Community Consultation

Appendix C

Johnstons Creek Catchment Floodplain Risk Management Study and Plan

August 2013

CITY OF SYDNEY 2030

Sydney2030/Green/Global/Connected

The City of Sydney is preparing a Floodplain Risk Management Study and Plan for the Johnstons Creek catchment area and we would like your help.

The study will tell us about the type of flood mitigation solutions feasible for the catchment and help us plan for and manage any flood risks.

Good management of flood risks can help reduce damage and improve social and economic opportunities.

city of villages

To access the questionnaire online visit

cityofsydney.nsw.gov.au/floodplain-management

The City of Sydney has engaged WMAwater to assist with the preparation of the Johnstons Creek Floodplain Risk Management Study and Plan.

The Johnstons Creek Flood Study was completed by WMAwater in 2012, giving the City of Sydney a better understanding of the nature of flooding in your area. The next step in the NSW Government Flood Management Process is the preparation of a Floodplain Risk Management Study and Plan. The purpose of this study and plan is to identify and recommend appropriate actions to manage flood risks in the Johnstons Creek area.

This brochure is an introduction to the Floodplain Risk Management Study and Plan and its objectives.

Stages of the NSW Government Flood Prone Land Policy

1. Formation of a Committee – complete
2. Data Collection – complete
3. Flood Study – complete
4. **Floodplain Risk Management Study**
5. **Floodplain Risk Management Plan**
6. Implementation of Plan.

Study area and flooding issues

The Johnstons Creek Catchment includes the suburbs of Annandale, Camperdown, Forest Lodge and parts of Glebe and Newtown.

Land uses within the catchment include residential, commercial and industrial properties as well as parklands.

Have your say

We want your comments about previous flood experiences and potential mitigation options.

The local knowledge of residents and business operators, including your personal experiences of flooding, is a valuable source of information.

The information you provide in the accompanying questionnaire will help the City of Sydney determine how to manage the floods in your area.

For more information about this project, please contact the City of Sydney or WMAwater via the details provided.

Floodplain risk management options

The following list of floodplain risk management options are examples of the type of strategies that could be considered to minimise risk and reduce the impact of flooding in the catchment. These options will be investigated in more detail during the preparation of the Management Study and Plan. The general categories of these options are:

Flood modification options.
Examples include:

- Construction of detention/ retarding basins to reduce the peak flow downstream;
- Upgrading of drainage systems, upgrade of existing pipes or construction of new pipes; and
- Regrading of roads to provide better overland flowpaths.

Property modification options and planning control.
Examples include:

- Building and development controls;
- Flood-proofing measures, such as flood barriers.

Response modification options.
Examples include:

- Revision of the Local Disaster Plan;
- Public awareness and education – locality-based flooding information for residents;
- Public awareness and education – flooding information for schools;
- Flood depth markers at major (flood-affected) road crossings;
- Continuation of existing public awareness and education campaigns; and
- Data collection strategies for future floods.

For more information please contact:

WMAwater
Steve Gray
Phone 02 9299 2855
Fax: 02 9262 6208
gray@wmawater.com.au

City of Sydney
Shah Alam
Phone: 02 9288 5925
salam@cityofsydney.nsw.gov.au

CITY OF SYDNEY 2030

Sydney2030/Green/Global/Connected

Local Resident/Land Owner Survey

The City of Sydney is conducting a Floodplain Risk Management Study and Plan for the Johnstons Creek. Please return your completed questionnaire in the reply-paid envelope by Friday 20 September 2013. Or complete the questionnaire online at cityofsydney.nsw.gov.au/floodplain-management

1

Please provide the following details as we may contact you to discuss some of the information you have provided us.

Name: .....

Address: .....

Contact phone number:.....

Email: .....

2

What is the best way to contact you?

☐ Letter (post) ☐ Email ☐ Phone

3

How many people regularly live/work on this property?

.....

.....

.....

4

How many of the permanent residents/workers are in age group below:

☐ 0–4 years ☐ 5–14 years ☐ 15–64 years ☐ 65+ years

5

What is the main language spoken at this address?

☐ English

☐ Other (please specify) .....

6

Is your property (please tick)

☐ Owner occupied ☐ Occupied by a tenant ☐ Business

☐ Other (please specify) .....

7

What type of structure is your property/business? (please tick)

☐ Freestanding house.....

☐ Apartment.....

☐ Dual occupancy.....

☐ Industrial.....

☐ Commercial.....

8

How long have you lived, worked at, and/or owned this property?

Years .....

Months .....

9

Have you ever experienced flooding since living and/or working in the Johnstons Creek catchment? (please tick relevant boxes)

☐ Yes, floodwaters entered my house/business

☐ Yes, floodwaters entered my yard/surrounds of my business

☐ Yes, the road was flooded and I couldn't get to my car

☐ Yes, other parts of my neighbourhood were flooded

☐ No, I haven't experienced flooding

10

Do you have any materials or photos you can provide to evidence the flooding you experienced? If yes, when did this flood occur?

☐ No

☐ Yes – the flooding occurred on: .....

.....

11

As a local resident who may have witnessed flooding/drainage problems, you may have your own ideas about how to reduce flood risks. Which of the following management options would you prefer for the Johnstons Creek catchment (1=least preferred, 5=most preferred)?

Proposed option	Preference
Stormwater harvesting, such as rainwater tanks — Suggested location/other comments:	1 2 3 4 5
Retarding or detention basins (these temporarily hold water and reduce peak flood flows) — Suggested location/other comments:	1 2 3 4 5
Improved flood flow paths — Suggested location/other comments:	1 2 3 4 5
Culvert/bridge enlarging — Suggested location/other comments:	1 2 3 4 5
Pit and pipe upgrades — Suggested location/other comments:	1 2 3 4 5
Levee banks or flood walls — Suggested location/other comments:	1 2 3 4 5
Strategic planning and flood related development controls — Suggested location/other comments:	1 2 3 4 5
Education of the community, providing greater awareness of potential hazards — Suggested location/other comments:	1 2 3 4 5
Flood forecasting, flood warnings, evacuation planning and emergency response measures — Suggested location/other comments:	1 2 3 4 5

Other (please specify any options you think are suitable):.....

.....

.....

.....

If you have any further comments that relate to the Johnstons Creek Flood Management Study and Plan, please write them in the space below. Feel free to attach additional pages if necessary.

.....

.....

.....

Glossary

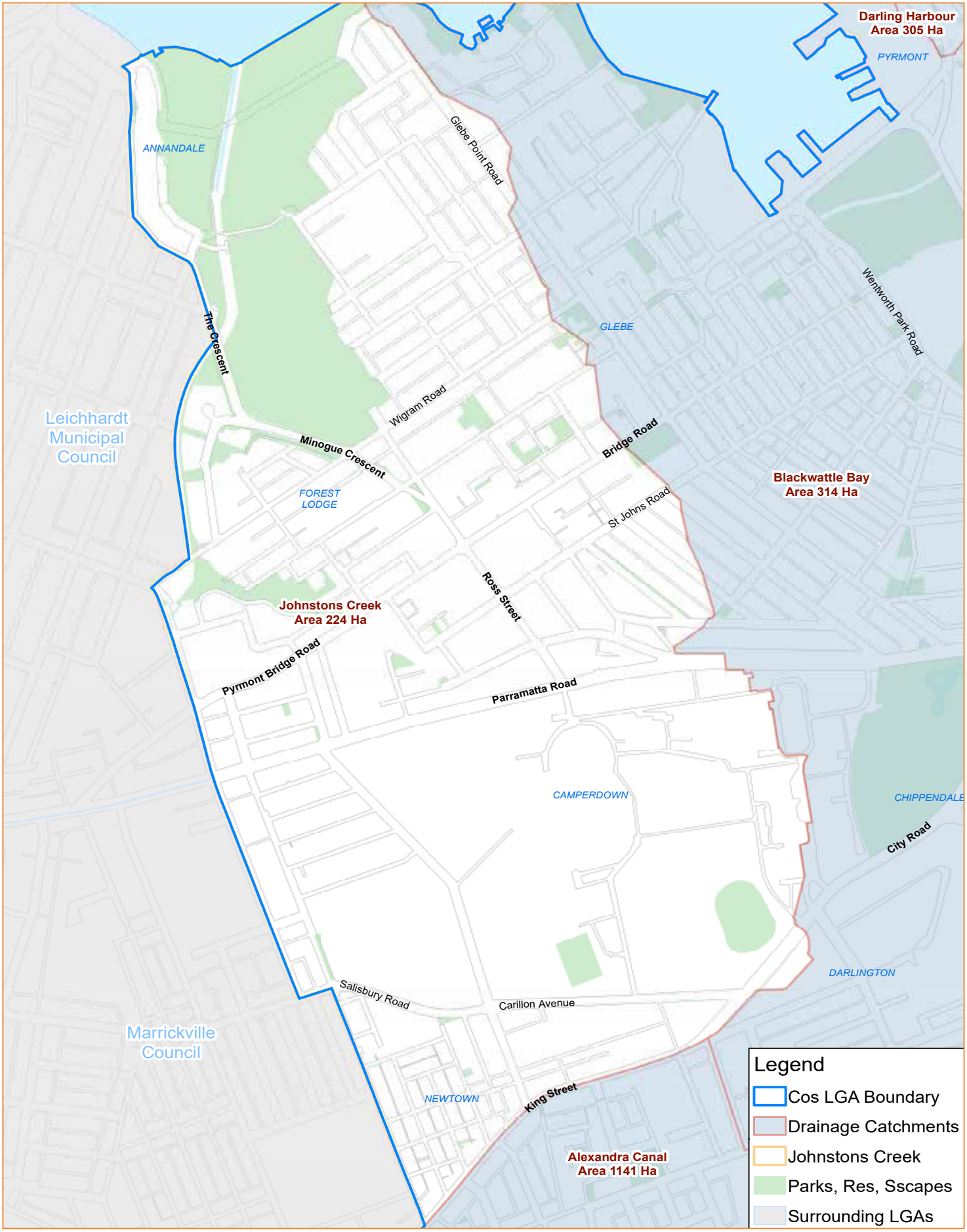
Culvert – a piped drain or covered channel that passes under a road or railroad.

Levee bank/flood wall – an embankment or wall, usually constructed from earth or concrete, built along the banks of a watercourse to help prevent overflow of its waters.

Retarding/detention basin – depression in the land surface that captures and holds stormwater runoff allowing it to slowly drain out of the basin into the adjoining natural drainage line or creek.

Stormwater harvesting – the collection, storage, treatment and use of stormwater run-off from urban areas.

Privacy notice: The information obtained from the survey will be used by staff from the City of Sydney Council and WMAwater only. The information supplied will remain completely confidential.


Darling Harbour
Area 305 Ha
PYRMONT
ANNANDALE
Glebe Point Road
Wentworth Park Road
GLEBE
The Crescent
Leichhardt
Municipal
Council
Wigram Road
Minogue Crescent
Bridge Road
Blackwattle Bay
Area 314 Ha
FOREST
LODGE
St Johns Road
Ross Street
Johnstons Creek
Area 224 Ha
Pyrmont Bridge Road
Parramatta Road
CAMPERDOWN
CHIPPENDALE
City Road
DARLINGTON
Salisbury Road
Carillon Avenue
Marrickville
Council
NEWTOWN
King Street
Alexandra Canal
Area 1141 Ha
Legend
Cos LGA Boundary
Drainage Catchments
Johnstons Creek
Parks, Res, Sscapes
Surrounding LGAs

The Floodplain Risk Management Process

Flood Risk – What Is It?

Flooding occurs when land is inundated with water, often from a river, creek or the ocean. The flood risk of an area is a product of the severity of the flood threat (including its magnitude and likelihood) and the extent of human development in the area. For instance, a section of houses built adjacent to a creek that regularly floods will have a much higher flood risk than a single property in an elevated area.

▶ **Properties affected by flooding**

Flood Risk - Where is it in NSW?

Flood risk in NSW is spread across the entire state, with nearly all local government areas affected in some form. The threat that flooding poses ranges from coastal inundation to the flooding of creeks and rivers, to surcharge of drainage systems in urban areas

How is flooding planned for?

The flood risk in a particular area is managed through the NSW Government's Flood Prone Land Policy, which sets out a multiple stage process for managing flood risk. The process determines the flood behaviour in an area, assesses what impact a possible flood event will have on the area, and then produces a series of recommendations as to how to manage the flood risk. The stages are shown below.

▶ **Flooding on Sparkes St, Camperdown**

Who has responsibility for managing flooding?

Generally speaking, Councils are responsible for carrying out the management process, with the NSW Government and SES providing assistance where necessary. Consultants with expertise in flooding are commonly engaged by the City to assist in each stage. Council's knowledge of its community, including their flood risk, is combined with a consultant's technical knowledge of flood behaviour and how to manage it, and both are guided by the NSW Government and the SES's policies, which ensures state-wide consistency.

How does the process work?

The process builds a complete picture of flooding in an area (both past and future) and then decides upon a strategy that will best manage the flood risk in the area. The process is cyclical. The last stage, implementing the chosen plan, is followed by a re-assessment of the flood behaviour, the management options, and so on. Flood threat is constantly changing, as uses evolve and the understanding of the lands hydrology grows. A better understanding of the possible impacts of climate change makes re-assessment of flood hydrology more important than ever.

▶ **The Floodplain Risk Management Process**

Managing the Flood Risk – What Can Be Done?

The Three Types of Measure

The ideal approach to manage flood risk varies greatly between areas, and as such, many measures exist and are currently in use. The measures can be divided into three categories: **Property Modification**, **Response Modification** and **Flood Modification**. The suitability of a particular measure will depend on its benefit to the area, the cost of the measure, its negative impacts, and a range of other factors. A full description of each category is given in the Floodplain Development Manual

▶ **Examples of the three types of measure**

Property Modification Examples	Response Modification Examples	Flood Modification Examples
• House Raising • Flood Proofing • Zoning controls	• Warning System • Evacuation Plan • Education	• Drainage Upgrade • Detention Basins

Property Modification

Property modification measures refer to those that modify an existing property or place a control that limits future development. These measures include voluntary purchase of high risk properties, zoning controls in at-risk areas, house raising, flood proofing and flood access. The measures do not attempt to control the extent of the floodwaters, but rather act to lower the impact of the flood.

▶ **House raising is an example of property modification**

Property modification measures are only effective in some areas. For example, the cost of raising or purchasing a house must be balanced with the monetary benefit of that action. Similarly, house purchasing may be unpopular with landowners who value the location and intrinsic worth of their property.

▶ **Detention basin is an example of flood modification**

▶ **Designating floodways is an important zoning measure**

Response Modification

Response modification measures are those that increase the community's ability to react to floods when they occur. This typically relates to writing or amending plans used in emergency situation. Examples of plans that may be affected are those for flooding warning, the protection of an area, community education and readiness, the relief of evacuees and the post-flood recovery.

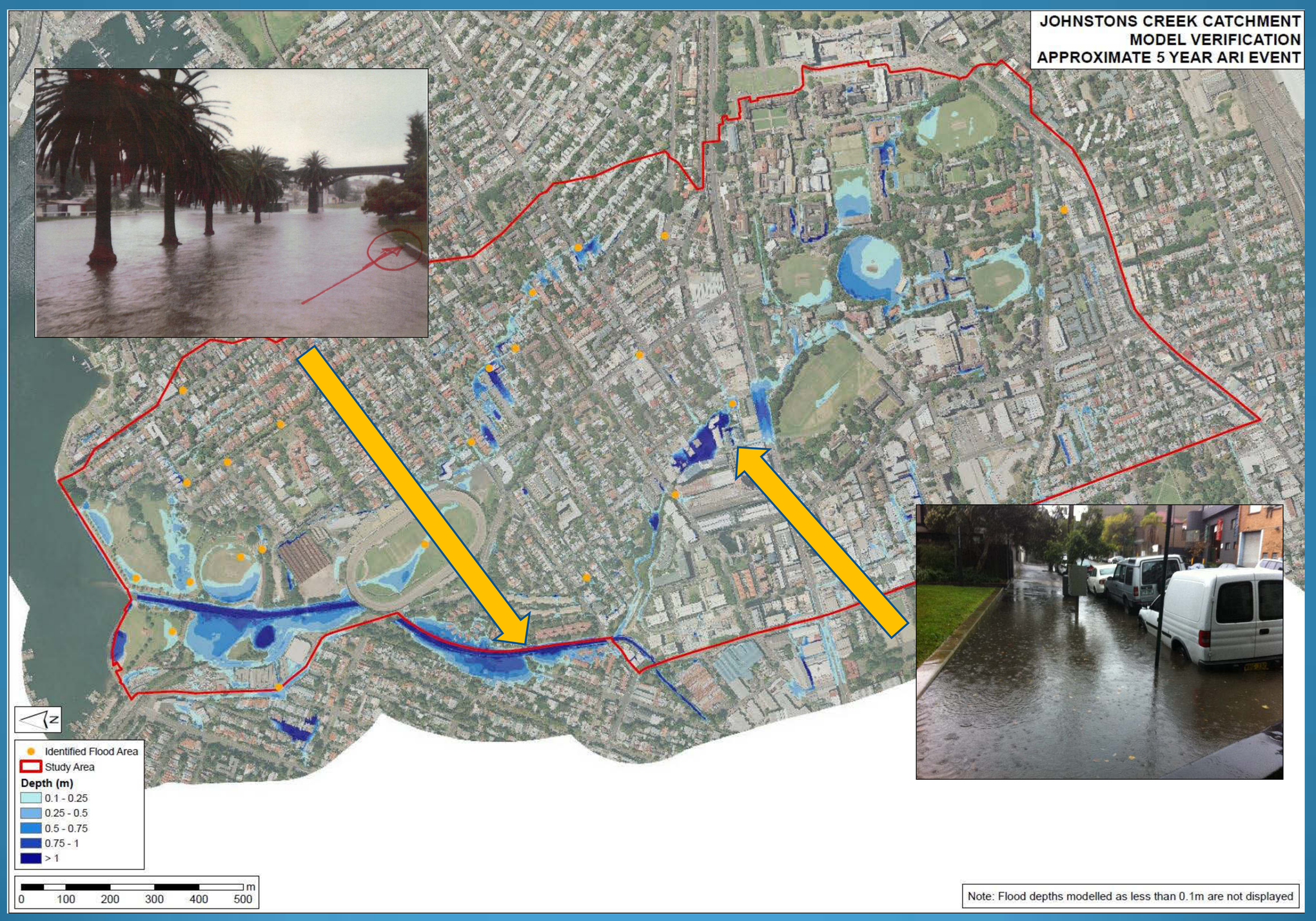
▶ **Knowledge of flooding in an area should be well documented**

While response modification measures will not alter the course of floodwaters, they have the advantage of generally being a cost-effective option. Plans such as those mentioned are typically easy to establish relative to other measures, and their benefits are immediate. A community that is well versed in the local flood risk, including their readiness, can minimize the impacts of a flood when it does occur.

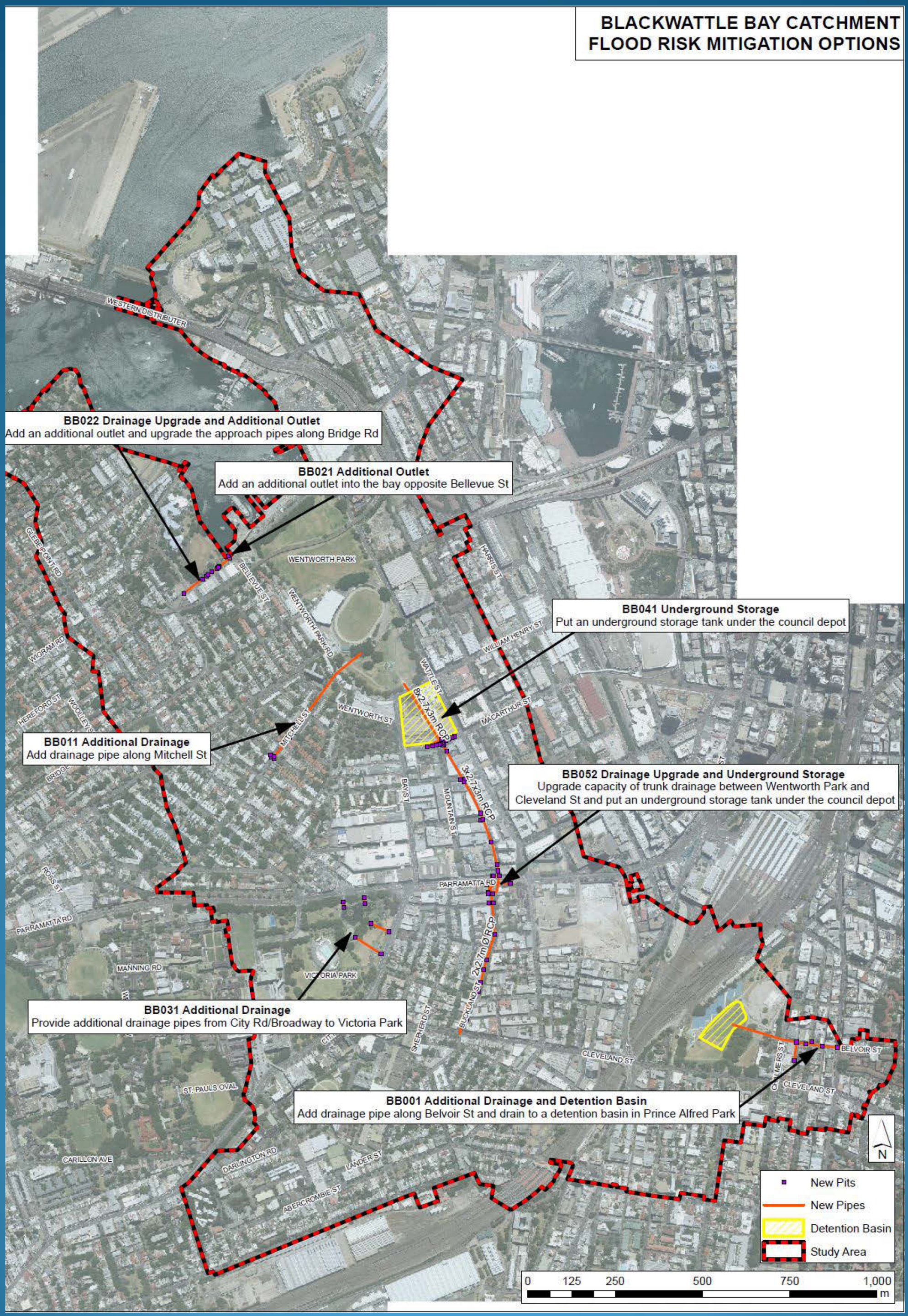
Flood Modification

Flood modification measures aim to alter the behaviour of the floodwaters, be it their extent, velocity or height. These can be large scale projects, such as levees or seawalls around towns, or flood mitigation dams, or smaller modifications, such as altering the river channel, installation of sub-surface drainage, or local retarding basins. While they have the ability to re-route or diminish a river's flow, lowering the flood risk for large areas of land, modifying an area's hydrology can be both expensive and ecologically harmful. Furthermore, these structures may lead to a false sense of security, for example, that a levee or dam will protect an area indefinitely when in fact it will always fail once a large enough flood occurs.

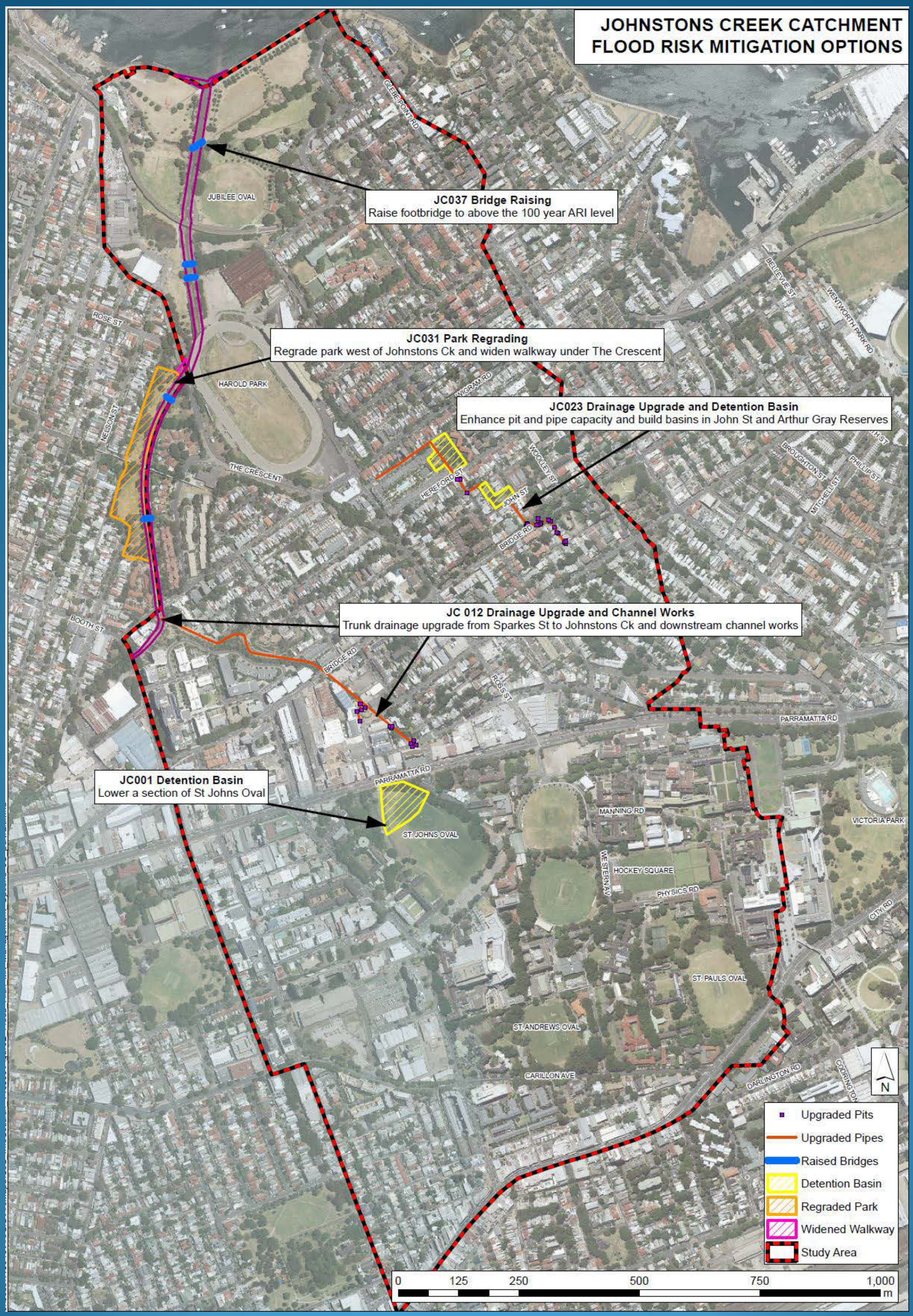
Historical floods in Blackwattle Bay and Johnstons Creek catchments



Preliminary Assessment of Flood Mitigation Measures – Blackwattle Bay Catchment



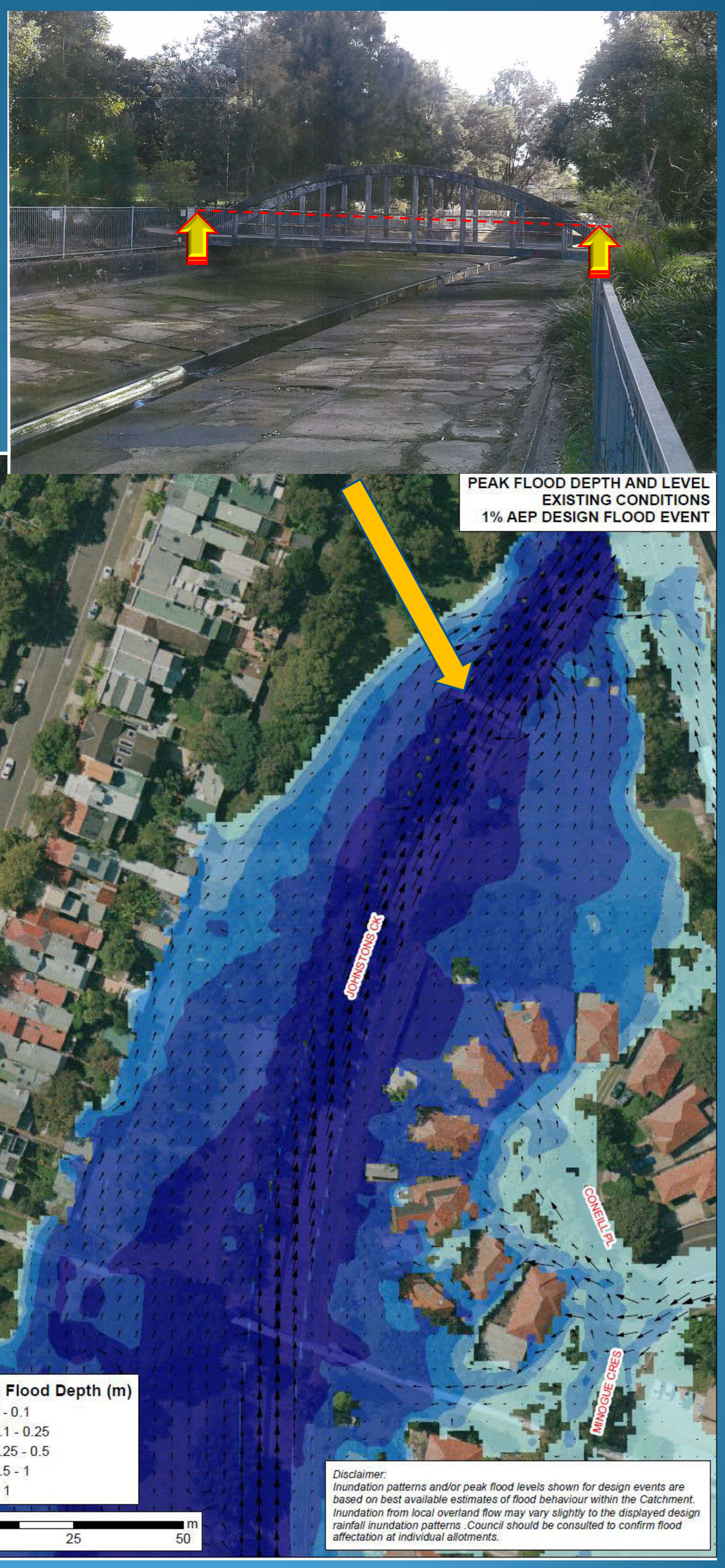
Preliminary Assessment of Flood Mitigation Measures – Johnstons Creek Catchment

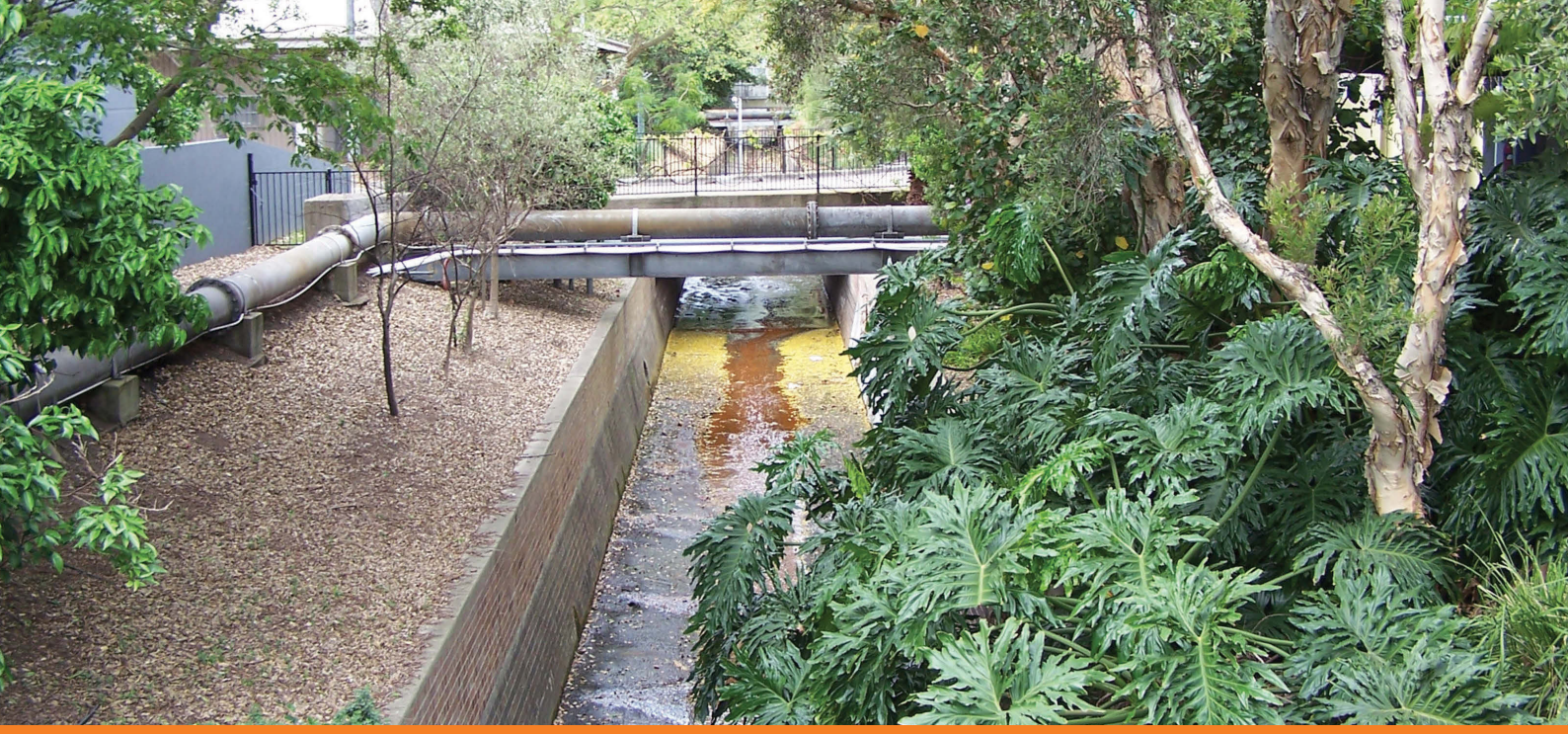


Johnstons Creek

Proposed works:

- Regrading adjacent parkland
- Raise pedestrian crossings
- Drainage upgrade





Johnstons Creek Catchment Floodplain Risk Management Study and Plan

CITY OF SYDNEY 2030

The City of Sydney is preparing a Floodplain Risk Management Study and Plan for the Johnstons Creek catchment area and we would like your help.

The study will tell us about the type of flood mitigation solutions feasible for the catchment and help us plan for and manage any flood risks.

Good management of flood risks can help reduce damage and improve social and economic opportunities.

Sydney2030/Green/Global/Connected

city of villages

cityofsydney.nsw.gov.au/floodplain-management

The City of Sydney has engaged WMAwater to assist with the preparation of the Johnstons Creek Floodplain Risk Management Study and Plan.

The Johnstons Creek Flood Study was completed by WMAwater in 2012, giving the City of Sydney a better understanding of the nature of flooding in your area. The next step in the NSW Government Flood Management Process is the preparation of a Floodplain Risk Management Study and Plan. The purpose of this study and plan is to identify and recommend appropriate actions to manage flood risks in the Johnstons Creek area.

Stages of the NSW Government Flood Prone Land Policy

1. Formation of a Committee – complete
2. Data Collection – complete
3. Flood Study – complete
4. **Floodplain Risk Management Study**
5. **Floodplain Risk Management Plan**
6. Implementation of Plan.

Study area and flooding issues

The Johnstons Creek Catchment includes the suburbs of Annandale, Camperdown, Forest Lodge and parts of Glebe and Newtown.

Land uses within the catchment include residential, commercial and industrial properties as well as parklands.

Have your say

We want your comments about previous flood experiences and potential mitigation options.

The local knowledge of residents and business operators, including your personal experiences of flooding, is a valuable source of information.

The information you provide in the accompanying questionnaire will help the City of Sydney determine how to manage the floods in your area.

For more information about this project, please contact the City of Sydney or WMAwater via the details provided.

Floodplain risk management options

The following list of floodplain risk management options are being investigated:

Flood modification options.

- Construction of detention/retarding basins to reduce the peak flow downstream;
- Upgrading of drainage systems, upgrade of existing pipes or construction of new pipes; and
- Raise footbridges to improve flood flow.

Property modification options and planning control.

- Strategic planning and flood related development controls; and
- Flood-proofing measures, such as flood barriers.

Response modification options.
Examples include:

- Revision of the Local Disaster Plan;
- Public awareness and education – locality-based flooding information for residents;
- Public awareness and education – flooding information for schools;
- Flood depth markers at major (flood-affected) road crossings; and
- Data collection strategies for future floods.

For more information please contact:

WMAwater
Steve Gray
Phone 02 9299 2855
Fax: 02 9262 6208
gray@wmawater.com.au

City of Sydney
Shah Alam
Phone: 02 9288 5925
salam@cityofsydney.nsw.gov.au

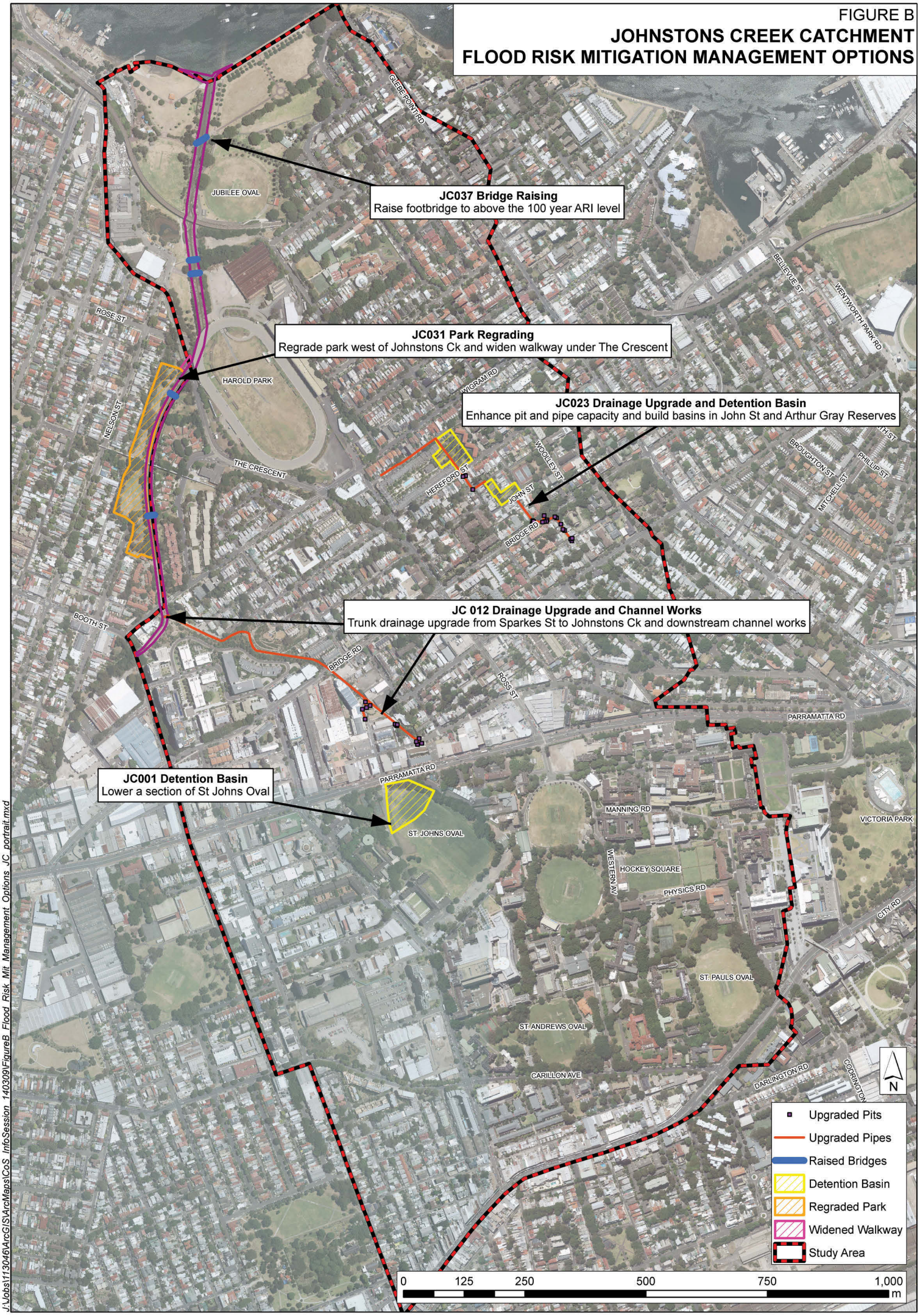


FIGURE B
JOHNSTONS CREEK CATCHMENT
FLOOD RISK MITIGATION MANAGEMENT OPTIONS
JC037 Bridge Raising
Raise footbridge to above the 100 year ARI level
JC031 Park Regrading
Regrade park west of Johnstons Ck and widen walkway under The Crescent
JC023 Drainage Upgrade and Detention Basin
Enhance pit and pipe capacity and build basins in John St and Arthur Gray Reserves
JC 012 Drainage Upgrade and Channel Works
Trunk drainage upgrade from Sparkes St to Johnstons Ck and downstream channel works
JC001 Detention Basin
Lower a section of St Johns Oval
JUBILEE OVAL
GLEBE POINT RD
ROSE ST
HAROLD PARK
THE CRESCENT
NELSON ST
BOOTH ST
HEREFORD ST
WOOLLEY ST
JOHN ST
BRIDGE RD
ROSS ST
PARRAMATTA RD
ST JOHNS OVAL
MANNING RD
VICTORIA PARK
WESTERN AV
HOCKEY SQUARE
PHYSICS RD
CITY RD
ST PAULS OVAL
ST ANDREWS OVAL
CARILLON AVE
DARLINGTON RD
CODRINGTON
BELLEVUE ST
WENTWORTH PARK RD
BROUGHTON ST
PHILLIP ST
MITCHELL ST
N
Upgraded Pits
Upgraded Pipes
Raised Bridges
Detention Basin
Regraded Park
Widened Walkway
Study Area
0
125
250
500
750
1,000
m
J:\Jobs\1\13046\ArcGIS\ArcMaps\CoS_InfoSession_140309\FigureB_Flood_Risk_Mit_Management_Options_JC_portrait.mxd

As a local resident who may have witnessed flooding/drainage problems, you may have your own ideas about how to reduce flood risks. Which of the following management options would you prefer for the Johnstons Creek catchment (1=least preferred, 5=most preferred)?

Proposed option	Preference
Enhance pit and pipe capacity and detention basins in John Street and Arthur Gray Reserves —	1 2 3 4 5
Detention basin at St Johns Oval —	1 2 3 4 5
Trunk drainage upgrade from Sparkes Street to Johnstons Creek and downstream channel works —	1 2 3 4 5
Regrade park west of Johnstons Creek and widen walkway under the Crescent —	1 2 3 4 5
Raise footbridges to above the 100 year average recurrence interval flood level —	1 2 3 4 5
Strategic planning and flood related development controls —	1 2 3 4 5
Education of the community, providing greater awareness of potential hazards —	1 2 3 4 5
Flood forecasting, flood warnings, evacuation planning and emergency response measures —	1 2 3 4 5

Other (please specify any options you think are suitable):.....

.....

.....

.....

If you have any further comments that relate to the Johnstons Creek Flood Management Study and Plan, please provide your name, address and phone number and any comments below and we will contact you.

.....

.....

.....

Glossary

Culvert – a piped drain or covered channel that passes under a road or railroad.

Levee bank/flood wall – an embankment or wall, usually constructed from earth or concrete, built along the banks of a watercourse to help prevent overflow of its waters.

Retarding/detention basin – depression in the land surface that captures and holds stormwater runoff allowing it to slowly drain out of the basin into the adjoining natural drainage line or creek.

Flood Damages Assessment

Appendix D

Table D1: Residential Tangible Damages - Option JC01

Event	Properties Affected	No. Of these Flooded Above Floor Level	Tangible Flood Damages	Average Tangible Damage Per Flood Affected Property
5Y ARI	93	27	$ 1,725,871	$ 18,558
10% AEP	108	35	$ 2,076,432	$ 19,226
5% AEP	120	63	$ 3,014,257	$ 25,119
2% AEP	133	68	$ 3,451,950	$ 25,955
1% AEP	136	73	$ 3,797,012	$ 27,919
PMF	166	125	$ 8,696,784	$ 52,390
Average Annual Damages (AAD)			**$ 1,203,375**	**$ 7,249**

Table D2: Commercial/Industrial Tangible Damages - Option JC01

Event	Properties Affected	No. Of these Flooded Above Floor Level	Tangible Flood Damages	Average Tangible Damage Per Flood Affected Property
5Y ARI	12	6	$ 1,228,067	$ 102,339
10% AEP	13	6	$ 1,390,824	$ 106,986
5% AEP	14	6	$ 1,609,404	$ 114,957
2% AEP	14	6	$ 1,864,357	$ 133,168
1% AEP	14	8	$ 2,129,113	$ 152,079
PMF	14	14	$ 5,620,218	$ 401,444
Average Annual Damages (AAD)			**$ 807,959**	**$ 57,711**

Table D3: Combined Tangible Damages - Option JC01

Event	Properties Affected	No. Of these Flooded Above Floor Level	Tangible Flood Damages	Average Tangible Damage Per Flood Affected Property
5Y ARI	105	33	$ 2,953,938	$ 28,133
10% AEP	121	41	$ 3,467,257	$ 28,655
5% AEP	134	69	$ 4,623,660	$ 34,505
2% AEP	147	74	$ 5,316,307	$ 36,165
1% AEP	150	81	$ 5,926,125	$ 39,508
PMF	180	139	$ 14,317,002	$ 79,539
Average Annual Damages (AAD)			**$ 2,011,334**	**$ 11,174**

Table D4: Residential Tangible Damages - Option JC02

Event	Properties Affected	No. Of these Flooded Above Floor Level	Tangible Flood Damages	Average Tangible Damage Per Flood Affected Property
5Y ARI	84	31	$ 1,674,415	$ 19,934
10% AEP	95	35	$ 1,930,382	$ 20,320
5% AEP	103	48	$ 2,271,322	$ 22,052
2% AEP	122	52	$ 2,552,794	$ 20,925
1% AEP	138	62	$ 3,017,216	$ 21,864
PMF	166	121	$ 8,474,873	$ 51,053
Average Annual Damages (AAD)			**$ 1,112,663**	**$ 6,703**

Table D5: Commercial/Industrial Tangible Damages - Option JC02

Event	Properties Affected	No. Of these Flooded Above Floor Level	Tangible Flood Damages	Average Tangible Damage Per Flood Affected Property
5Y ARI	11	3	$ 672,284	$ 61,117
10% AEP	12	4	$ 739,916	$ 61,660
5% AEP	12	5	$ 1,011,489	$ 84,291
2% AEP	12	6	$ 1,090,297	$ 90,858
1% AEP	12	9	$ 1,424,402	$ 118,700
PMF	14	14	$ 5,572,545	$ 398,039
Average Annual Damages (AAD)			**$ 462,359**	**$ 33,026**

Table D6: Combined Tangible Damages - Option JC02

Event	Properties Affected	No. Of these Flooded Above Floor Level	Tangible Flood Damages	Average Tangible Damage Per Flood Affected Property
5Y ARI	95	34	$ 2,346,699	$ 24,702
10% AEP	107	39	$ 2,670,298	$ 24,956
5% AEP	115	53	$ 3,282,811	$ 28,546
2% AEP	134	58	$ 3,643,092	$ 27,187
1% AEP	150	71	$ 4,441,618	$ 29,611
PMF	180	135	$ 14,047,419	$ 78,041
Average Annual Damages (AAD)			**$ 1,575,022**	**$ 8,750**

Table D7: Residential Tangible Damages - Option JC03

Event	Properties Affected	No. Of these Flooded Above Floor Level	Tangible Flood Damages	Average Tangible Damage Per Flood Affected Property
5Y ARI	79	27	$ 1,656,112	$ 20,963
10% AEP	90	47	$ 2,337,829	$ 25,976
5% AEP	95	56	$ 2,740,414	$ 28,846
2% AEP	104	65	$ 3,370,966	$ 32,413
1% AEP	114	70	$ 3,756,434	$ 32,951
PMF	152	100	$ 7,746,099	$ 50,961
Average Annual Damages (AAD)			**$ 1,173,861**	**$ 7,723**

Table D8: Commercial/Industrial Tangible Damages - Option JC03

Event	Properties Affected	No. Of these Flooded Above Floor Level	Tangible Flood Damages	Average Tangible Damage Per Flood Affected Property
5Y ARI	14	6	$ 1,371,068	$ 97,933
10% AEP	13	7	$ 1,615,775	$ 124,290
5% AEP	14	8	$ 2,088,000	$ 149,143
2% AEP	14	9	$ 2,364,943	$ 168,924
1% AEP	14	10	$ 2,705,056	$ 193,218
PMF	14	14	$ 5,620,218	$ 401,444
Average Annual Damages (AAD)			**$ 924,092**	**$ 66,007**

Table D9: Combined Tangible Damages - Option JC03

Event	Properties Affected	No. Of these Flooded Above Floor Level	Tangible Flood Damages	Average Tangible Damage Per Flood Affected Property
5Y ARI	93	33	$ 3,027,179	$ 32,550
10% AEP	103	54	$ 3,953,604	$ 38,385
5% AEP	109	64	$ 4,828,414	$ 44,297
2% AEP	118	74	$ 5,735,909	$ 48,609
1% AEP	128	80	$ 6,461,490	$ 50,480
PMF	166	114	$ 13,366,317	$ 80,520
Average Annual Damages (AAD)			**$ 2,097,953**	**$ 12,638**

Table D10: Residential Tangible Damages - Option JC04

Event	Properties Affected	No. Of these Flooded Above Floor Level	Tangible Flood Damages	Average Tangible Damage Per Flood Affected Property
5Y ARI	97	32	$ 1,908,046	$ 19,671
10% AEP	113	53	$ 2,655,956	$ 23,504
5% AEP	124	66	$ 3,170,953	$ 25,572
2% AEP	134	72	$ 3,614,837	$ 26,976
1% AEP	145	84	$ 4,346,748	$ 29,978
PMF	166	125	$ 8,694,988	$ 52,379
Average Annual Damages (AAD)			**$ 1,343,829**	**$ 8,095**

Table D11: Commercial/Industrial Tangible Damages - Option JC04

Event	Properties Affected	No. Of these Flooded Above Floor Level	Tangible Flood Damages	Average Tangible Damage Per Flood Affected Property
5Y ARI	14	6	$ 1,369,161	$ 97,797
10% AEP	13	7	$ 1,614,408	$ 124,185
5% AEP	14	8	$ 2,136,545	$ 152,610
2% AEP	14	9	$ 2,345,083	$ 167,506
1% AEP	14	10	$ 2,701,003	$ 192,929
PMF	14	14	$ 5,606,380	$ 400,456
Average Annual Damages (AAD)			**$ 924,567**	**$ 66,040**

Table D12: Combined Tangible Damages - Option JC04

Event	Properties Affected	No. Of these Flooded Above Floor Level	Tangible Flood Damages	Average Tangible Damage Per Flood Affected Property
5Y ARI	111	38	$ 3,277,207	$ 29,524
10% AEP	126	60	$ 4,270,364	$ 33,892
5% AEP	138	74	$ 5,307,498	$ 38,460
2% AEP	148	81	$ 5,959,920	$ 40,270
1% AEP	159	94	$ 7,047,752	$ 44,325
PMF	180	139	$ 14,301,368	$ 79,452
Average Annual Damages (AAD)			**$ 2,268,396**	**$ 12,602**

Table D13: Residential Tangible Damages - Option JC05

Event	Properties Affected	No. Of these Flooded Above Floor Level	Tangible Flood Damages	Average Tangible Damage Per Flood Affected Property
5Y ARI	97	32	$ 1,910,510	$ 19,696
10% AEP	113	53	$ 2,674,655	$ 23,670
5% AEP	122	65	$ 3,123,645	$ 25,604
2% AEP	134	71	$ 3,590,965	$ 26,798
1% AEP	145	81	$ 4,219,906	$ 29,103
PMF	166	125	$ 8,656,216	$ 52,146
Average Annual Damages (AAD)			**$ 1,342,509**	**$ 8,087**

Table D14: Commercial/Industrial Tangible Damages - Option JC05

Event	Properties Affected	No. Of these Flooded Above Floor Level	Tangible Flood Damages	Average Tangible Damage Per Flood Affected Property
5Y ARI	12	6	$ 1,365,558	$ 113,796
10% AEP	11	7	$ 1,606,234	$ 146,021
5% AEP	12	9	$ 2,123,638	$ 176,970
2% AEP	14	9	$ 2,331,603	$ 166,543
1% AEP	14	10	$ 2,688,354	$ 192,025
PMF	14	14	$ 5,592,543	$ 399,467
Average Annual Damages (AAD)			**$ 921,351**	**$ 65,811**

Table D15: Combined Tangible Damages - Option JC05

Event	Properties Affected	No. Of these Flooded Above Floor Level	Tangible Flood Damages	Average Tangible Damage Per Flood Affected Property
5Y ARI	109	38	$ 3,276,068	$ 30,056
10% AEP	124	60	$ 4,280,889	$ 34,523
5% AEP	134	74	$ 5,247,284	$ 39,159
2% AEP	148	80	$ 5,922,568	$ 40,017
1% AEP	159	91	$ 6,908,260	$ 43,448
PMF	180	139	$ 14,248,758	$ 79,160
Average Annual Damages (AAD)			**$ 2,263,860**	**$ 12,577**

Options Costing

Appendix E

Table E1: Cost Estimate - Option FM-JC01: Detention basin in part of St Johns Oval, University of Sydney

Item No.	Description of work	Quantity	Unit	Rate	Cost
1	General Construction Costs				
1.1	Site establishment, security fencing, facilities and disestablishment	1	item	0	0
1.2	Provision of sediment and erosion control	1	item	0	0
1.3	Construction setout and survey	1	item	0	0
1.4	Work as executed survey and documentation	1	item	0	0
1.5	Geotechnical supervision, testing and certification	1	item	0	0
	SUBTOTAL (Assumed as 15% of works cost)				$ 267,548
2	Demolition and Clearing				
2.1	Clearing and grubbing	7,665	sq. m	11	82,787
2.2	Strip topsoil and stockpile for re-use (assuming 150mm depth)	1,150	cu. m	27	31,045
2.3	Dispose of excess topsoil (nominal 10% allowance)	115	cu. m	65	7,451
2.4	Pull up and dispose existing road surface	0	sq. m	38	0
	SUBTOTAL				$ 121,283
3	Excavation and earthworks				
3.1	Excavation of detention basins and swales	14,365	cu. m	49	698,126
3.2	Disposal of excess cut (assuming 80% of total excavation)	11,492	item	65	744,668
	SUBTOTAL				$ 1,442,794
10	Minor Landscaping				
10.1	Repair disturbed areas in accordance with landscape architects requirements (nominal allowance)	7,665	sq. m	22	165,574
10.2	Reinstate park and oval infrastructure including stands, tracks, etc (nominal allowance)	1	item	54,000	54,000
	SUBTOTAL				$ 219,574
	CONSTRUCTION SUBTOTAL				$ 2,051,198
11	Contingencies				$ 1,025,599
11.1	50% construction cost				$ -
	CONSTRUCTION TOTAL, exc. GST				$ 3,076,797
	GST				$ 307,680
	CONSTRUCTION TOTAL, inc. GST				$ 3,384,477
	CONSTRUCTION TOTAL, rounded				$ 3,384,500
12	MAINTENANCE				
12.1	Maintenance of mitigation option		item	0	$ 10,000

Table E2: Cost Estimate - Option FM-JC02: Drainage upgrade between Sparkes St to Johnstons Creek and Downstream channel works					
Item No.	Description of work	Quantity	Unit	Rate	Cost
1	General Construction Costs				
1.1	Site establishment, security fencing, facilities and disestablishment	1	item	0	0
1.2	Provision of sediment and erosion control	1	item	0	0
1.3	Construction setout and survey	1	item	0	0
1.4	Work as executed survey and documentation	1	item	0	0
1.5	Geotechnical supervision, testing and certification	1	item	0	0
	SUBTOTAL (Assumed as 15% of works cost)				$ 847,984
2	Demolition and Clearing				
2.1	Clearing and grubbing	0	sq. m	11	0
2.2	Strip topsoil and stockpile for re-use (assuming 150mm depth)	0	cu. m	27	0
2.3	Dispose of excess topsoil (nominal 10% allowance)	0	cu. m	65	0
2.4	Pull up and dispose existing road surface	1,456	sq. m	38	55,037
	SUBTOTAL				$ 55,037
3	Excavation and earthworks				
3.1	Excavation of detention basins and swales	2,220	cu. m	49	107,892
3.2	Disposal of excess cut (assuming 80% of total excavation)	1,776	item	65	115,085
	SUBTOTAL				$ 222,977
4	Installation of Drainage				
4.4	Supply, excavate, bed, lay, joint, backfill and provide connections 1.2m dia. Pipe	23	lin. m	1,782	41,164
4.5	Supply, excavate, bed, lay, joint, backfill and provide connections 1.5m dia. Pipe	7	lin. m	2,430	17,010
4.6	Supply, excavate, bed, lay, joint, backfill and provide connections 3 x 0.6m dia. Pipe	21	lin. m	2,430	52,002
4.8	Supply, excavate, bed, lay, joint, backfill and provide connections 2.1m dia. Pipe	20	lin. m	4,212	83,398
4.1	Supply, excavate, bed, lay, joint, backfill and provide connections 2.4m dia. Pipe	9	lin. m	4,536	39,010
4.11	Supply, excavate, bed, lay, joint, backfill and provide connections triple 0.9m dia. Pipe	22	lin. m	4,536	97,978
4.17	Supply, excavate, bed, lay, joint, backfill and provide connections 2.1m x 1.8m culvert	92	lin. m	3,888	358,085
4.18	Supply, excavate, bed, lay, joint, backfill and provide connections 2.4m x 1.5m culvert	60	lin. m	4,320	260,496
4.19	Supply, excavate, bed, lay, joint, backfill and provide connections 2.7m x 1.5m culvert	36	lin. m	4,428	159,851
4.22	Supply, excavate, bed, lay, joint, backfill and provide connections 2x 3.0m x 1.5m culvert	53	lin. m	5,940	314,820
4.26	Supply, excavate, bed, lay, joint, backfill and provide connections 3.3m x 1.8m culvert	385	lin. m	7,452	2,869,020
4.29	Install new drainage/junction pit (assumed 1 pit per 50m of pipe)	15	each	4,320	64,800
4.31	Adjustment of existing services (nominal allowance) (assumed 10% of drainage installation cost)	435,763	item	74,547	42,984
	SUBTOTAL				$ 4,793,396
7	Footpath and Road Surfaces				
7.1	Reinstate disturbed road pavement, including demolition and disposal of additional material to provide good jointing	1,456	sq. m	130	188,698
	SUBTOTAL				$ 188,698

9	**Traffic Management**				
9.1	**Control of traffic during works (nominal allowance) (assumed $500 per lin.m)**	728	lin. m	540	100
	SUBTOTAL				**$ 393,120**
	CONSTRUCTION SUBTOTAL				**$ 6,501,211**
10	**Contingencies**				**$ 3,250,606**
10.1	**50% construction cost**				**$ -**
	CONSTRUCTION TOTAL, exc. GST				**$ 9,751,817**
	GST				**$ 975,182**
	CONSTRUCTION TOTAL, inc. GST				**$ 10,726,998**
	CONSTRUCTION TOTAL, rounded				**$ 10,727,000**
11	**MAINTENANCE**				
11.1	Maintenance of mitigation option		item	0	**$ 27,280**

Table E3: Cost Estimate - Option FM-JC03: Drainage upgrade near Hereford St and detention basins in John St and Arthur Gray Reserves					
Item No.	**Description of work**	**Quantity**	**Unit**	**Rate**	**Cost**
1	**General Construction Costs**				
1.1	**Site establishment, security fencing, facilities and disestablishment**	1	item	0	0
1.2	**Provision of sediment and erosion control**	1	item	0	0
1.3	**Construction setout and survey**	1	item	0	0
1.4	**Work as executed survey and documentation**	1	item	0	0
1.5	**Geotechnical supervision, testing and certification**	1	item	0	0
	SUBTOTAL (Assumed as 15% of works cost)				**$ 712,313**
2	**Demolition and Clearing**				
2.1	**Clearing and grubbing**	6,545	sq. m	10.8	70,686
2.2	**Strip topsoil and stockpile for re-use (assuming 150mm depth)**	982	cu. m	27	26,507
2.3	**Dispose of excess topsoil (nominal 10% allowance)**	98	cu. m	64.8	6,362
2.4	**Pull up and dispose existing road surface**	1,040	sq. m	37.8	39,304
	SUBTOTAL				**$ 142,860**
3	**Excavation and earthworks**				
3.1	**Excavation of detention basins and swales**	15,807	cu. m	48.6	768,201
3.2	**Disposal of excess cut (assuming 80% of total excavation)**	12,645	item	64.8	819,414
	SUBTOTAL				**$ 1,587,615**
4	**Installation of Drainage**				
4.3	**Supply, excavate, bed, lay, joint, backfill and provide connections 0.9m dia. Pipe**	29	lin. m	1296	37,973
4.4	**Supply, excavate, bed, lay, joint, backfill and provide connections 1.2m dia. Pipe**	16	lin. m	1782	27,621
4.5	**Supply, excavate, bed, lay, joint, backfill and provide connections 1.5m dia. Pipe**	4	lin. m	2430	8,991
4.7	**Supply, excavate, bed, lay, joint, backfill and provide connections 1.8m dia. Pipe**	30	lin. m	3564	107,276
4.8	**Supply, excavate, bed, lay, joint, backfill and provide connections 2.1m dia. Pipe**	292	lin. m	4212	1,228,219
4.9	**Supply, excavate, bed, lay, joint, backfill and provide connections twin 1.2m dia. Pipe**	52	lin. m	4212	220,709
4.1	**Supply, excavate, bed, lay, joint, backfill and provide connections 2.4m dia. Pipe**	36	lin. m	4536	161,482
4.12	**Supply, excavate, bed, lay, joint, backfill and provide connections 2.7m dia. Pipe**	6	lin. m	4860	28,188
4.14	**Supply, excavate, bed, lay, joint, backfill and provide connections twin 2.1m dia. Pipe**	48	lin. m	5616	270,130
4.15	**Supply, excavate, bed, lay, joint, backfill and provide connections triple 2.1m dia. Pipe**	8	lin. m	7020	54,756
4.29	**Install new drainage/junction pit (assumed 1 pit per 50m of pipe)**	10	each	4320	43,200
4.31	**Adjustment of existing services (nominal allowance) (assumed 10% of drainage installation cost)**	218,854	item	74547	42,984
	SUBTOTAL				**$ 2,407,399**
7	**Footpath and Road Surfaces**				
7.1	**Reinstate disturbed road pavement, including demolition and disposal of additional material to provide good jointing**	1,040	sq. m	129.6	134,758
	SUBTOTAL				**$ 134,758**

9	**Traffic Management**				
9.1	**Control of traffic during works (nominal allowance) (assumed $500 per lin.m)**	520	lin. m	540	100
	SUBTOTAL				**$ 280,746**
10	**Minor Landscaping**				
10.1	**Repair disturbed areas in accordance with landscape architects requirements (nominal allowance)**	6,545	sq. m	21.6	141,373
10.2	**Reinstate park and oval infrastructure including stands, tracks, etc (nominal allowance)**	1	item	54000	54,000
	SUBTOTAL				**$ 195,373**
	CONSTRUCTION SUBTOTAL				**$ 5,461,063**
11	**Contingencies**				**$ 2,730,532**
11.1	**50% construction cost**				**$ -**
	CONSTRUCTION TOTAL, exc. GST				**$ 8,191,595**
	GST				**$ 819,159**
	CONSTRUCTION TOTAL, inc. GST				**$ 9,010,754**
	CONSTRUCTION TOTAL, rounded				**$ 9,010,800**
11	**MAINTENANCE**				
11.1	**Maintenance of mitigation option**		item	0	**$ 15,199**

Table E4: Cost Estimate - Option FM-JC04: Regrade Hogan Park and widen walkway under The Crescent

Item No.	Description of work	Quantity	Unit	Rate	Cost
1	General Construction Costs				
1.1	Site establishment, security fencing, facilities and disestablishment	1	item	0	0
1.2	Provision of sediment and erosion control	1	item	0	0
1.3	Construction setout and survey	1	item	0	0
1.4	Work as executed survey and documentation	1	item	0	0
1.5	Geotechnical supervision, testing and certification	1	item	0	0
	SUBTOTAL (Assumed as 15% of works cost)				$ 361,646
2	Demolition and Clearing				
2.1	Clearing and grubbing	19,506	sq. m	11	210,667
2.2	Strip topsoil and stockpile for re-use (assuming 150mm depth)	2,926	cu. m	27	79,000
2.3	Dispose of excess topsoil (nominal 10% allowance)	293	cu. m	65	18,960
2.4	Pull up and dispose existing road surface	0	sq. m	38	0
	SUBTOTAL				$ 308,627
3	Excavation and earthworks				
3.1	Excavation of detention basins and swales	16,199	cu. m	49	787,266
3.2	Disposal of excess cut (assuming 80% of total excavation)	12,959	item	65	839,750
	SUBTOTAL				$ 1,627,016
10	Minor Landscaping				
10.1	Repair disturbed areas in accordance with landscape architects requirements (nominal allowance)	19,506	sq. m	22	421,333
10.2	Reinstate park and oval infrastructure including stands, tracks, etc (nominal allowance)	1	item	54,000	54,000
	SUBTOTAL				$ 475,333
	CONSTRUCTION SUBTOTAL				$ 2,772,622
11	Contingencies				$ 1,386,311
11.1	50% construction cost				$ -
	CONSTRUCTION TOTAL, exc. GST				$ 4,158,934
	GST				$ 415,893
	CONSTRUCTION TOTAL, inc. GST				$ 4,574,827
	CONSTRUCTION TOTAL, rounded				$ 4,574,800
11	MAINTENANCE				
11.1	Maintenance of mitigation option		item	0	$ -

Table E5: Cost Estimate - Option FM-JC05: Raise footbridges along Johnstons Creek above the 100 year ARI level					
Item No.	**Description of work**	**Quantity**	**Unit**	**Rate**	**Cost**
1	**General Construction Costs**				
1.1	**Site establishment, security fencing, facilities and disestablishment**	1	item	0	0
1.2	**Provision of sediment and erosion control**	1	item	0	0
1.3	**Construction setout and survey**	1	item	0	0
1.4	**Work as executed survey and documentation**	1	item	0	0
1.5	**Geotechnical supervision, testing and certification**	1	item	0	0
	SUBTOTAL (Assumed as 15% of works cost)				**$ 9,223**
2	**Demolition and Clearing**				
2.1	**Clearing and grubbing**	200	sq. m	11	2,160
2.2	**Strip topsoil and stockpile for re-use (assuming 150mm depth)**	30	cu. m	27	810
2.3	**Dispose of excess topsoil (nominal 10% allowance)**	3	cu. m	65	194
2.4	**Pull up and dispose existing road surface**	0	sq. m	38	0
	SUBTOTAL				**$ 3,164**
5	**Bridges**				
5.1	**Concrete in footings, abutments, retaining walls and approach slabs**	120	cu. m	280	33,566
5.2	**Concrete in bridge deck, thickenings and beams**	36	cu. m	280	9,944
5.3	**Class F2 formwork**	575	sq. m	151	86,940
5.4	**Deformed bar reinforcement**	1	t	2,041	2,449
5.5	**Composite**	240	sq. m	740	177,552
	SUBTOTAL				**$ 310,452**
10	**Minor Landscaping**				
10.1	**Repair disturbed areas in accordance with landscape architects requirements (nominal allowance)**	200	sq. m	22	4,320
10.2	**Reinstate park and oval infrastructure including stands, tracks, etc (nominal allowance)**	1	item	54,000	54,000
	SUBTOTAL				**$ 58,320**
	CONSTRUCTION SUBTOTAL				**$ 381,159**
11	**Contingencies**				**$ 190,579**
11.1	**50% construction cost**				**$ -**
	CONSTRUCTION TOTAL, exc. GST				**$ 571,738**
	GST				**$ 57,174**
	CONSTRUCTION TOTAL, inc. GST				**$ 628,912**
	CONSTRUCTION TOTAL, rounded				**$ 628,900**
11	**MAINTENANCE**				
11.1	**Maintenance of mitigation option**		item	0	**$ 20,000**

Discarded Options

Appendix F

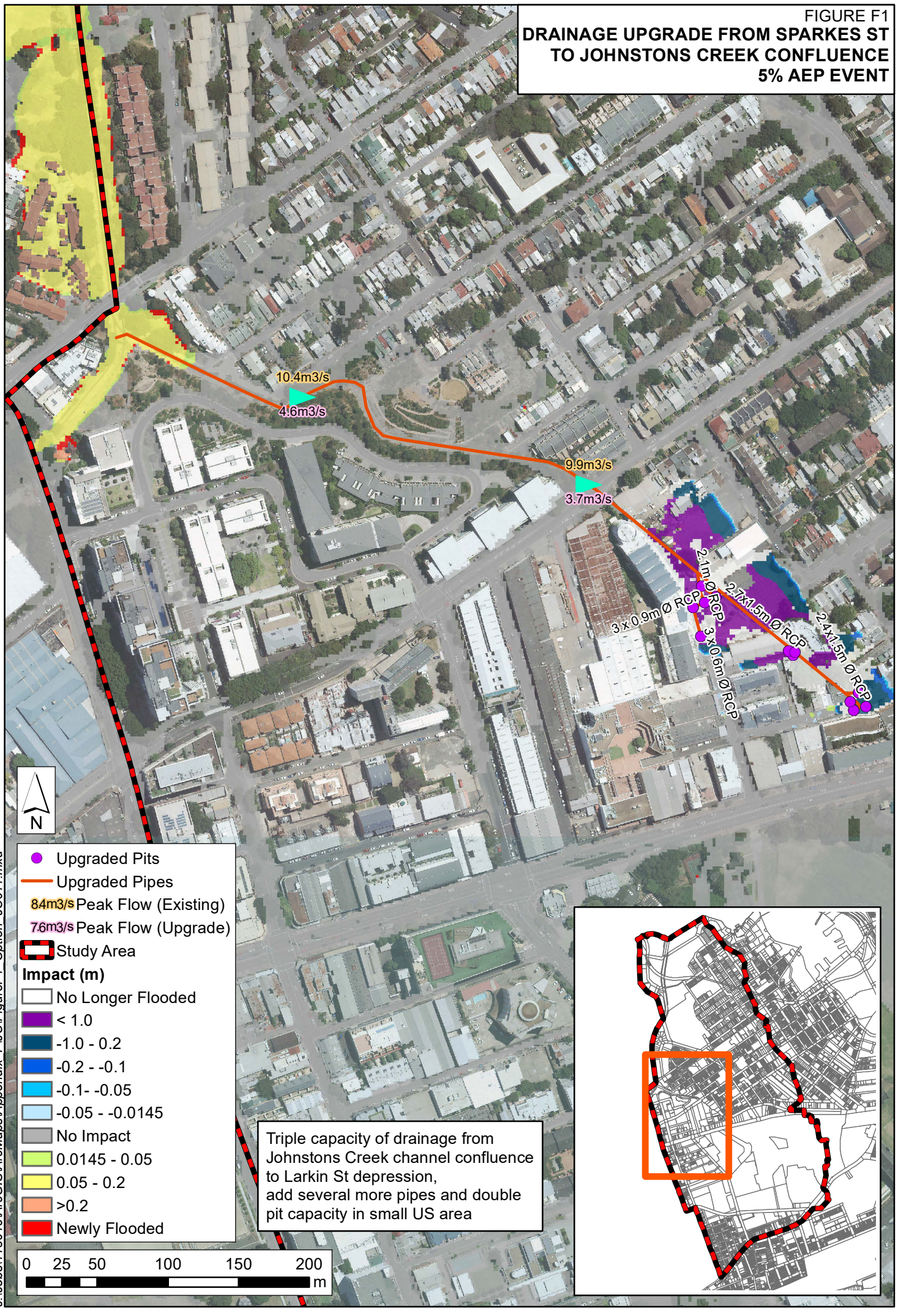
Johnstons Creek - Mitigation Options Considered

Location	*Description*	*Type of Measure*	*Impact*	*Outcome*
Larkin St - Johnstons Creek	Triple capacity of drainage from Johnstons Creek channel confluence to Larkin St depression	Drainage Upgrade	Drop of around 0.1 m in the Sparkes Street hotspot in the 1% AEP event.	Negligible drop in flood level (given magnitude of current flooding) **Discarded**
Larkin St - Johnstons Creek	Triple capacity of drainage from Johnstons Creek channel confluence to Larkin St depression, add several more pipes and double pit capacity in small US area (see Figure F1)	Drainage Upgrade	Drop of up to 2.4 m in the Sparkes Street hotspot in the 5% AEP event. Impact of around 0.1 m at the confluence with Johnstons Creek.	Significant drop in flood level, however, significant impact downstream would increase flood risk there. **Refined to become FM - JC02**
Larkin St - Johnstons Creek	As above, but increase pit capacity to 4x instead of 2x	Drainage Upgrade	0.3 m decrease upstream of Bridge Rd in the 1% AEP event.	Negligible drop in flood level (given magnitude of current flooding). **Refined to become FM - JC02**
Sparkes St - Larkin St	Enhance pit and pipe capacity from Sparkes St to Larkin St depression	Drainage Upgrade	0.1 - 0.2 m decrease upstream of Pyrmont Bridge Rd in the 1% AEP event.	Negligible drop in flood level (given magnitude of current flooding). **Refined to become FM - JC02**
Parramatta Rd - Sparkes St - Larkin St	Enhance pit and pipe capacity from Sparkes St to Larkin St depression, as well as pits on Parramatta Road.	Drainage Upgrade	0.1 - 0.2 m decrease upstream of Pyrmont Bridge Rd in the 1% AEP event.	Negligible drop in flood level (given magnitude of current flooding). **Refined to become FM - JC02**
Hereford St (Glebe Gardens)	Enhance pit and pipe capacity for Glebe Gardens to improve flooding for Hereford St	Drainage Upgrade	Less than 0.1 m drop in 1% AEP event	Negligible drop in flood level. **Refined to become FM - JC03**
Wigram Rd/Ross St	Enhance pit and pipe capacity for Wigram Rd/Ross St intersection	Drainage Upgrade	Less than 0.1 m drop in 1% AEP event	Negligible drop in flood level. **Discarded**
Coneill Pl/Minogue Cres	Levee and flood gate system for Coneill Pl, with 3x450 at each drainage location	Levee and Flood gate system	Minor impact in Coneill Place, slight increase in Johnstons Creek.	Only a minor drop in flood level for quite extensive works. **Discarded**
Coneill Pl/Minogue Cres	Levee system for Coneill Pl (no drainage)	Levee	Increase of 0.2 m inside the levee.	Flood level is increased. **Discarded**
Coneill Pl/Minogue Cres	Levee system for Coneill Pl (shorter and reconfigured), with double existing pipe draining Coneill Place and a hump at entrance to Coneill Pl	Levee and Flood Gate system and Flow Path Modification	Decrease of up to 0.1 m inside the levee, but also an increase of up to 0.1 m near the southern end of the levee.	Flood level is not consistently decreased. **Discarded**
Coneill Pl/Minogue Cres	Levee system for Coneill Pl (shorter and reconfigured compared to above options) with double existing pipe draining Coneill Place (see Figure F2)	Levee and Flood gate system	Predominantly 0.03m decrease, with some areas increasing up to 0.1m at Coneill Place	Impact of flood level is mostly negligible. **Discarded**

Location	*Description*	*Type of Measure*	*Impact*	*Outcome*
Coneill Pl/Minogue Cres	Levee system for Coneill Pl (shorter and reconfigured) with a raised island blocking the overland flow coming off The Crescent	Levee and Flood Gate system and Flow Path Modification	0.1m decrease in 1% AEP event at Coneill Place with up to a 0.03m increase along The Crescent (on road only).	Some beneficial impact at Coneill Place; however, quite extensive works and changes to landscape for only a small reduction in flood level. **Discarded**
The Crescent	Levee and flood gate system for The Crescent	Levee and Flood gate system	0.03 - 0.1m decrease Chapman Road, up to 0.1m increase in proximate drain	Some drop in flood level, but also increases nearby. **Discarded**
Pyrmont Bridge Rd	Cut through Bridge Road to re-establish original flow path. Lower pits/pipes in area of lowered terrain.	Flow Path Modification	0.5 - 1.2m decrease upstream of Pyrmont Bridge Rd, 0.1m increase in downstream channel	Beneficial drop in flood level; however, large area of land re-graded. Other option with only pipe upgrades less obtrusive. **Discarded**
Pyrmont Bridge Rd	As above but don't cut out the road (cut up to either side of the road) and put in 3 x 2.1 m dia. pipes	Flow Path Modification	0.5 - 1.6 m decrease upstream of Pyrmont Bridge Rd, 0.3 m increase in downstream channel.	Beneficial drop in flood level; however, large area of land re-graded. Other option with only pipe upgrades less obtrusive. **Discarded**
Pyrmont Bridge Rd	As above but use two pipes instead of three, and extend the lowered terrain back to the park.	Flow Path Modification	0.5 - 1.8m decrease upstream of Pyrmont Bridge Rd in 1% AEP event, 0.25m increase in downstream channel.	Beneficial drop in flood level; however, large area of land re-graded. Other option with only pipe upgrades less obtrusive. **Discarded**
St Johns Rd - Bridge Rd	3 clusters of pit upgrades, double pipes between them (near St Johns Rd) (see Figure F3)	Drainage Upgrade	0.03 - 0.13m decrease near St Johns Rd and Mount Vernon Ln in 1% AEP event.	Only a minor drop in flood level for quite extensive drainage upgrade. **Refined to become FM - JC03**
Johnstons Creek	Remove 4 bridges DS of Harold park (3 pedestrian DS coneill pl, one near Coneill Pl)	Bridge Modification	0.1 - 0.35m decrease in 1% AEP event along Johnstons Creek downstream of Wigram Road.	Not considered as an option per se, rather as a diagnostic tool to see which areas are sensitive to bridge raising and by how much. **Refined to become FM - JC05**
Entire Catchment	Upgrade all pits and pipes to 3x existing capacity	Drainage Upgrade	Drop of 0.5 m at the Sparkes Street hotspot in the 5% AEP event. Drop of around 0.1 m along Ross/Wigram Road drainage line.	Not considered as an option per se, rather as a diagnostic tool to see which areas are sensitive to pipe upgrades and by how much.

FIGURE F1

DRAINAGE UPGRADE FROM SPARKES ST TO JOHNSTONS CREEK CONFLUENCE 5% AEP EVENT



J:\Jobs\113046\ArcGIS\ArcMaps\Appendix F\JC\FigureF1_Option_JC011.mxd

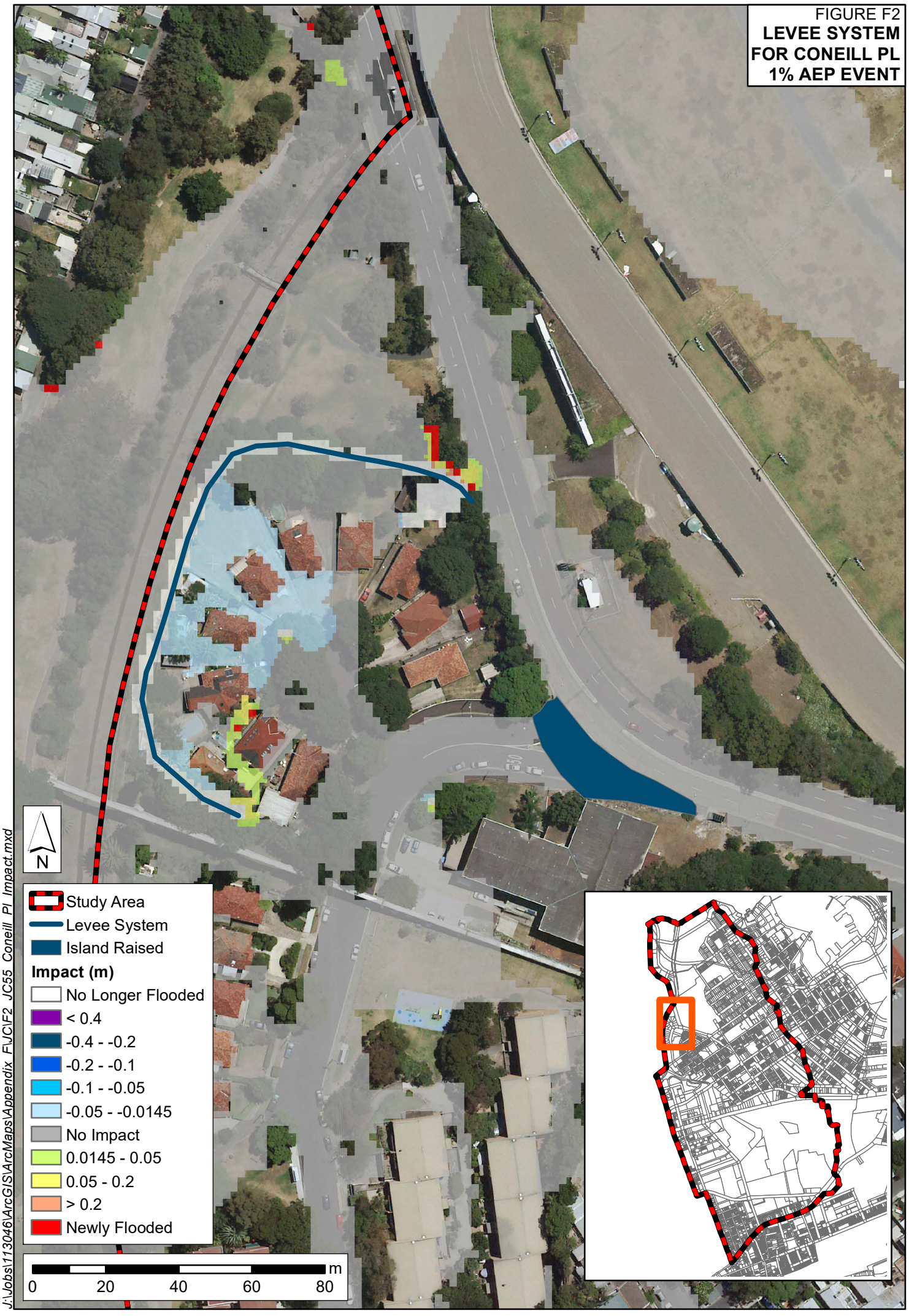


FIGURE F2
LEVEE SYSTEM
FOR CONEILL PL
1% AEP EVENT
N
Study Area
Levee System
Island Raised
Impact (m)
No Longer Flooded
< 0.4
-0.4 - -0.2
-0.2 - -0.1
-0.1 - -0.05
-0.05 - -0.0145
No Impact
0.0145 - 0.05
0.05 - 0.2
> 0.2
Newly Flooded
0
20
40
60
80
m
J:\Jobs\113046\ArcGIS\ArcMaps\Appendix F\JC\F2_JC55_Coneill_Pl_Impact.mxd

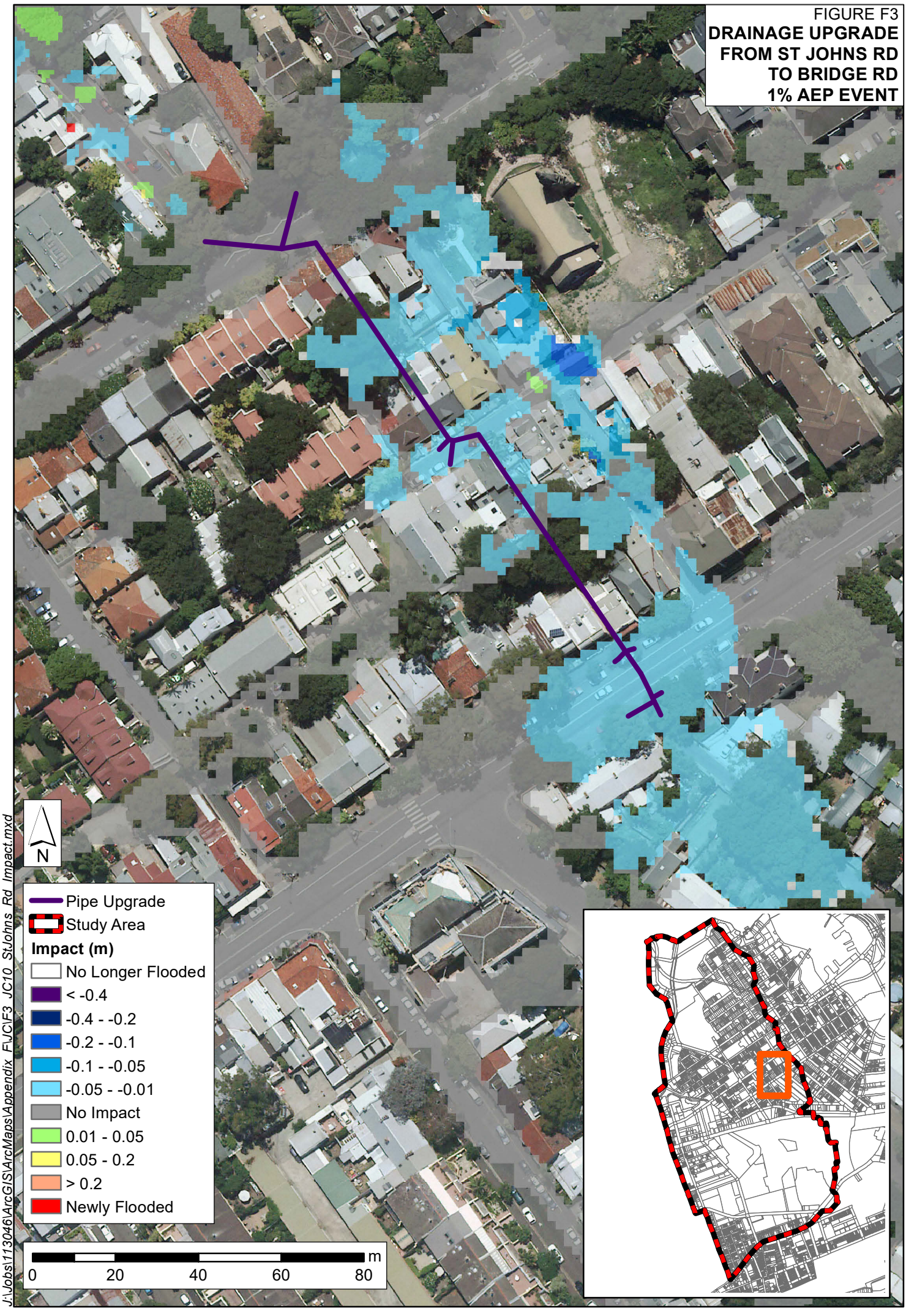


FIGURE F3
DRAINAGE UPGRADE
FROM ST JOHNS RD
TO BRIDGE RD
1% AEP EVENT
N
Pipe Upgrade
Study Area
Impact (m)
No Longer Flooded
< -0.4
-0.4 - -0.2
-0.2 - -0.1
-0.1 - -0.05
-0.05 - -0.01
No Impact
0.01 - 0.05
0.05 - 0.2
> 0.2
Newly Flooded
0
20
40
60
80
m
J:\Jobs\113046\ArcGIS\ArcMaps\Appendix F\JC\F3_JC10_StJohns_Rd_Impact.mxd

Early Catchment Conditions

Appendix G

APPENDIX G: EARLY CATCHMENT CONDITIONS

The Johnstons Creek catchment has undergone extensive urbanisation over the past 200 years. Development has occurred uniformly across the area, with the suburbs of Glebe, Camperdown, Annandale, Forest Lodge and Newtown growing as Sydney expanded outward from what is now the Central Business District. Urbanisation of the catchment had a significant effect on flood behaviour, with watercourses and depressions being re-directed, blocked or sometimes removed, as streets and buildings were laid out and constructed. Understanding of the original catchment facilitates comprehension of the current flood liability and the general functioning of the catchment.

The following is a summary of what is known about the catchment features in the 19th century:

1. Johnstons Creek was a natural watercourse and flowed through what is now Hogan Park. A map from Atlas of the Suburbs of Sydney (ca 1885) shows it running from its confluence with Orphan School Creek down to the Rozelle Bay shoreline.
2. Orphan School Creek extended past Bridge Road, across Parramatta Road, into what is now the University of Sydney.
3. The same map also shows an unnamed creek running from Bridge Road south to what is now Harold Park, where the shoreline used to be. This creek has been fully urbanised and now connects to the Johnstons Creek open channel.
4. Jubilee Oval, Bicentennial Park and part of Harold Park were all recorded as being in Rozelle Bay, in what was likely an intertidal area. These parks are therefore reclaimed land, likely created using fill from the surrounding area.

Figure G1 shows Johnstons Creek and the shoreline as they were recorded in the Atlas of the Suburbs of Sydney (ca 1885), overlaid on the current 1% AEP peak flood depth. The figure shows that the main concentrations of flow are where creeks used to exist in the catchment. The urbanisation causes flow to become trapped in heavy rainfall. For example, the streets north of Harold Park now bear little to no sign of what was once a creek, and the area upstream of Bridge Road on Orphan School Creek is significantly blocked by Bridge Road itself.

FIGURE G1

19TH CENTURY CATCHMENT CONDITIONS CREEK LOCATIONS SHOWN WITH CURRENT 1% AEP PEAK FLOOD DEPTH

BELLEVUE ST
PHILLIP ST
BROUGHTON ST
MITCHELL ST
PARRAMATTA RD
ST. PAULS OVAL
PHYSICS RD
MANNING RD
WESTERN AV
ST. ANDREWS OVAL
CARILLON AVE
WOOLLEY ST
JOHN ST
BRIDGE RD
ROSS ST
WIGRAM RD
HEREFORD ST
GLEBE POINT RD
ST. JOHNS OVAL
PARRAMATTA RD
Orphans Creek
BRIDGE RD
JUBILEE OVAL
HAROLD PARK
THE CRESCENT
Johnstons Creek
ROSE ST
NELSON ST
BOOTH ST

N

Study Area
(1899 Map) Creeks
(1899 Map) Shoreline

Depth (m)

0.1 - 0.25
0.25 - 0.5
0.5 - 0.75
0.75 - 1
>1

0 100 200 300 400 500 m

Disclaimer:
Inundation patterns and/or peak flood levels shown for design events are based on best available estimates of flood behaviour within the Catchment. Inundation from local overland flow may vary slightly to the displayed design rainfall inundation patterns .Council should be consulted to confirm flood affectation at individual allotments.

Note: Flood depths modelled as less than 0.1m are not displayed

J:\Jobs\113046\ArcGIS\ArcMaps\FRMS&P Report\JC\FigureG1 Original Creek Locations Peak Flood Depth 1%.mxd