	National Australia Bank (NAB)	Term Deposits	139	4.15%	$3,000,000.00	
18/07/2025	Maturity	ING	Term Deposits	365	5.33%	($2,500,000.00)	$133,250.00
18/07/2025	Purchase	State Bank of India, Sydney Branch	Term Deposits	145	4.50%	$2,500,000.00	
21/07/2025	Reset	Westpac	Fixed Rate Bond	1826	4.95%	($1,800,000.00)	$44,550.00
21/07/2025	Reset	Westpac	Fixed Rate Bond	1645	4.95%	$1,800,000.00	
22/07/2025	Reset	Rabobank Aus Branch	Floating Rate Notes	1002	5.13%	($1,000,000.00)	$12,654.74
22/07/2025	Reset	Rabobank Aus Branch	Floating Rate Notes	912	4.86%	$1,000,000.00	
24/07/2025	Maturity	ANZ	Term Deposits	253	5.11%	($2,000,000.00)	$70,840.00
24/07/2025	Purchase	State Bank of India, Sydney Branch	Term Deposits	195	4.35%	$2,000,000.00	
28/07/2025	Purchase	National Australia Bank (NAB)	Term Deposits	240	4.20%	$2,000,000.00	
28/07/2025	Purchase	National Australia Bank (NAB)	Term Deposits	268	4.20%	$2,000,000.00	
31/07/2025	Maturity	National Australia Bank (NAB)	Term Deposits	366	5.30%	($2,500,000.00)	$132,863.02
	Activity	Macquarie Bank	Macquarie CMA		4.15%	$6,720.49	$6,720.49
	Activity	CBA Business Online Saver	CBA (BOS)		3.85%	($11,040,313.40)	
	Activity	AMP Bank 31Day Notice	AMP Notice		4.50%	$6,472,619.41	
	Activity	AMP Business Saver	AMP BSA		2.25%		
31/07/2025		**EOM Balance**			**Total**	**$194,813,941.58**	**$1,065,125.78**

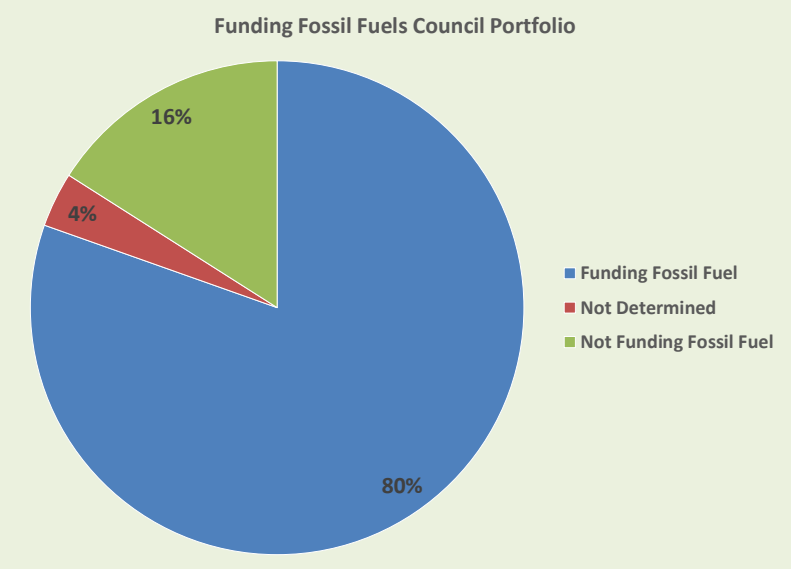
Investment Report JULY 2025

Total Interest Received during July 2025

Ledger Account	Type	July
102623-1465-40068	Investments	$1,058,405.29
102623-1465-40067	At Call Accounts	$6,720.49
	Sub-Total	**$1,065,125.78**
102623-1465-40066	General Bank Account	$10,767.72
	Total	**$1,075,893.50**

Fossil Fuel Allocation (Green Funding) as of 31 July 2025

Sum of Fair Value		
Funding Fossil Fuel	**Bank/Issuer**	**Total**
Funding Fossil Fuel	ING	$50,300,000.00
	National Australia Bank (NAB)	$35,100,000.00
	ANZ	$28,300,000.00
	Commonwealth Bank	$13,850,000.00
	Westpac	$12,000,000.00
	Macquarie Bank	$7,613,441.58
	Rabobank Aus Limited	$4,000,000.00
	Suncorp Covered	$3,000,000.00
	Rabobank Aus Branch	$2,000,000.00
	ING Bank Covered	$500,000.00
Funding Fossil Fuel Total		**$156,663,441.58**
Not Determined	State Bank of India, Sydney Branch	$7,000,000.00
Not Determined Total		**$7,000,000.00**
Not Funding Fossil Fuel	AMP	$12,800,500.00
	Bank of Queensland	$11,000,000.00
	RACQ Bank	$2,300,000.00
	Bendigo Adelaide Bank	$1,800,000.00
	Bank of Queensland Covered	$1,250,000.00
	Great Southern Bank	$1,150,000.00
	Teachers Mutual Bank	$850,000.00
Not Funding Fossil Fuel Total		**$31,150,500.00**
Grand Total		**$194,813,941.58**



Investment Report JULY 2025

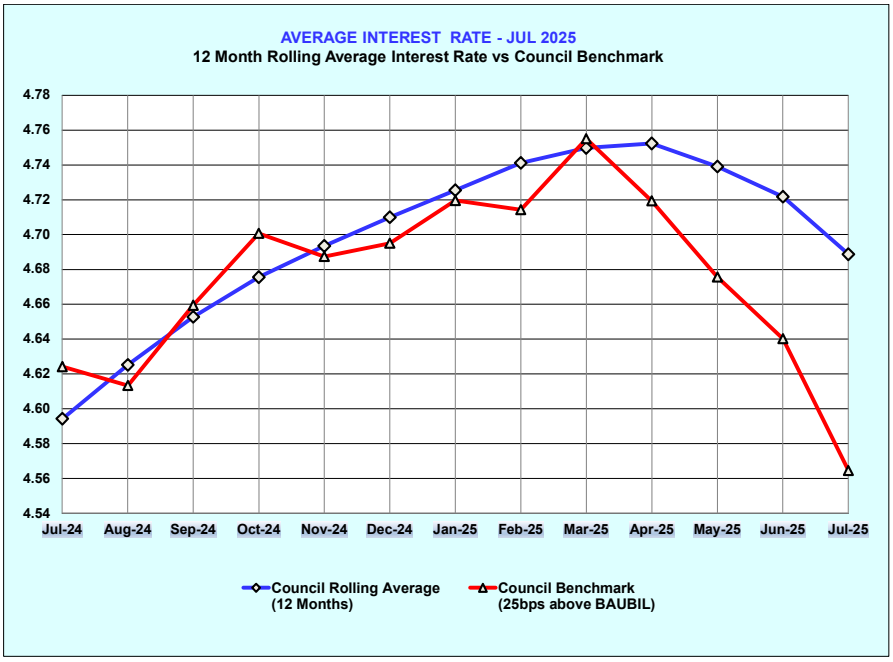
Statement of Consolidated Cash and Investments as of 31 July 2025

Consolidated Cash & Investments		
Cash & Investments		
Cash At Bank as at 31 Jul 2025	$5,138,172.73	
Investments at Fair Value as at 31 Jul 2025	$194,813,941.58	
Total Cash & Investments		**$199,952,114.31**
The above cash and investments are comprised of:		
Externally Restricted Reserves		
Externally restricted reserves refer to funds received that are restricted by externally		
Total External Restrictions		**$146,169,900.44**
Internally Restricted Reserves		
Internally restricted reserves are funds restricted in the use by resolution or policy of Council		
Total Internal Restrictions		**$45,851,102.79**
Unrestricted Cash & Investments		
Total Unrestricted Cash & Investments		**$7,931,111.08**
Total Cash & Investments		**$199,952,114.31**

Note: At the time of this report, reserve balances have yet to be finalised for 31 Jul 2025

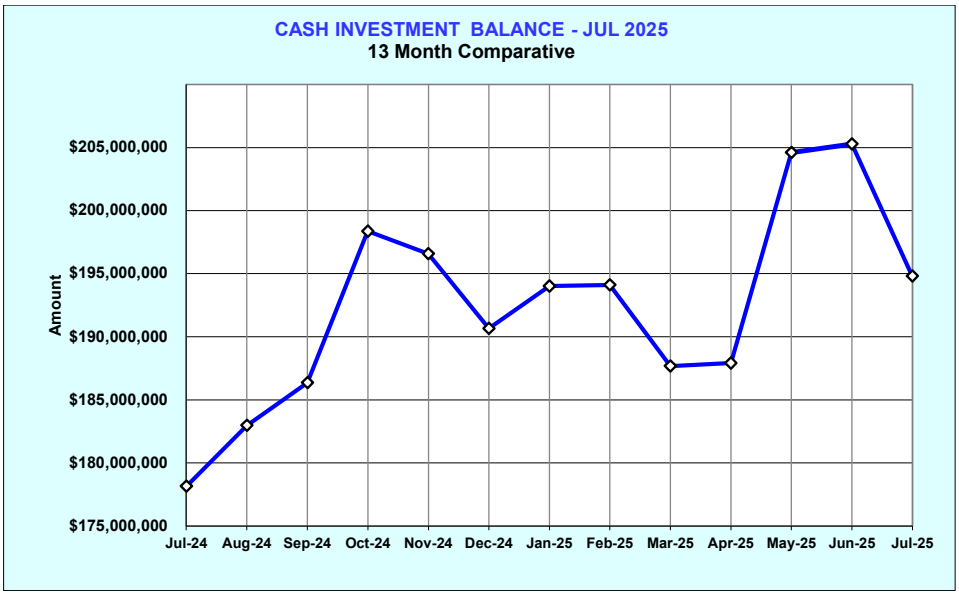
Investment Report JULY 2025

Comparative Graphs

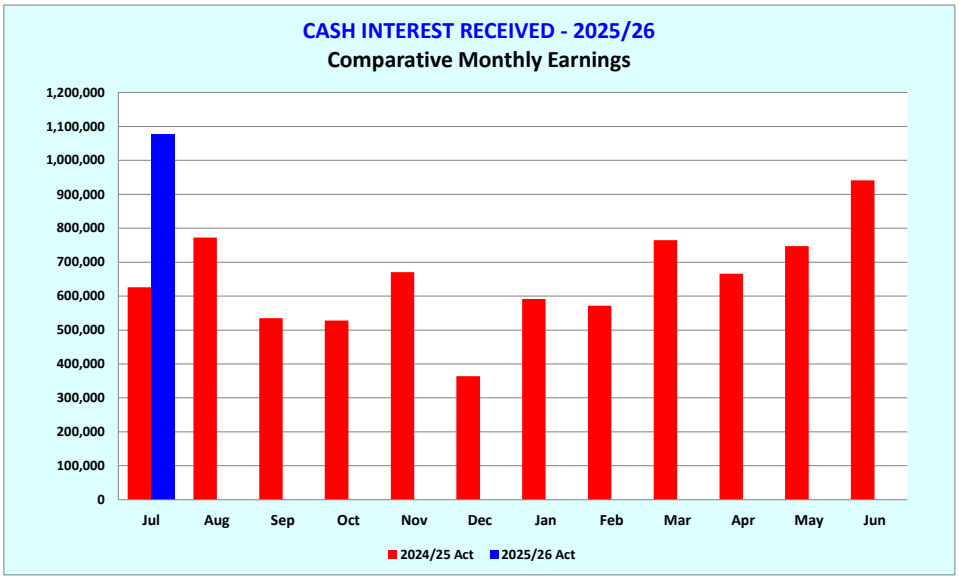


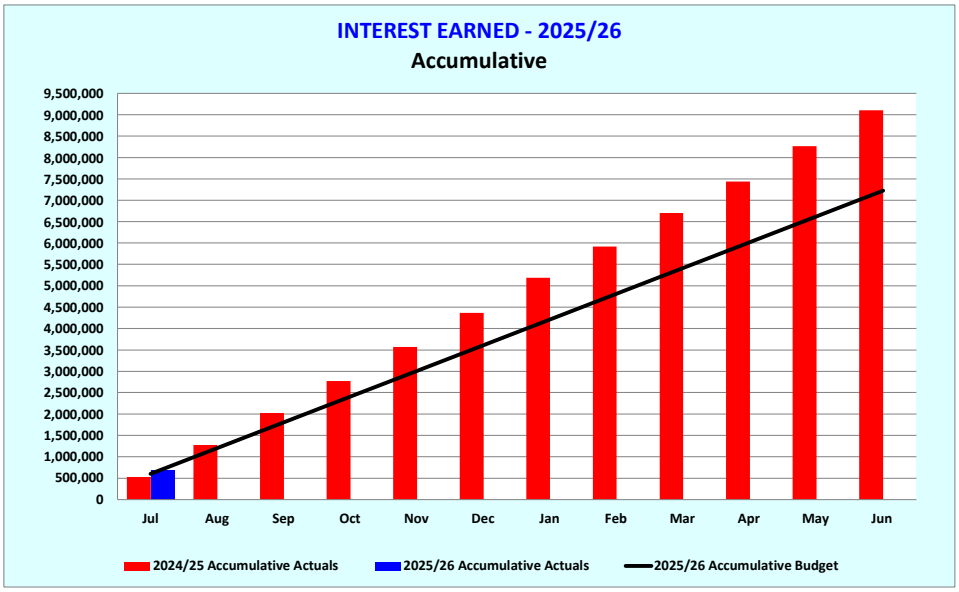
The rolling 12-month portfolio return relative to the index has achieved benchmark. It is a result of higher than anticipated cash balances, and favourable returns on investments.

Council's adopted budget for 2025-26 forecasts interest earnings of $7.225M. Investment income earned for July 2025 amounted to $681,880.49



Investment Report JULY 2025





Investment Report JULY 2025

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REPORT ON PROGRESS
JANUARY TO JUNE 2025
DELIVERY PROGRAM
2022-2026
OPERATIONAL PLAN
2024-2025
City of Canada Bay

Contents

Acknowledgement of Country

The City of Canada Bay acknowledges the Wangal clan, one of the 29 tribes of the Eora nation and the traditional custodians of this land.

Council pays respect to Elders past, present and emerging and extends this respect to all Aboriginal and Torres Strait Islander people living in or visiting the City of Canada Bay.

Front cover image: Foreshore Flicks at Chiswick

Mayor's message

Welcome to the second report of progress toward achievement of the Delivery Program 2022-2026 and Operational Plan 2024-2025. This report covers the period between January and June 2025. These are a few highlights from this period:

In June we celebrated the completion of the $5.5 million Majors Bay Reserve Upgrades. Together with the State Government and with input from the community, the upgrades include enhancements to the existing baseball, cricket and soccer facilities and the inclusion of a BMX jump park, basketball courts, handball courts, an outdoor fitness station and a new playground. The precinct is linked together by all-access pathways and a Changing Places amenity block meaning that everyone has the opportunity to visit the Reserve and stay and play.

Additional capital works projects that were completed during this period include the McIlwaine Park playground in Rhodes, the Iron Cove Seawall beside the Bay Run in Drummoyne and road safety upgrades at the intersection of First Avenue and Arthur Street in Rodd Point. We also completed road resurfacing projects across the local government area as part of our 'business as usual' capital works programs.

Our Business Breakfast in March was attended by over 80 local entrepreneurs who enjoyed a morning of connection, innovation and community spirit. They listened to the inspiring stories of resilience and adaptability from a panel of local business leaders. This project is an important element of addressing our Community Strategic Plan goal of promoting the City as an attractive, welcoming place to do business.

Council's 2025 Youth Week program took place in April, with 13 varied events including creative workshops, free exercise sessions, a sustainable clothing swap and even a rodeo at Five Dock Library. The launch event was an intergenerational dumpling workshop with teens from Concord High School coming together with senior volunteers from the Rhodes Multicultural Community Association. The program was grant funded by the NSW Department of Communities and Justice.

Please read on to learn more about our programs and projects. If you have any questions about this report or its contents, please contact Council on 9911 6555 or email council@canadabay.nsw.gov.au.

Thank you for taking the time to read Council's progress report.

Michael Megna
Mayor

General Manager's message

The team at Council have had a busy six months of delivering operational and capital projects to meet the community's aspirations from the Community Strategic Plan.

Council delivered projects to enhance community connections such as Seniors Week, Youth Week and the City of Canada Bay hosting the Pride Basketball Tournament during Mardi Gras. A couple of exciting new playground facilities were opened. One at Majors Bay Reserve in Concord and one at McIlwaine Reserve in Rhodes.

Environmental programs this six-month period included a Recycling Drop Off Day hosted at Cintra Park in Concord, where household electronics, polystyrene packaging, bikes and clothing and manchester could be dropped off by our residents. Over 15,000 kg of waste was diverted from landfill by this event alone. Council also supported Clean Up Australia Day in March and held a staff volunteer Clean Up event in the Five Dock industrial area.

Our Business Breakfast was a feature of Council's Place and Event Management team's work on creating a vibrant urban environment that is a great place to do business. The team also hosted Foreshore Flicks at different community venues during summer.

Transport and infrastructure projects in this six-month period included footpath and crossing infrastructure upgrades, road resurfacing projects and a toilet upgrade at Wangal Reserve in Mortlake.

In the context of civic leadership, our staff have been undertaking data-driven business improvements across the categories of budget savings, technology initiatives, efficiency initiatives and process improvements. We are always striving to work more efficiently and business improvement is a big focus of our work.

Picture: Clean up Australia Day at Taplin Park, Drummoyne

Read on to learn more about the projects that Council delivered in the period.

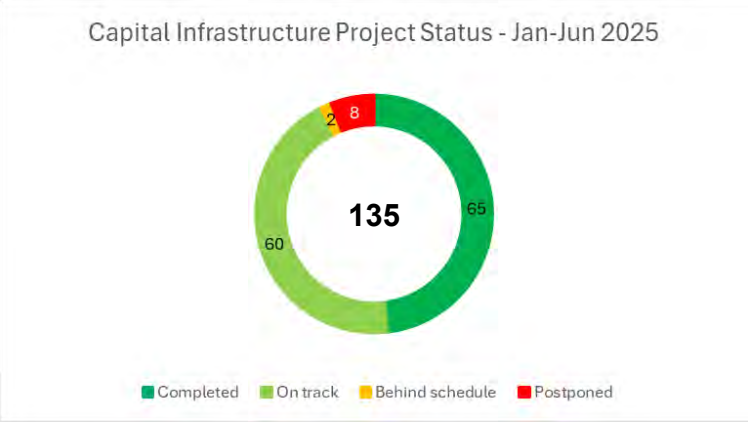
Contact Council on 9911 6555 or by email council@canadabay.nsw.gov.au if you would like any information about the projects covered in this progress report.

John Clark
General Manager

Year to date overview

The following charts show the progress of Council's scheduled capital infrastructure and operational projects as at 30 June 2025.

Capital infrastructure project progress

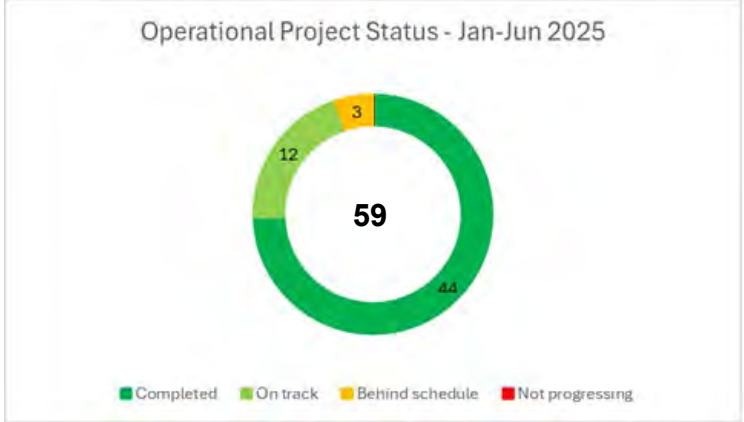


Capital infrastructure projects key

Completed	The scheduled activities were completed
On track	The scheduled activities are on track for completion within the project time frame
Behind schedule	This project is progressing at a rate that is behind its original schedule
Postponed	This project has been deferred to a future year

Commentary on delayed and postponed capital infrastructure projects is located in Attachment 1.

Operational project progress



Operational projects key

Completed	The scheduled activities were completed
On track	The scheduled activities are on track for completion within the project time frame
Behind schedule	This activity is progressing at a rate that is behind its original schedule
Not progressing	This activity has been deferred to a future year, or may be removed from the program

Capital infrastructure program highlights

Introduction

In the six months between January and June 2025, Council continued to deliver its adopted $77.4 million capital works program. The following pages contain its highlights for the period.

New playground at McIlwaine Park, Rhodes

The opening of the McIlwaine Park playground was celebrated on 1 February 2025. Completion of the playground was the final stage of the $10 million transformation of McIlwaine Park that commenced in 2021.

This spectacular open space rejuvenation project has resulted in the new playground, with picnic tables, barbeques, a new amenities block, rejuvenation of the putt-putt golf course, foreshore seawall enhancements and all of it linked together with assessable pathways and pedestrian lighting.

The playground at McIlwaine Park in Rhodes.

State-of-the-art video screen at Drummoyne Oval

Council and Cricket NSW have worked together to upgrade the screen at Drummoyne Oval. The upgrade enables fast replay of the action at Sydney Thunder Women's Big Bash League home games. The scoreboard function can also be used by other sports including rugby and AFL

Council will be able to attract more elite-level sport to this venue because of the versatility of the new screen. The new screen also enables broader community use of the facility as the screen can be used for activities such as an outdoor theatre.

The new screen at Drummoyne Oval.

Seawall replacement works along Iron Cove in Drummoyne

Sections of seawall along the shores of Iron Cove have been upgraded as part of this $4.4 million project. Old sections of concrete wall have been replaced with over 300 tonnes of terraced sandstone.

The sandstone terraces protect the landward side of the shoreline, which includes the adjacent Bay Run. They also provide textures which allow nooks and crannies for local invertebrate wildlife to take hold and thrive.

This project received joint funding from the NSW State government.

Aerial view of the Iron Cove seawall replacement.

Operational projects update

Introduction

Council's operational program is in place to progress the goals of the Community Strategic Plan: Our Future 2036, (CSP) for residents and visitors alike. These are the CSP directions:

Direction 1: Connected community
Direction 2: Sustainable and thriving environment
Direction 3: Vibrant urban living
Direction 4: Infrastructure and transport
Direction 5: Civic leadership

The tables contained in this section of the report detail the progress on each of the operational projects from Council's Delivery Program 2022-26 and Operational Plan 2024-25. Where projects are identified as 'behind schedule' or 'not progressing, an explanation is provided.

The coloured symbols below are used to identify the status of all activities in the Operational Plan 2024-2025 as at 30 June 2025.

- Completed – *the scheduled activities were completed*
- On track – *the scheduled activities are on track for completion within the project time frame*
- Behind schedule – *this activity is progressing at a rate that is behind its original schedule*
- Not progressing – *this activity has been deferred to future year, or may be removed from the program*

Connected community

Goal 1.1.

Foster an inclusive community where diversity is welcomed and celebrated

1.1.1. Deliver community initiatives that strengthen social inclusion

Reporting responsibility	Status	Deliverable	Performance commentary
Place and Events		**1.1.1.1** Deliver Council's annual program of festivals and events.	The annual program of Council-led and Council-supported events has delivered 38 events, festivals, activations and commemorative services to the community during 2024-2025. The events included Ferragosto, Halloween on Majors Bay Road, Carols in the Park Lunar New Year and Neon Nightfall as well as a number of commemorative services. This year, Council introduced the highly successful Foreshore Flicks' series of outdoor movies.
Library & Community Services		**1.1.1.2** Finalise and implement the Social Sustainability Plan.	This project is progressing in accordance with its revised schedule.
Library & Community Services		**1.1.1.3** Draft revised Disability Inclusion Action Plan (DIAP).	At the May Council meeting, Council resolved to extend the current Disability Inclusion Action Plan (2021-2025) to June 2026. This will enable continued implementation of the current plan, which stands at 77%. The extension also gives the State Government time to release a new NSW State Disability Inclusion Plan around which Council can then build the new DIAP to implement. No further action on this item was required this financial year.

1.1.2. Support volunteering programs that strengthen social inclusion and connection

Reporting responsibility	Status	Deliverable	Performance commentary
Library & Community Services	✓	**1.1.2.1** Support volunteer-led initiatives in the libraries.	The Library and Community Services volunteer initiatives were supported throughout the reporting year. The contribution of Council's volunteers is enormously appreciated.

1.1.3. Deliver initiatives that address local housing affordability

Reporting responsibility	Status	Deliverable	Performance commentary
Property Strategy & Leasing	✓	**1.1.3.1** Develop a holistic strategy for Council's affordable housing portfolio.	A Community Housing Provider has been appointed to manage Council's affordable housing portfolio and an Affordable Housing Strategy is in development. The Strategy includes a pipeline of new property acquisitions, recycling of existing stock, strategic development and ongoing operation and maintenance of the existing affordable housing portfolio.

Goal 1.2.

Celebrate, recognise, and honour Aboriginal and Torres Strait Islander cultures

1.2.1. Increase opportunities to celebrate Aboriginal and Torres Strait Islander cultures

Reporting responsibility	Status	Deliverable	Performance commentary
Communications and engagement	◔	**1.2.1.1** Deliver actions within the Reflect Reconciliation Action Plan (RAP) and submit a draft Innovation RAP in 2025.	Reconciliation Australia has advised that the actions within Council's Reflect Reconciliation Action Plan (RAP) must be completed prior to an Innovate RAP being drafted. It is anticipated that a final report on the Reflect RAP will be presented to Reconciliation Australia by September 2025.

Goal 1.3.

Provide the community with equitable access to a range of programs, services, and facilities

1.3.1. Deliver community and cultural facilities that respond to the diverse needs of the community

Reporting responsibility	Status	Deliverable	Performance commentary
Venues Management	-	**1.3.1.1** Implement the use of smart technology to provide pin code access to Council's venues for hire.	This project has moved into the capital works program.
Property Strategy & Leasing		**1.3.1.2** Implement new property management system to enhance customer experience and improve efficiency and oversight.	The new Property Management System has been commissioned with full data migration and user testing completed.

1.3.2. Deliver programs, services, and facilities that increase community connection

Reporting responsibility	Status	Deliverable	Performance commentary
Library & Community Services		**1.3.2.1** Review and improve wayfinding at Concord and Five Dock Libraries.	The final signage and wayfinding package has been completed and prepared for tender. Signage contractors will be engaged to create and install all signs and directories in the 2025-2026 financial year.

Goal 1.4.

Promote a community where residents feel safe and enjoy good health

1.4.1. Implement initiatives that contribute to the community's sense of safety and wellbeing

Reporting responsibility	Status	Deliverable	Performance commentary
Library & Community Services	✓	**1.4.1.1** Implement the Council-wide Child Safe Action Plan.	Council's program of implementing the Council-wide Child Safe Action Plan was completed.
Open Space	✓	**1.4.1.2** Conduct Crime Prevention through Environmental Design (CPTED) audits in partnership with Burwood Local Area Command.	CPTED audits were completed for select parks and as a routine part of due diligence on park upgrade projects. Staff continue to liaise with Burwood Local Area Command on any crime prevention matters in public open space.

1.4.2. Implement initiatives that support local resilience and adaptability

Council's Roads and Traffic Business unit progressed this Delivery Program strategy within its business-as-usual work plan. Highlights will be reported in the Annual Report.

1.4.3. Continuously improve public and environmental health services to support health and safety of residents

Council's Environmental Health Team completed work on this strategy through business-as-usual activities during the reporting period. Highlights will be reported in the Annual Report.

Goal 1.5.

Provide open space, facilities, and programs that promote active lifestyles

1.5.1. Improve quality and capacity of open space to support a diversity of recreation activities

The Open Space business unit progressed this strategy through business-as-usual activities this period. Highlights will be reported in the Annual Report.

1.5.2. Investigate opportunities for new and connected open spaces, recreation facilities, and programs

Reporting responsibility	Status	Deliverable	Performance commentary
Recreation Management	✓	**1.5.2.1** Prepare the operational management plan for the upcoming Rhodes Recreation Centre.	Development of the operational plan for the Rhodes Recreation Centre is on track, with the facility to be operational towards the end of 2025.
Project Management Office	✓	**1.5.2.2** Review and consolidate Council's plans of management for community and operational lands.	This project was deferred to the 2025-2026 financial year as resources were prioritised towards the completion of the masterplans for Queen Elizabeth Park, Concord, and Five Dock Park.
Project Management Office	◔	**1.5.2.3** Deliver masterplans for Queen Elizabeth Park, Concord, and Five Dock Park.	At the end of the financial year, the masterplan for Queen Elizabeth/Goddard Park was completed and ready for Council to adopt in July 2025. The masterplan for Five Dock Park was in draft and ready for Council endorsement in July 2025 to publicly exhibit, with a view to its adoption in October 2025.
Recreation Management	✓	**1.5.2.4** Manage the tender for the operation of Council's swimming centres.	The tender process for the operation of Council's swimming centres was completed.

Performance measures

Measure	Baseline	Target	Frequency of reporting	Result 31 Dec 2024	Result 30 Jun 2025
Number of library service visitors, including the Learning Space*	200,000 yearly (2022-23)	Maintain or increase	Every six months	229,356	229,874 Annual total: 459,230
Number of library service members*	34,000 members (2022-23)	Maintain or increase	Annually	-	33,545
Number of community groups and organisations supported during the year*	20 (2022-23)	Maintain or increase	Annually	-	48
Percentage capacity of Council's recreational bus trips for senior residents*	65% (2021-22)	70%	Every six months	48%	51%

** Outcomes that Council can control*
*** Outcomes that Council can influence*

Sustainable and thriving environment

Goal 2.1.

Reduce greenhouse gas emissions

2.1.1. Lead initiatives that empower the community to reach emissions targets, transition to renewable energy, and improve climate resilience

Reporting responsibility	Status	Deliverable	Performance commentary
Sustainability & Waste	✓	**2.1.1.1** Deliver program for residents - Emissions Reductions and Climate Resilience Framework.	Council's emissions reduction program engaged 39 residents through two community workshops focused on solar energy and energy efficiency in the period January to June 2025. In partnership with Inner West Community Energy, Council developed five Smart Energy Switch guides to support residents in transitioning from gas to electric solutions. A total of 500 printed guides were distributed across Council libraries, with 148 additional downloads recorded online.
Sustainability & Waste	✓	**2.1.1.2** Deliver projects for Climate Resilience and reduced emissions.	Council purchased three home energy assessment monitoring kits, which will be available for loan through local libraries later this year. These kits will help households identify energy inefficiencies and make informed decisions to reduce energy use and costs. In addition, seven energy efficiency and solar workshops were delivered for apartment residents, including four sessions in partnership with Climate Action Burwood-Canada Bay, engaging 300 participants.

Goal 2.2.

Increase urban tree canopy

2.2.1. Encourage residents and stakeholders to plant, retain, and maintain the urban tree canopy

Reporting responsibility	Status	Deliverable	Performance commentary
Open Space		**2.2.1.1** Complete the review of actions and targets within the Urban Tree Canopy Strategy.	The review of the actions and targets of the Urban Tree Canopy Strategy will continue into the 2025-2026 financial year to enable broader internal engagement.
Open Space		**2.2.1.2** Finalise the Street Tree Masterplan and tree inventory database.	The tree inventory database has been completed and work continues on the Street Tree Masterplan. A contractor has been appointed to collect data and develop the Masterplan.
Sustainability & Waste		**2.2.1.3** Develop and implement a tree program aimed at increasing and retaining the number of trees on private land.	During this period, Council planted 480 trees in public spaces and distributed 466 shrubs and trees through three community plant giveaway events.

Goal 2.3.

Reduce waste to landfill through waste avoidance and increasing recycling and reuse

2.3.1. Deliver best practice programs that reduce waste to landfill and promote a circular economy

Reporting responsibility	Status	Deliverable	Performance commentary
Sustainability & Waste		**2.3.1.1** Deliver an expanded food organics garden organics (FOGO) trial for multi-unit dwellings.	Expansion of the FOGO trial has resulted in an additional 384 households joining the program and 80 tonnes of FOGO waste being collected between Jan - July 2025. Council officers continue to conduct face to face engagement throughout the trial to educate and seek feedback from participants.
Sustainability & Waste		**2.3.1.2** Deliver a program targeting waste diversion and increased recycling of materials in apartments and houses.	Council's waste diversion and increased recycling programs have been progressing to schedule. HomeCycle undertook 2,259 collections in this period. One drop off event was held for e-waste, clothing and manchester, expanded polystyrene (EPS) and bicycles. Over 12 tonnes of e-waste was diverted from landfill. 19 apartment buildings joined the Apartment Recycling Program between January-July 2025.

2.3.2. Deliver innovative programs aimed at reducing illegal dumping and littering in City streets and parks

Reporting responsibility	Status	Deliverable	Performance commentary
Sustainability & Waste		**2.3.2.1** Deliver a new litter prevention plan.	Council has secured a grant from the NSW Environment Protection Authority to support the strategic implementation of actions outlined in the Litter Management and Prevention Plan. A dedicated Litter Prevention Officer has been appointed on a three-year contract to lead the delivery of priority initiatives.

Reporting responsibility	Status	Deliverable	Performance commentary
Sustainability & Waste	✓	**2.3.2.2** Deliver a new illegal dumping strategy.	A draft Illegal Dumping Plan has been developed.

Goal 2.4.

Enhance and protect native flora and fauna to support local biodiversity

2.4.1. Deliver initiatives that protect, manage, and restore the City's habitat areas, fauna, and native species

Reporting responsibility	Status	Deliverable	Performance commentary
Sustainability & Waste	✓	**2.4.1.1** Deliver biodiversity and biosecurity programs and projects to protect and enhance native species and local biodiversity.	A total of 95 community members participated in five workshops focused on the biodiversity values of the local area and practical ways to support and enhance native flora and fauna. Six biosecurity inspections were conducted on private land to manage invasive weed species. In addition, two nature strip planting applications were approved to enhance local flora and support the development of biodiversity corridors. From April onwards, Council supported the reactivation of the Bushcare program, delivering 19 volunteer sessions across 10 sites, contributing a total of 335.25 volunteer hours. Participation figures are lower than in previous years due to a program pause earlier in the period and a revised method of calculating actual volunteer hours based on attendance duration.

Goal 2.5.

Improve access to, and enhance quality of, foreshore and waterways

2.5.1. Implement initiatives to expand, enhance, and promote public spaces and paths along the foreshore

The Strategic Planning and Open Space business units have worked to progress this strategy during this period. Highlights will be reported in the Annual Report.

2.5.2. Work with the Parramatta River Catchment Group to deliver the Parramatta River Masterplan

Reporting responsibility	Status	Deliverable	Performance commentary
Open Space	✓	**2.5.2.1** Implement and support the Parramatta River Masterplan.	Council continued to support the Parramatta River Catchment Group this period.
Open Space	✓	**2.5.2.2** Maintain membership of Parramatta River Catchment Group.	Council is a member of the Parramatta River Catchment Group.

Performance measures

Measure	Baseline	Target	Frequency of reporting	Result 31 Dec 2024	Result 30 Jun 2025
Net emissions (tonnes CO_2-e) from Council operations*	7,579 tCO_2-e (2017-18)	• 2,983 t CO_2-e by 2025 • Zero CO_2-e by 2030	Annually◆	400 tonnes	1,052 tonnes
Net emissions (tonnes CO_2-e) from the City of Canada Bay Community**	772,220 tCO_2-e (2017-18)	• 351,682 t CO2-e by 2035 • Zero CO2-e by 2050	Annually◈	-	697,649** 2022-23
Average kilograms of domestic waste sent to landfill per resident** *Calculated by dividing the total waste stream (kerbside red lidded bin plus bulky goods collection) by the current year population of the city of Canada Bay, obtained from profileid.*	213kg/per person /per annum (2019-20)	Decrease	Annually	210kg	207kg
Number of trees planted**	800 (2019-20)	1,500	Annually	-	1,120

** Outcomes that Council can control*
*** Outcomes that Council can influence*
◆ *Note that this number is variable as Council's energy bills come in at different frequencies, and a lag is also experienced*
◈ *Annual total community emissions data has a lag of 12 months from reporting year*

Vibrant urban living

Goal 3.1.

Create vibrant local village centres and community hubs

3.1.1. Implement a multidisciplinary and collaborative Place and Events approach to maximise City-wide social, economic, and environmental outcomes

Reporting responsibility	Status	Deliverable	Performance commentary
Place and Events		**3.1.1.1** Implement the Place and Events Framework and adopted Place Plans.	Grant funding has been secured through Transport for NSW to deliver process and infrastructure improvements at three strategic locations across the LGA to assist in making the delivery of community events and activations simpler, easier and more cost-effective. Additional funding has also been secured through Sydney Metro to deliver place making initiatives in Five Dock to support local businesses and the community during construction of the new Metro station. The delivery of both of these projects will continue into 2025-26.

Goal 3.2.

Improve access to local art, culture, and creative activities

3.2.1. Deliver innovative and accessible arts and cultural projects, programs, and creative activities

The Place and Events business unit progressed this strategy through business-as-usual activities this period. Highlights will be reported in the Annual Report.

3.2.2. Encourage integration of public art and design in key sites around the City

Reporting responsibility	Status	Deliverable	Performance commentary
Place and Events	✓	**3.2.2.1** Implement the Cultural Plan and Public Art Strategy.	During this period, Council delivered a number of new public artworks including the "Windows Through Five Dock" mural by Fintan Magee at Charles Heath Reserve, "Eucalypt" by Maddie Gibbs surrounding the basketball court at Concord Oval and the "Jump Track Mural" by Sam Absurd on the new BMX Jump Track at Majors Bay Reserve. A Public Art Strategy for the new Rhodes Recreation Centre was developed and endorsed by Council in March 2025 and delivery of the artworks will commence in late 2025.

Goal 3.3.

Promote the City as an attractive, welcoming place to do business

3.3.1. Support and promote an enlivened evening economy

The evening economy was supported by the Place and Events business unit in this period. Highlights will be reported in the Annual Report.

3.3.2. Provide economic development activities in partnership to stimulate the local economy

Reporting responsibility	Status	Deliverable	Performance commentary
Place and Events	✓	**3.3.2.1** Conduct business and economic development programs in priority places.	Council is continuing to develop and invest in its Local Business Program. The Coffee Connections program and Business e-newsletter were launched in October 2024 to mark Small Business Month. In addition to monthly networking events, Council held two major events for the local business community - the Small Business Month workshop was attended by over 70 participants in October 2024 and in March 2025, Council held a Women in Business breakfast panel with over 80 attendees.

Goal 3.4.

Ensure the built environment respects the unique neighbourhood character and responds deftly to evolving community needs

3.4.1. Effectively plan for future growth by balancing regional priorities with local values

Reporting responsibility	Status	Deliverable	Performance commentary
Strategic Planning	✓	**3.4.1.1** Prepare background studies to inform an update to the Canada Bay Local Strategic Planning Statement.	The Draft Local Housing Strategy and Employment and Productivity Strategy have been prepared. Finalisation of the strategies will occur following release of the Greater Sydney Region Plan for Sydney by the Department of Planning, Housing and Infrastructure.

3.4.2. Implement best practice land use planning and construction approaches to deliver quality development outcomes

Reporting responsibility	Status	Deliverable	Performance commentary
Strategic Planning		**3.4.2.1** Prepare background studies to inform land use change around the Five Dock Metro Station.	A draft Masterplan has been prepared and is currently being finalised. Supporting studies relating to contamination, employment, land valuation and sustainability have been completed. Other studies relating to public domain, flood, heritage, social, traffic, feasibility and infrastructure are being updated to inform the Masterplan
Strategic Planning		**3.4.2.2** Finalise the Planning Proposal for Stage 2 of the Parramatta Road Corridor.	A Gateway determination was received on 28 Jan 2025 that requires the planning proposal to be reviewed to provide additional housing. Council resolved to undertake the review and the revised plans are awaiting comment from the Department of Planning, Housing and Infrastructure.
Strategic Planning		**3.4.2.3** Review and update the Canada Bay Development Control Plan.	The draft Development Control Plan was placed on public exhibition and was adopted by Council on 17 June 2025.
Strategic Planning		**3.4.2.4** Review and update the Canada Bay Local Infrastructure Contributions Plan.	Internal engagement has occurred with data collated to inform updates to the new Local Infrastructure Contribution Plan. The draft plan will be reported to Council prior to being placed on public exhibition.

Performance measures

Measure	Baseline	Target	Frequency of reporting	Result 31 Dec 2024	Result 30 Jun 2025
Percentage of people and businesses who agree town centres are vibrant*	57% (2019-20)	Maintain or improve	Biennially	-	50%○
Average number of days to assess Development Applications*	124 days (2023-24)	115 days✧ (2024-25)	Six monthly and annually	129	101
Percentage of planned environmental health inspections completed according to the inspection schedule*	100% (2023-24)	100%	Six monthly and annually	On track	100%

** Outcomes that Council can control*
*** Outcomes that Council can influence*

✧ *State Government Average Assessment Days Expectation for 2024-25 (per NSW Government DA Assessment table)*
○ *Per Council's Biennial Community Research Report March 2025*

Infrastructure and transport

Goal 4.1.

Manage local assets to ensure they continue to meet the City's needs and address climate adaptation issues

4.1.1. Ensure that Council's buildings, parks, stormwater and seawalls, and infrastructure assets are climate resilient and able to support a growing community

Reporting responsibility	Status	Deliverable	Performance commentary
Strategic Asset Services & Innovation		**4.1.1.1** Develop Powells Creek Flood Plain Risk Management Plan.	This project is being delivered on a revised schedule as it involves our neighbouring Councils.
Strategic Asset Services & Innovation		**4.1.1.2** Management of the Sydney Metro works within public roads in accordance with the Sydney Metro Interface Agreement and relevant legislation.	Council continues to liaise with Sydney Metro as required.
Strategic Asset Services & Innovation		**4.1.1.3** Review Council's Stormwater Risk Management Strategy.	The review of the Strategy was completed in the first six months of the financial year.
Strategic Asset Services & Innovation		**4.1.1.4** Complete a review of the Asset Management Strategy and Plans.	The updated Asset Management Strategy and Plans were adopted by Council in June 2025.

4.1.2. Proactively manage and maintain Council's local road and footpath network

Council's local road and footpath network is managed by the Roads and Traffic business unit. This financial year they delivered 17,422 square metres of footpath renewals and road reserve maintenance works including utility restorations. Further highlights will be reported in the Annual Report.

Goal 4.2.

Manage traffic and parking to minimise congestion and improve the City's road safety

4.2.1. Plan, deliver, and manage traffic and parking so that it can better support population change

Council's Roads and Traffic business unit operated the Local Traffic Committee during the period. Highlights will be reported in the Annual Report.

Goal 4.3.

Encourage active and accessible transport opportunities

4.3.1. Support and advocate for safe and accessible active and public transport networks

Council's advocacy and support for safe an accessible active and public transport networks was delivered within the Roads and Traffic business unit business-as-usual activities in this period. Highlights will be reported in the Annual Report.

Performance measures

Measure	Baseline	Target	Frequency of reporting	Result 31 Dec 2024	Result 30 Jun 2025
Number of participants in car safety seat fittings and road safety activities*	193 (2023-24)	Maintain or increase	Annually	-	0 (Program recommencing in July 2025 with strong interest from several residents)
Metres of new active travel assets (footpaths, shared paths, on-road cycleways) delivered.*	n/a	Workload measure (delivered per program)	Annually	-	0 (1.2km of shared path/on-road cycling infrastructure under construction at time of publication)
Percentage of road surfaces rated in satisfactory condition or better.*	91% (2019-20)	>90%	Annually	-	91%

** Outcomes that Council can control*
*** Outcomes that Council can influence*

Civic leadership

Goal 5.1.

Council is accountable, efficient, and ready to meet future challenges

5.1.1. Ensure decision making is open, accountable, and informed by integrated planning and risk management

Reporting responsibility	Status	Deliverable	Performance Commentary
Governance & Risk	✓	**5.1.1.1** Manage and administer the local government elections.	The Local Government Elections were administered in accordance with legislation and all the NSW Electoral Commission requirements were met.
Corporate Strategy & Business Improvement	✓	**5.1.1.2** Meet the Integrated Planning and Reporting Requirements.	Council's legislative reporting requirements and timeframes were all met during this period. This included refreshing the Community Strategic Plan, rewriting the Delivery Program and Operational Plan and refreshing the Resourcing Strategy.
Corporate Strategy & Business Improvement	✓	**5.1.1.3** Prepare the Annual Report, incorporating the end of term report, by November 2024.	Council's Annual Report was completed in accordance with the statutory requirements. It is available on Council's webpage.

5.1.2. Strengthen Council's financial operations and processes

Reporting responsibility	Status	Deliverable	Performance Commentary
Property Strategy & Leasing	✓	**5.1.2.1** Develop draft Community Leasing policy.	The draft Community Leasing Policy has been prepared.

Reporting responsibility	Status	Deliverable	Performance Commentary
Finance & Procurement		**5.1.2.2** Monitor and participate in the IPART review of the financial model for NSW local councils.	In May 2025 the Government announced support for 15 out of 17 recommendations from the NSW Parliament's Upper House inquiry into the ability of local governments to fund infrastructure and services. The Government has proposed five key actions: 1) The Independent Pricing and Regulatory Tribunal (IPART) will continue to oversee council rates to ensure councils' revenue keeps pace with cost changes, while protecting ratepayers from excessive rate hikes. 2) Councils that want to permanently increase their rates will be required to submit a Comprehensive Spending Review to IPART that forensically examines their expenditure as well as their revenue. 3) The Special Variation process will be simplified and used solely by councils to fund specific projects or programs supported by the community. 4) Local government financial statements and reporting will be streamlined to increase transparency and councillor and public oversight over council spending. 5) Establishing an Expert Advisory Panel of experienced general managers, finance directors and other local government experts to support the government in delivering its reforms. The Government will also audit local government fees and charges, to ensure they reflect inflation and changes in market costs. Models for distributing State Government grants to councils will also be assessed so that councils continue to receive sustainable and equitable funding.

Reporting responsibility	Status	Deliverable	Performance Commentary
Finance & Procurement		**5.1.2.3** Review Council's current Investment Policy and implement amendments whilst ensuring the Investment Portfolio continues to be managed within a prudent and conservative risk framework.	Council considered amendments to the investment policy at its meeting of 17 June 2025. The main change to the policy involves increasing the proportion of the investment portfolio able to be held in lower rated and smaller ADIs (Approved Deposit taking institutions), which may bring better financial returns and more investment in non-fossil fuel lending institutions. Public exhibition of the draft Investment Policy closes on 23 July 2025. A further report will be presented to Council in August to consider any public comments and feedback and to adopt the Policy.

5.1.3. Implement environmental efficiency measures across Council assets and services

Reporting responsibility	Status	Deliverable	Performance Commentary
Sustainability & Waste		**5.1.3.1** Deliver projects that support climate resilience for Council assets.	During the July to December period, a set of audit templates was prepared to assess the climate resilience of Council buildings. The templates are to be consolidated into the building asset audit reports. The environmental assessment heads of consideration will be incorporated in the condition assessments planned for the 2025-2026 financial year.

Goal 5.2.

Council is supported by a skilled and efficient workforce that is equipped to meet the needs of a growing community

5.2.1. Establish timely plans for future workforce needs and deliver Workforce Management Plan

Reporting responsibility	Status	Deliverable	Performance Commentary
People & Culture	✓	**5.2.1.1** Develop Council's new Workforce Management Plan for 2025-2029.	The Workforce Management Plan was completed and endorsed by Council in June 2025. A copy is available on Council's website as part of the Resourcing Strategy.
People & Culture	✓	**5.2.1.2** Implement a new Human Resource Information System.	Phase 1 of the 18-month project to upgrade Council's Human Resource Information System is now complete. The three modules that went live in May 2025 were: Organisation Management, Payroll and Workforce Management. The project has now entered Phase 2 to deliver three more modules: Probation management, Performance Appraisals and Training (includes the implementation of a new Learning Management System).

5.2.2. Promote Council as an employer of choice with a talented and valued workforce

Reporting responsibility	Status	Deliverable	Performance Commentary
People & Culture	✓	**5.2.2.1** Implement Council's Mental Health Support Strategy to provide for the mental safety and wellbeing of staff through provision of training and support mechanisms.	Implementation of Council's Mental Health Support initiatives progressed according to schedule and activities as part of this ongoing program were completed, including conducting risk assessments which consider psychosocial safety, training of Mental Health First Aid Officers, organising tailored resilience from conflict training for front line staff.
People & Culture	✓	**5.2.2.2** Drive organisational culture and values through initiatives such as the annual staff recognition and excellence awards.	The annual staff recognition awards were held in November 2024.
People & Culture	✓	**5.2.2.3** Implement the Learning and Development Strategy to foster an engaged and empowered learning culture.	Program completed for 2024-2025.
People & Culture	✓	**5.2.2.4** Revise Council's Recruitment and Marketing Strategies to include Disability Inclusion and Reconciliation Action Plan tasks relating to cultural sensitivity, diversity and traineeships.	Council has gained additional funding to support a total of five new positions ranging from cadets to apprentices and continues to support them and their supervisors with tailored learning plans. Council continues to use recruitment platforms which enable accessibility functionality.

Reporting responsibility	Status	Deliverable	Performance Commentary
People & Culture		**5.2.2.5** Embed the Safety First culture throughout the organisation through the implementation of the Health, Safety and Wellbeing Strategy and Framework.	The Safety First culture continues to be a priority for the organisation demonstrated through 80% of the five focus area actions being completed. This showcases the organisation's commitment to creating a healthy and safe workplace. Council has also completed the StateCover self-audit which will continue to provide guidance on areas to strengthen the focus on safety. HSW Dashboard reporting has now extended to the ARIC and City Assets Management team for additional oversight and accountability. Council has also implemented a new incident management system to all staff. This provides easy access and reporting functionality to manage incidents, injuries and hazards in real time.

5.2.3. Implement best practice technology and processes

Reporting responsibility	Status	Deliverable	Performance Commentary
Digital Information Services		**5.2.3.1** Undertake a major software incident management exercise as part of organisational business continuity.	The major cyber incident exercise was successfully undertaken in conjunction with cyber partners in April 2025.
Digital Information Services		**5.2.3.2** Continue digitisation of Council archived records.	The bulk digitisation of Development Application files has been successfully completed on time and within budget. As a result, all DA files from 2007 are now available electronically to staff, and to provide a better service to the community.

Reporting responsibility	Status	Deliverable	Performance Commentary
Digital Information Services		**5.2.3.3** Implement recommendations from Council's Cyber Security Audit.	The recommendations from Council's Cyber Security Audit have all been actioned.

5.2.4. Deliver business and service delivery improvements

Reporting responsibility	Status	Deliverable	Performance Commentary
Corporate Strategy & Business Improvement		**5.2.4.1** Undertake two Service Reviews each financial year, consistent with the Service Review Framework.	The two service reviews for this financial year were completed. The outcomes of the review of the GIPA (Government Information Public Access Act application) and parking permit processes will be reported in the Annual Report.
Property Strategy & Leasing		**5.2.4.2** Progress Council's administration and operational accommodation strategy.	Work on this project is progressing according to schedule.
Digital Information Services		**5.2.4.3** Develop a corporate Customer Experience Strategy.	The planning phase for the Customer Experience Strategy has commenced in conjunction with the Customer Experience Improvement Project. Subject to the outcomes from the planning phase, the implementation plan will be developed with the view to delivery in the second half of the 2026 calendar year.

Goal 5.3.

Council works with partners to actively shape the City's future

5.3.1. Partner with the community and stakeholders to deliver integrated planning objectives and advocacy to State and Federal Governments

Reporting responsibility	Status	Deliverable	Performance Commentary
Corporate Strategy & Business Improvement	✓	**5.3.1.1** Develop and implement the Community Perception Survey.	Council's biennial community survey was undertaken in February 2025, with the final report arriving in March 2025.

5.3.2. Seek smart City partnerships to improve community and Council outcomes

Smart City technologies are integrated into Council's projects where suitable. Highlights will be reported in the Annual Report.

Goal 5.4.

City of Canada Bay community is well informed and eager to engage in issues and decisions that impact them

5.4.1. Ensure the community is well-informed through high quality, accessible, and timely information

Council's Communications and Engagement business unit works to ensure that the community is well-informed. Highlights will be reported in the Annual Report.

Performance measures

Measure	Baseline	Target	Frequency of reporting	Result 31 Dec 2024	Result 30 Jun 2025
Percentage of scheduled operational activities that are on track for completion within the project timeframe*	95% (June 2024)	80%	Six monthly and annually	98%	95%
Percentage of scheduled capital infrastructure projects that are on track for completion within the project timeframe*	79% (June 2024)	80%	Six monthly and annually	89%	93%
Percentage of high impact projects with a community engagement plan*	100% (2022-24)	100%	Annually	-	100%
Percentage of rates collected by due date**	95% (2021-22)	95%	Annually	96.01^	-
Cash expense cover ratio*	-	>3 months	Annually	15.95 months^	-
Debt service cover ratio*	-	>2.00x	Annually	11.44^	-
Operating performance ratio*	-	>0.00%	Annually	2.28	-
Own source operating revenue ratio*	-	>60%	Annually	60.92%^	-
Unrestricted current ratio*	-	>1.5x	Annually	4.02x^	-

** Outcomes that Council can control*
*** Outcomes that Council can influence*
^ As per Annual Financial Statements FY2024

Attachment 1: Behind schedule and postponed capital infrastructure commentary

The following table provides a commentary on the capital infrastructure projects that were behind schedule or postponed as at 30 June 2025.

Project name and status	Performance commentary
Concord Library - Lift Car Interior Renewal-Building Renewal Program Behind Schedule	Delays on this project have been caused by supply chain issues. It will be reconsidered as part of the 2026 Library Renewal program.
Lovedale Place improvements Behind Schedule	This project was delayed as there were ongoing negotiations with NSW Health relating to project scope. Planning is now underway for finalisation in the 2025-2026 financial year.
Victoria Ave Children Centre - Shade Sail Upgrade-Childcare Centres Postponed	This project will be delivered as part of the 2026 Childcare Renewal program.
Drummoyne Oval/ Taplin Stormwater re-use Postponed	This project has been postponed so Council can reconsider the project scope and funding methodology.
Deakin St Foreshore Access Postponed	Council has postponed this project as the estimated delivery costs were found to exceed the allocated grant funding and the project has significant ongoing operational maintenance risks.
Floodplains - Powells Creek East Catchment FS, FRMS, FRM Postponed	This project has been moved to the financial year 2025-2026 due to dependencies on nearby developments and State Government precinct plans, including the Housing Acceleration Fund (HAF) and the Transport Oriented Development (TOD) in the area. The study and plan will be reviewed and amended to better align with these private and State Government plans.
The Terrace - Embankment Stabilisation Postponed	This project has been moved to future years as further consultation with authorities is required.

Project name and status	Performance commentary
Wellbank Children Centre - Reception Area Fitout Upgrade-Childcare Centres Postponed	This project has been moved to the 2025-2026 financial year to include the broader scope of works identified during site investigations.
Rothwell Park Maintenance Shed & Storage - Building Renewal Program Postponed	This project has been deferred to a future year as a review of scope, feasibility and benefit is required.
Drummoyne Pool - Sustainability Project Electric Heat Pumps Postponed	This project has been postponed until grant funding is secured. It was found that the scope of electrical demand is greater than initially anticipated.

Investment Policy (April 2025)

1. Purpose

To provide a framework for the investing of Council's surplus funds in a prudent manner to generate the most favourable returns within acceptable risk parameters whilst ensuring that Council's liquidity requirements are being met.

Specific strategies maybe employed at different times to achieve this objective so long as those strategies always lie within the policy.

2. Background and Standards

Section 625 of the Local Government Act 1993 allows Council to invest funds in particular securities so long as the funds are not required for any other purpose.

The Minister for Local Government issued revised guidelines in 2010 which placed emphasis on observing the 'prudent person test'.

The investments will be managed with the care, diligence and skill that a prudent person would exercise. As trustees of public monies, officers are to manage Council's investment portfolio to safeguard the portfolio in accordance with the spirit of this Investment Policy, and not for speculative purposes (DLG - May 2010).

At the same time the investment of Council's funds must be conducted to the highest of ethical standards:

Officers shall refrain from personal activities that would conflict with the proper execution and management of this portfolio. This policy requires officers to disclose any actual or perceived conflicts of interest to the General Manager. Independent advisors are also required to declare that they have no actual or perceived conflicts of interest. (DLG - May 2010).

3. Authority for Investment

The Council may invest surplus funds pursuant to the:

- Local Government (General) Regulation 2021
- Local Government Act 1993
- Ministerial Investment Order
- Local Government Code of Accounting Practice and Financial Reporting
- Australian Accounting Standards
- Division of Local Government Circulars
- The Trustee Act 1925 Section 14 and the Trustee Amendment (Discretionary Investments) Act 1997- Sections 14A(2), 14C(1) and (2)
- Office of Local Government Policy Guidelines

4. Delegation Authority

Authority for implementation of this Policy is delegated by the elected Council to the General Manager in accordance with the Local Government Act 1993 (NSW).

Subject to regular review, the General Manager has delegated the day-to-day management of Council's Investment Portfolio to the:

- Director Corporate Services and Strategy
- Chief Financial Officer
- Corporate Accounting Manager
- Management Accountant – Investments

To be effective, a delegation must be in writing.

Staff members delegated to manage Council's Investment Portfolio must acknowledge that they have received a copy of this Policy and that they understand the obligations and responsibilities of their role.

5. Authorised Investments

Investments are limited to those allowed by the most current Ministerial Investment Order that has been issued by the NSW Minister for Local Government.

The most current Ministers Order is dated 12 January 2011 and is detailed in Attachment A. Authorised Investments will be limited to:

- any public funds or securities issued by or guaranteed by, the Commonwealth, any State of the Commonwealth or a territory
- any Debentures or Securities issued by a Council, within the meaning of the Local Government Act 1993 (NSW)
- interest bearing deposits with, or debentures or bonds issued by, an Authorised Deposit-taking institution (ADI), as defined in the Banking Act 1959 (Commonwealth), but excluding subordinated debt obligations
- any bill of exchange which has a maturity date of not more than 200 days and if purchased for value confers on the holder in due course a right of recourse against a bank which has been designated as an ADI
- a deposit with the New South Wales Treasury Corporation (TCorp) or investments in managed funds with TCorp

6. Prohibited Investments

In accordance with the Ministerial Investment Order, this Investment Policy prohibits, but is not limited, to any investment carried out for speculative purposes including:

- derivative based instruments
- principal only investments or securities that provide nil or negative cash flow
- standalone securities issued that have underlying futures, options, forward contracts and swaps of any kind
- shares of any kind
- any investments not denominated in Australian Dollars or that carry foreign exchange risk

This policy also prohibits the use of leveraging (borrowing to invest) for any investment.

Council officers should ensure that before new investments are made, they establish whether a product complies with the Investment Policy and, where necessary, obtain independent financial advice in writing on the nature and risk of the financial product.

7. Investment Guidelines

While exercising the power to invest, consideration is to be given to the preservation of capital, liquidity, and the return on investment.

- Preservation of capital is the principal objective of the Investment Policy. Investments are to be placed in a manner that seeks to ensure security and safeguarding the Investment Portfolio. This includes managing credit and interest rate risk within identified thresholds and parameters
- Investments should be allocated to ensure there is sufficient liquidity to meet all reasonably anticipated cash flow requirements, as and when they fall due, without incurring the risk of significant costs due to the unanticipated sale of an investment
- Investments are expected to achieve a market return in line with the Council's risk tolerance

Investments obtained are to be considered based on the following key criteria:

- Preservation of Capital - the requirement for preventing losses in an investment portfolio's total value (considering the time value of money)
- Diversification - setting limits to the amounts invested with a particular financial institution or government authority to reduce credit, interest rate, liquidity and market risks
- Credit risk - the risk the investment Council has made fails to pay the interest and repay the principal when due
- Liquidity Risk - the risk council is unable to redeem the investment at a fair price within a timely period, or the risk the fair price has changed significantly due to market risks and council is in a position where it must sell before maturity incurring a loss
- Interest Rate Risk - the risk the fair market value of the investment fluctuates significantly due to changes in underlying interest rates
- Market Risk - the risk that the fair value or future cash flows of an investment will fluctuate due to changes in market conditions and prices, principally interest rate, credit and liquidity risks
- Maturity Risk - the risk relating to the length of term to maturity of the investment. The larger the term, the greater the length of exposure and exposure to market risks.
- Reinvestment Risk – the risk that income will not meet expectations or budgeted requirement because interest paid on the investments are lower in future than they are currently

8. Direct Investments

Portfolio Credit Framework

The portfolio credit guidelines to be adopted will be based on the Standard and Poor's (S&P) ratings system criteria (or Moody's and Fitch equivalent if an S&P rating is not available). The maximum available limits in each rating category are as follows:

Long Term Rating	Minimum Requirement	Maximum Limit
AAA to AA-or Major Banks and below	30%	100%
A+ to A- and below	0%	70%
BBB+, BBB, BBB- and below	0%	40%
Unrated ADI with a branch within the Canada Bay LGA	0%	$250,000 or the prevailing Government Guaranteed Amount
TCorpIM Funds	0%	40%

9. Individual Counterparty Credit Framework

The individual credit guidelines to be adopted will be based on the Standard and Poor's (S&P) ratings system criteria (or Moody's and Fitch equivalent if an S&P rating is not available}. The maximum available limits in each rating category are as follows:

Long Term Rating	Maximum Individual Limit
Federal or NSW Government	100%
AAA	50%
AA+ to AA- or Major Banks	45%
A+ to A-	30%
BBB+ to BBB-	10%
Unrated	$250,000 or the prevailing Government Guaranteed Amount
TCorp Managed Funds	20%

For the purpose of this Policy, “Major Banks” are defined as:

- Australia and New Zealand Banking Group Limited
- Commonwealth Bank of Australia
- National Australia Bank Limited
- Westpac Banking Corporation

including any of their wholly owned subsidiaries that are explicitly guaranteed by the parent (such as St George, Bank West).

S&P ratings will be used in the first instance for the purposes of Minimum Portfolio Requirements and Maximum Individual Limits. In the event an investment is not rated by S&P, then the lower of its alternative ratings from Moody’s and Fitch (in the event it has more than one alternative rating) will be used for the purposes of this policy.

10. Term to Maturity Framework

The portfolio is to be invested with the following term to maturity constraints.

Maturity Band	Minimum Portfolio Exposure	Maximum Portfolio Exposure
<1 year	30%	100%
>1 year	0%	70%
>3 year	0%	30%
>5 years	0%	0%

Individual Investments must conform to the following term maturities based on credit rating.

Long Term Rating	Maximum Tenor
AAA to AA-	5 Years
A+ , A , A-	5 Years (Floating Rate Notes) 5 Years (All other investments)
BBB+ and BBB	3 Years
BBB- and below	1 Year
TCorpIM Funds	N/A

For the avoidance of doubt the Term to Maturity Framework Limits do not apply to any investments in TCorp IM Funds

11. Environmental, Social and Governance (ESG) Investing

Where financial institutions are offering equivalent investment returns with the same credit rating and assessed financial risk and the investment fits within the provisions of this Investment Policy, preference will be given to placing funds with institutions identified as having the higher ESG standards which may include, but not limited to, investing with institutions not financing fossil fuel companies.

12. Investment Strategy

On an on-going basis and in conjunction with this Investment Policy, an Investment Strategy will be formulated and documented. This strategy may be formulated in conjunction with Council's Investment Advisor, if applicable, and be documented in the reports from that advisor to council. The strategy will consider the following:

- Council's cash flow requirements and implications for the portfolio liquidity profile.
- Allocation of investment types, credit quality, counterparty exposure and term to maturity.
- Current and projected market conditions and any likely impacts on relative positioning in terms of the portfolio and any necessary policy implications.
- Relative return outlook; risk-reward considerations; assessment of the market cycle and hence constraints on risk.
- Appropriateness of overall investment types for Council's portfolio and,
- The projected investment portfolio level for the forthcoming year.

13. Grandfathering

Any investment purchased when compliant with the Investment Policy may be held to maturity or sold as Council believes best dependent on the individual circumstances, so long as that risk management strategy is in accordance with the principles of the Investment Guidelines as above, the prevailing legislation and the prudent person guidelines.

Specifically, Grandfathering will apply to any investment that:

- Was made ineligible by a previous change to the external legislation if that change allows for grandfathering (e.g., changes regarding COO's following the change of legislation post the Cole Report)
- Is made ineligible because of a change to this Investment Policy
- Is in breach of the Investment Policy due to a change of circumstance. (e.g., because the investment has been downgraded or has had its credit rating withdrawn post purchase)
- Is in breach due to a change of portfolio size or composition (e.g. because the overall portfolio size has decreased and as a result the percentage of total portfolio limit which applies to individual remaining investments increases and therefore causes a breach).

14. Trading Policy

Council will make every effort and will undertake cash flow forecasting to match investment maturities to cash flow requirements to minimise early liquidation of investments prior to scheduled maturities and any associated penalties either explicit in the form of break costs or implicit in terms of broker fees, market spreads and liquidity risks.

Investments will be acquired with the intention of holding them through maturity, and cash liquidity requirements will be managed to ensure Council avoids a situation that will require a forced sale of these assets in normal circumstances.

However, if Investment Policy Limits have been breached due to a change in the overall size of the investment portfolio, external or internal changes to investment policy parameters or for any other reason, then investments maybe sold prior to maturity. Under these situations Council has the authority to make the necessary arrangements to withdraw from the investment as soon as practicable.

Council may also sell assets prior to maturity in the following circumstances:

- If the asset is liquid, easily tradeable, can be sold without significant loss and was purchased as part of a "liquidity buffer" against the event of unforeseen and unexpected liquidity requirements.
- If Council judges that the asset has deteriorated in credit quality and there is a material risk of loss on the asset if held to maturity and Council upon seeking external advice from a competent and reputable independent advisor is advised that a sale of the asset is in the best interests of Council for risk management purposes to potentially minimise any future losses.
- For the avoidance of doubt, Council will not adopt an active trading strategy buying and selling assets on broker recommendations for the purposes of enhancing returns through the accumulation of capital profits

15. Quotations for Purchases and Sales of Investments

The investing officer must satisfy themselves that they are obtaining a fair market price for all investments made at all times. This can be accomplished by obtaining multiple independent quotes from reputable market makers where the investment is widely traded or where it is not widely traded

by reference to other similar instruments that are traded in the market place. Council will take due steps to ensure that any investment is executed at the best pricing reasonably possible.

If this is not possible or impractical, the investing officer can rely on representations made by an Independent Advisor with no conflicts of interest regarding the purchase or sale of the investment.

For the avoidance of doubt, the investing officer must not rely or representations made by the buyer, seller or broker or any other person with a potential conflict of interest.

16. Performance Benchmark

The performance benchmark has been set at the Bloomberg Bank Bill Index. Performance relative to this index should be assessed with reference to Council's investment risk appetite, marked conditions and by comparison to other peer Councils.

17. Safe Custody Arrangements

Where necessary, investments may be held in safe custody on Council's behalf as long as the following criteria are met:

- Council must retain beneficial ownership of all the investments
- Adequate documentation is provided verifying the existence of the investments
- The Custodian conducts regular reconciliation of records with relevant registries and/or clearing systems
- The institution or Custodian recording and holding the assets will be:
    - Austraclear or an equivalent globally recognised registry service or,
    - A major Australian Bank (ANZ, CBA, NAB, Westpac)
    - An entity with a credit rating of AA- rating from S&P (or its equivalent rating from Fitch or Moody's) or better

18. Reporting

All investments are to be appropriately recorded in Council's financial records and reconciled at least on a monthly basis.

Certificates must be obtained from the financial institutions confirming the amounts of investments held on the Council's behalf as at 30 June each year (or any other date which is the end of financial year) and reconciled in the Investment Register.

A monthly report will be provided to Council which details:

- Portfolio performance
- Portfolio composition with relevant data on types of investment, credit ratings and maturities
- Compliance with the terms of the investment policy (with any breaches noted)
- Independent financial assessments of the value of the investments and the investments portfolio.

19. Investment Advisor

Council's investment advisor must be approved by Council and hold an Australian Financial Services License issued by the Australian Securities and Investment Commission. The advisor must be an independent person who has no actual or potential conflict of interest in

relation to investment products being recommended and is free to choose the most appropriate product within the terms and conditions of the investment policy.

The independent advisor is required to provide written confirmation that they do not have any actual or potential conflicts of interest in relation to the investments they are recommending or reviewing, including that they are not receiving any commission or other benefits in relation to the investments being recommended or reviewed unless these commissions are disclosed and fully rebated to Council.

20. Review of Policy

This investment policy will be reviewed at least once a year or as required in the event or result of legislative changes.

The Investment Policy may also be changed as a result of other amendments that are to the advantage of Council and in the spirit of this policy. Any amendment to the Investment Policy must be by way of Council resolution

21. Definitions

ADI	Authorised Deposit-Taking Institutions are corporations that are authorised under the Bank Act 1959 (Cwth) to take deposits from customers
Bill of Exchange	- a bill of exchange is an unconditional order in writing, addressed by one person to another, signed by the person giving it, requiring the person to whom it is addressed to pay on demand, or at a fixed or determinable future time, a sum certain in money to or to the order of a specified person, or to bearer:
Debentures	**Debentures** - A debenture is a document evidencing an acknowledgement of a debt, which a company has created for the purposes of raising capital. Debentures are issued by companies in return for medium and long-term investment of funds by lenders.
DLG	NSW Office of Local Government, Department of Premier and Cabinet
Grandfather Clause	Grandfather clause is a legislative clause, which, in prohibiting a certain activity, exempts those who were already engaged in the activity at the time the legislation was passed.
Preservation of Capital	Preservation of capital refers to an investment strategy with the primary goal of preventing losses in an investment portfolio's total value
Prudent Person Standard	Prudent person standard is a legal standard restricting the investing and managing of a client's account to what a prudent person seeking reasonable income and preservation of capital might exercise for his or her own investment.
Securities	For financial markets, these and many types of financial instruments (i.e. documents) that are traded in financial markets (except future contracts) e.g. bills of exchange, transferable certificates of deposit, negotiable certificates of deposit, floating rate notes

22. Approval Status

Council approved this policy / procedure on [insert date].

23. Approval History

Stage	Date	Comment	ECM ID
Original Policy / Procedure	01/11/2016	Approved by Council	6395402
Reviewed	20/09/2022	Approved by Council	6395402
Reviewed	20/05/2025	To be Approved by Council	8553170
Next Review	01/05/2026		

24. Ownership and Approval

Responsibility	Role
Author	Chief Financial Officer - Finance
Owner	Director Corporate Services and Strategy
Endorser	City of Canada Bay Executive
Approver	City of Canada Bay Council

Attachment A

https://www.olg.nsw.gov.au/wp-content/uploads/Investment-Order-12-1-2011.pdf

LOCAL GOVERNMENT ACT 1993 – INVESTMENT ORDER
(Relating to investments by councils)

I, the Hon. Barbara Perry MP, Minister for Local Government, in pursuance of section 625(2) of the *Local Government Act 1993* and with the approval of the Treasurer, do, by this my Order, notify for the purposes of section 625 of that Act that a council or county council may only invest money (on the basis that all investments must be denominated in Australian Dollars) in the following forms of investment:

(a) any public funds or securities issued by or guaranteed by, the Commonwealth, any State of the Commonwealth or a Territory;

(b) any debentures or securities issued by a council (within the meaning of the *Local Government Act* 1993 (NSW));

(c) interest bearing deposits with, or any debentures or bonds issued by, an authorised deposit-taking institution (as defined in the *Banking Act* 1959 (Cwth)), but excluding subordinated debt obligations;

(d) any bill of exchange which has a maturity date of not more than 200 days; and if purchased for value confers on the holder in due course a right of recourse against a bank which has been designated as an authorised deposit-taking institution by the Australian Prudential Regulation Authority;

(e) a deposit with the New South Wales Treasury Corporation or investments in an Hour-Glass investment facility of the New South Wales Treasury Corporation;

All investment instruments (excluding short term discount instruments) referred to above include both principal and investment income.

Transitional Arrangements

(i) Subject to paragraph (ii) nothing in this Order affects any investment made before the date of this Order which was made in compliance with the previous Ministerial Orders, and such investments are taken to be in compliance with this Order.

(ii) Paragraph (i) only applies to those investments made before the date of this Order and does not apply to any restructuring or switching of investments or any re-investment of proceeds received on disposal or maturity of such investments, which for the avoidance of doubt must comply with this Order.

Key Considerations

An investment is not in a form of investment notified by this order unless it also complies with an investment policy of council adopted by a resolution of council.

All councils should by resolution adopt an investment policy that is consistent with this Order and any guidelines issued by the Chief Executive (Local Government), Department of Premier and Cabinet, from time to time.

The General Manager, or any other staff member, with delegated authority by a council to invest funds on behalf of a council must do so in accordance with the council's adopted investment policy.

Councils have a fiduciary responsibility when investing. Councils should exercise the care, diligence and skill that a prudent person would exercise in managing the affairs of other persons.

When exercising the power of investment councils should consider, but not be limited by, the risk of capital or income loss or depreciation, the likely income return and the timing of income return, the length of the term of the proposed investment, the liquidity and marketability of the proposed investment, the likelihood of inflation affecting the value of the proposed investment and the costs (including commissions, fees, charges and duties payable) of making the proposed investment.

Dated this 12th day of January 2011

Hon BARBARA PERRY MP
Minister for Local Government