

SUTHERLAND SHIRE COUNCIL



**OYSTER CREEK
FLOODPLAIN RISK MANAGEMENT PLAN**

JUNE 2005

WEBB, McKEOWN & ASSOCIATES PTY LTD



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Webb, McKeown & Associates Pty Ltd
Level 2, 160 Clarence Street, SYDNEY 2000
Telephone: (02) 9299 2855
Facsimile: (02) 9262 6208
23078:OysterCreekManagementPlan.wpd

Prepared by: _____

Verified by: _____

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FOREWORD

The State Government's Flood Policy is directed at providing solutions to existing flooding problems in developed areas and to ensuring that new development is compatible with the flood hazard and does not create additional flooding problems in other areas.

Under the Policy, the management of flood liable land remains the responsibility of local government. The State Government subsidises flood mitigation works to alleviate existing problems and provides specialist technical advice to assist Councils in the discharge of their floodplain management responsibilities.

The Policy provides for technical and financial support by the Government through the following sequential stages:

1. *Flood Study*
 - determine the nature and extent of the flood problem.
2. *Floodplain Risk Management Study*
 - evaluates management options for the floodplain in respect of both existing and proposed development.
3. *Floodplain Risk Management Plan*
 - involves formal adoption by Council of a plan of management for the floodplain.
4. *Implementation of the Plan*
 - construction of flood mitigation works to protect existing development,
 - use of Local Environmental Plans to ensure new development is compatible with the flood hazard.

The Oyster Creek Floodplain Risk Management Plan constitutes the third stage of the management process for Oyster Creek and its catchment area. Webb, McKeown & Associates were commissioned by Sutherland Shire Council to prepare this plan. The plan provides the basis for the future management of flood liable lands in the Oyster Creek floodplain.

1. INTRODUCTION

1.1 Background

Oyster Creek has a 3.5 km² catchment which drains to Oyster Bay and the Georges River (Figures 1 and 2). The catchment area is predominantly occupied by urban development (Sutherland, Jannali, Oyster Bay, Kareela and Kirrawee) including both residential and commercial/light industrial development. There are no large areas of open space except for sporting fields and creek lines. The downstream reach between Box Road (unformed) and Bates Drive forms a narrow floodplain. Downstream of Bates Drive the creek becomes a mangrove lined estuary leading to Oyster Bay and the Georges River.

In the mid to late 1990's Sutherland Council initiated a series of community workshops relating to flooding. This culminated in a series of proposed management measures to address the flood problems experienced. These proposals included the construction of a 1 m² slot in the base of the Bates Drive culverts, and the dredging of a channel some 0.5 m deep and 10 m wide for a distance of approximately 400 m upstream of the culverts. Subsequently in July 2003 Webb McKeown were commissioned by Sutherland Shire Council to investigate the feasibility of these measures.

A Draft Feasibility Assessment (Reference 1) outlined the likely high cost of the mitigation works proposed and also dealt with the possible adverse social and environmental implications. In view of the complexity of the flooding problem it was decided to embark on the floodplain management process as outlined in the NSW Government's Floodplain Management Manual (2001-Reference 2).

1.2 Floodplain Risk Management Process

In accordance with the guidelines of the Floodplain Management Manual (Reference 2), Sutherland Shire Council commissioned the following studies:

- Stage 1:** Flood Study,
- Stage 2:** Floodplain Risk Management Study,
- Stage 3:** Floodplain Risk Management Plan.

The Flood Study (Stage 1 of the process - Reference 3) established design flood behaviour for the study area using a hydrologic (WBNM) and hydraulic (Mike-11) model. The models were calibrated (as far as possible) to historical flood data.

The Floodplain Risk Management Study (Stage 2 - Reference 4) sought to fully identify the nature of the flood problem in terms of risks to floodplain occupants and their assets, and then to canvass various management measures to mitigate the effects of flooding.

The end product is this Floodplain Risk Management Plan (Stage 3) which describes how flood liable lands in the Oyster Creek catchment are to be managed in the future. Both the Management Study and Plan have involved community consultation (workshops, questionnaires, interviews).

Sutherland Shire Council will complete the process through implementation of the actions identified in the Plan (depending upon financial and other constraints).

2. STUDY AREA

The study area for the Floodplain Risk Management Study was defined as the 600 m reach from Bates Drive upstream to beyond Box Road. Downstream of Bates Drive there are no buildings inundated in the 1% AEP event and further upstream from Box Road the development is largely outside the floodplain area.

Bates Drive itself is constructed on a raised embankment with six 3 m by 1.8 m culverts underneath. The invert of the culverts is at 0.7 mAHD and thus it acts as a weir to restrict tidal flow upstream. For this reason the upstream reach is only semi-tidal and predominantly freshwater. Dredging of the creek upstream of Bates Drive was undertaken by Council in the 1970's but not since. The raised invert has meant that the creek bed upstream has silted up to approximately 0.3 mAHD.

The eastern overbank area upstream of Bates Drive was filled in the early 1960's and some 20 houses constructed. All have experienced inundation of their yards at some time during the 1970's but only 13 floors are inundated in the 1% AEP event. Several homes have more recently been rebuilt with floors above the 1% AEP flood level. The only known record of flooding is contained in Reference 5 and is summarised in Table 1.

Table 1: Flood History from M G Carleton's Report (Reference 5)

Event	No. of Buildings Inundated above floor	House No's * Inundated in Buderim Avenue	Approximate Peak Level at Bates Drive (mAHD)	Number of Recorded Flood Levels
?? 1969	approx. 8	unsure	3.0	nil
?? 1970	unknown	??	??	nil
26 March 1974	6	5,7,17,27,31,33	2.8	8
11 March 1975	10	5,7,15,17,23,25,27,31,33,39	3.0	11
4 March 1977	nil	-	2.4	8

Note: * Some buildings may have been rebuilt since 1977.

In March 1975 the Bates Drive bridge was overtopped but since 1977 there are no records of houses or yards being inundated.

As part of the Oyster Creek Flood Study (Reference 3) computer based hydrologic and hydraulic models were established, calibrated to historical data and used to determine design flood levels. The design flood contours for the 1% AEP flood event are provided on Figure 3.

The Floodplain Risk Management Study (Reference 4) identified the number of buildings inundated above floor level and the estimated tangible flood damages. These are provided in Table 2.

Table 2: Buildings Inundated and Tangible Damages at Buderim Avenue/Box Road

Design Flood	Buildings Inundated		Tangible Damages	
	100% Blockage	No Blockage	100% Blockage	No Blockage
PMF	21	21	\$1 140 000	\$1 140 000
0.2% AEP	17	11	\$620 000	\$400 000
1% AEP	13	7	\$480 000	\$240 000
2% AEP	12	7	\$430 000	\$170 000
5% AEP	12	4	\$360 000	\$100 000
10% AEP	9	1	\$200 000	\$25 000

Note: The values are shown assuming 100% blockage at the Bates Drive and Box Road culverts as well as for no blockage.

The average annual damages were estimated to be \$125 000 assuming 100% blockage.

Reference 4 provides a preliminary environmental assessment of the study area.

3. ASSESSMENT OF RISK MANAGEMENT MEASURES

An assessment of all floodplain risk management measures was undertaken in the Floodplain Risk Management Study (Reference 4). In summary, the majority of residents supported the following flood modification measures:

- dredging,
- vegetation clearing,
- additional waterway area at Bates Drive (remove culverts, construct bridge),
- construction of a 1 m² slot in the base of Bates Drive culverts. This measure provides no significant direct reduction in flood level but is intended to provide a means of reducing the build up of sediment upstream,
- measures to enhance the environmental quality of the creek such as debris and/or litter removal,
- measures to reduce the likelihood of blockage for the Bates Drive culverts.

The above measures combined could provide up to 300 mm reduction in flood level in the 1% AEP event and so eliminate above floor inundation (in the 1% AEP event) to all except three houses (for the NO blockage scenario).

The main disadvantages of dredging and vegetation clearing are:

- high cost,
- potentially high environmental consequence,
- low benefit cost ratio,
- requires regular ongoing maintenance.

The main disadvantage of provision of additional waterway area at Bates Drive is the high cost, low benefit cost ratio and significant traffic disruption during construction. If the creek bed is lowered as part of the works or with construction of the 1 m² slot there is a significant environmental consequence as the upstream regime is changed from brackish freshwater to estuarine. If upgrading of Bates Drive was being undertaken in the future then the provision of additional waterway area should also be considered at the same time.

The 1 m² slot measure has no ongoing maintenance requirement but there is a significant environmental consequence (as with the provision of additional waterway area).

There are few disadvantages with the measures to enhance the environmental quality of the creek or reduce blockage which are generally supported by all local residents.

A levee around the Buderim Avenue properties was proposed in the past and whilst it does involve a high cost it would provide protection to all properties. The main disadvantage is that it is not supported by the local residents for aesthetic and access reasons.

Other measures that were considered to eliminate above floor inundation included:

- voluntary purchase (unlikely to receive funding),
- house raising (difficult to raise brick houses),
- flood proofing (difficult to implement properly on residential buildings and therefore rarely applied).

Flood warning and evacuation planning can reduce future flood damages but are unlikely to be successful measures on this small catchment which has a very short warning time.

Development control measures are generally supported by the local residents and are the key means of providing protection as redevelopment occurs.

The use of flood awareness and readiness programs by the SES, Council and other bodies are supported by the residents.

Development of a maintenance plan for Oyster Creek will ensure that any changes (man made or natural) to the creek system are monitored and if necessary measures are undertaken to address them. The maintenance plan would also include an assessment under the EP&A Act for the initial maintenance works and for any ongoing works that are likely to be required. The plan would indicate, using photographs and descriptions, the extent and type of works to be undertaken, as well as the processes involved. A monitoring program would also be implemented, this would involve inspecting and documenting any changes (written and with photographs) to the creek at regular intervals. Part of this program would require comparing previous and current photographs of the creek. In this manner subtle changes to the creek system would be monitored, including:

- erosion,
- sedimentation,
- changes to the density and type of vegetation,
- illegal activities (filling, clearing of mangroves, excavation etc.),
- build up vegetative debris,
- significant change in land use activities,
- construction of new works that may affect the flood regime.

4. RECOMMENDED MEASURES

The recommendations of this Plan are summarised in Table 3 and on Figure 5.

Table 3: Recommended Floodplain Risk Management Measures

Measure	Discussion	Recommendation	Indicative Cost	Responsibility	Required Approvals
HIGH PRIORITY:					
High 1 - Planning and future development control measures.	These measures will ensure that new developments are designed with appropriate flood related controls to minimise future flood damages.	Council is currently implementing a Shire wide scheme as indicated in their Flood Risk Management DCP. Figure 4 indicates the Flood Risk Precincts within the study area.	Minimal if undertaken as part of a Shire wide program.	Sutherland Shire Council (all areas)	None
High 2 - Implement Flood Awareness and Readiness Program.	This measure will ensure that residents are aware of the flood problem and the means available to help reduce flood damages.	A variety of measures should be implemented as part of a Shire wide program.	Minimal if undertaken as part of a Shire wide program.	Stormwater Management Branch	None
High 3 - Improve water quality.	Water quality is a key issue for residents and is particularly noticeable following heavy rain.	The main stormwater pipes discharging upstream of Bates Drive should have debris collector "devices" installed. Council must then undertake a regular maintenance program to remove the accumulated debris. Consideration could be given to constructing a man-made wetland upstream of Bates Drive. However, this would need to be considered in conjunction with the possible adverse flooding implications.	Install debris collector devices (8 outfalls) - \$160,000	Stormwater Management Branch	<ul style="list-style-type: none"> Review of Environmental Factors Department of Infrastructure, Planning and Natural Resources NSW Fisheries NSW National Parks and Wildlife
			Undertake maintenance - \$15,000 p.a.	Civil Works Unit	
			Construct wetland - \$80,000	Stormwater Management Branch	
			Cut vegetation in Crown Land / Council Reserve - \$10,000 p.a.	Parks Operations Unit	
High 4 - Stream clearing and channel works downstream of Box Road.	The reach immediately downstream of Box Road is heavily vegetated and acts as a hydraulic restriction. Removal of vegetation and possibly some minor earthworks would return the creek to a more efficient channel, thus reducing the flood levels upstream..	Council should undertake the necessary stream clearing and channel works with ongoing maintenance required. The development of a maintenance plan for Oyster Creek will ensure that future changes (man made or natural) to the creek system are monitored and controlled (if required).	Stream clearing - \$20,000 Cost of Disposal - up to \$50,000	Civil Works Unit	<ul style="list-style-type: none"> Review of Environmental Factors Authority to dispose of material Further sampling of material Department of Infrastructure, Planning and Natural Resources NSW Fisheries NSW National Parks and Wildlife
			Develop Oyster Creek Maintenance Plan - \$5,000	Stormwater Management Branch	

Measure	Discussion	Recommendation	Indicative Cost	Responsibility	Required Approvals
High 5 - Reduce likelihood of blockage at Bates Drive culverts.	Blockage of one or two cells of the culverts has occurred previously. Determination of the design flood levels assumes 100% blockage of the Bates Drive and Box Road structures. A variety of methods are feasible.	At a minimum the build up of existing vegetative and other debris within the catchment upstream of Box Road should be reduced on an ongoing basis. Consideration should also be given to installing debris collectors upstream of the Bates Drive culverts. Some Councils are installing debris deflectors at such locations.	Remove debris within catchment upstream of Box Road - \$6,000 p.a.	Civil Works Unit	<ul style="list-style-type: none">Review of Environmental FactorsNSW FisheriesDepartment of Infrastructure, Planning and Natural Resources
			Install debris collector - \$50,000	Stormwater Management Branch	
LOW PRIORITY:					
Low 1 - Construct a 1 m ² slot in the Bates Drive culvert.	This measure by itself provides little reduction in flood level. However it is seen as a means of reducing the build up of sediment upstream. The likely change in the ecosystem upstream will require detailed environmental investigation.	This measure needs to be discussed further with the relevant authorities and local residents.	Up to \$100,000	Sutherland Shire Council	<ul style="list-style-type: none">Review of Environmental FactorsRoads and Traffic AuthorityNSW FisheriesDepartment of Infrastructure, Planning and Natural ResourcesNSW National Parks and Wildlife
Low 2 - Additional waterway area at Bates Drive culverts.	This measure will reduce flood levels upstream. However the high cost and relatively small reduction in levels means that the works cannot be justified purely on a flood benefit/cost analysis.	The RTA should be advised that consideration is to be given to upgrading the waterway area when future upgrading works on Bates Drive are being designed.	Up to \$2 million	RTA, Sutherland Shire Council	<ul style="list-style-type: none">Review of Environmental FactorsRoads and Traffic AuthorityNSW FisheriesDepartment of Infrastructure, Planning and Natural ResourcesNSW National Parks and Wildlife

Note: The measures are listed in order of priority with each group.

5. REFERENCES

1. Sutherland Shire Council
**Oyster Creek Waterway/Flooding Improvements
Stage 1 - Feasibility Assessment**
Webb, McKeown & Associates Pty Ltd, Draft Report, October 2003.
2. New South Wales Government
Floodplain Management Manual
January 2001.
3. Sutherland Shire Council
Oyster Creek Flood Study
Webb, McKeown & Associates Pty Ltd, June 2005.
4. Sutherland Shire Council
Oyster Creek Floodplain Management Study
Webb, McKeown & Associates Pty Ltd, June 2005.
5. M G Carleton
Oyster Creek Flood Investigations
Project Report, November 1977.

FIGURES



FIGURE 1
OYSTER CREEK CATCHMENT

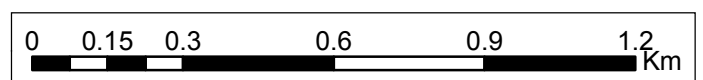
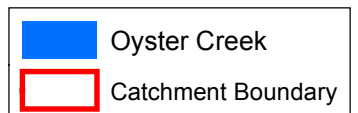
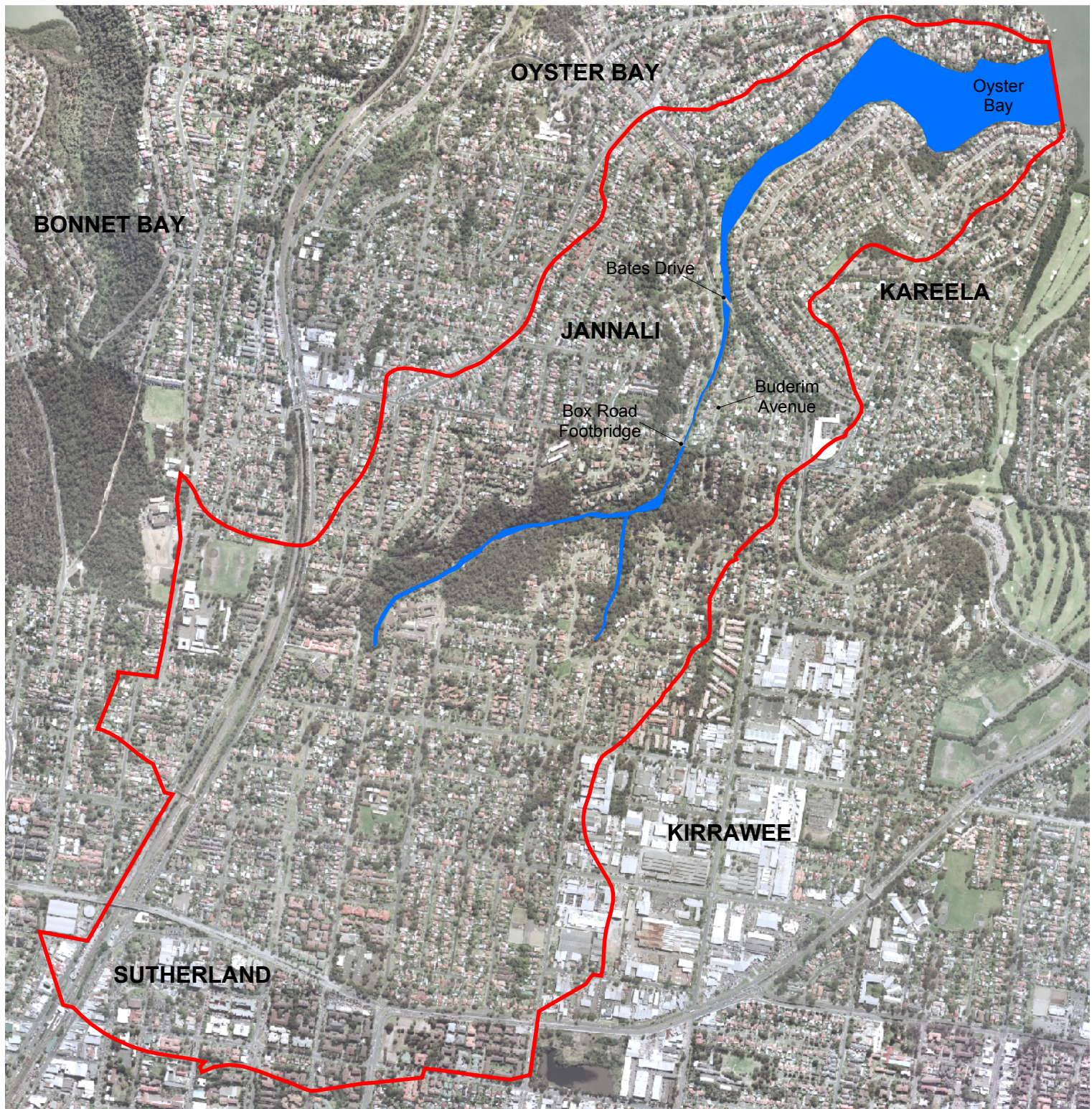


FIGURE 2
STUDY AREA



FIGURE 3

**DESIGN FLOOD CONTOURS
1% AEP FLOOD WITH 100% BLOCKAGE**

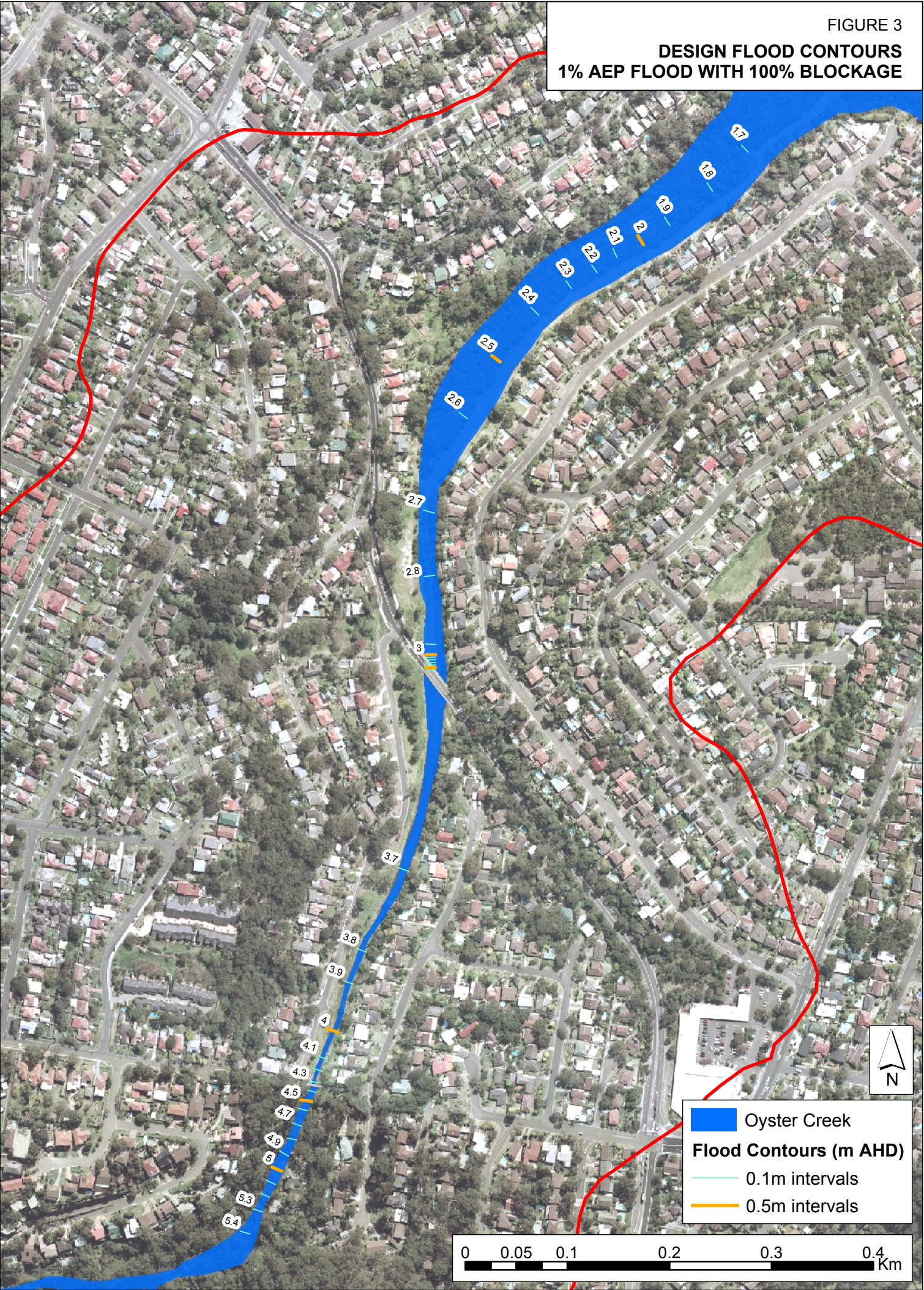


FIGURE 4
FLOOD RISK PRECINCTS

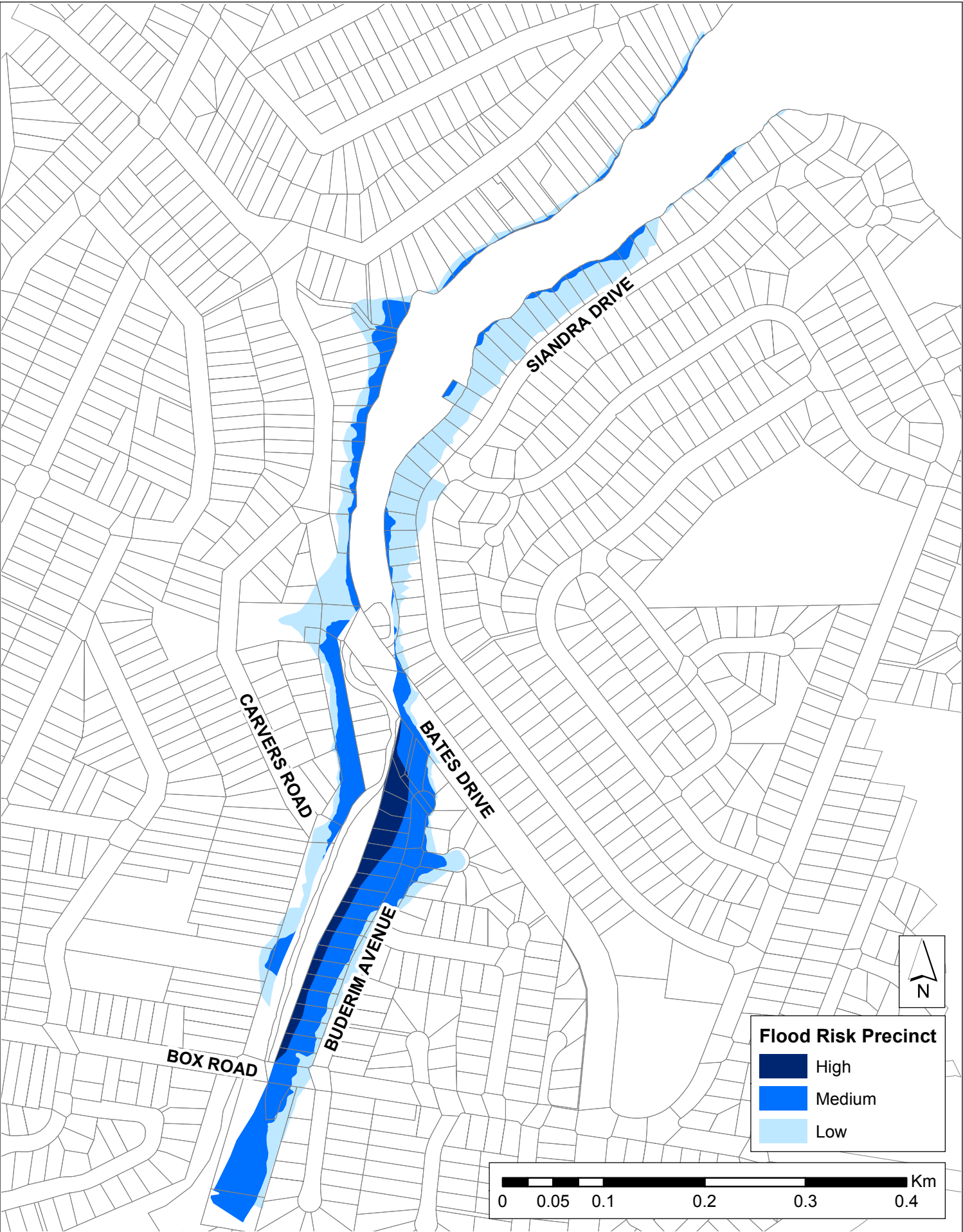


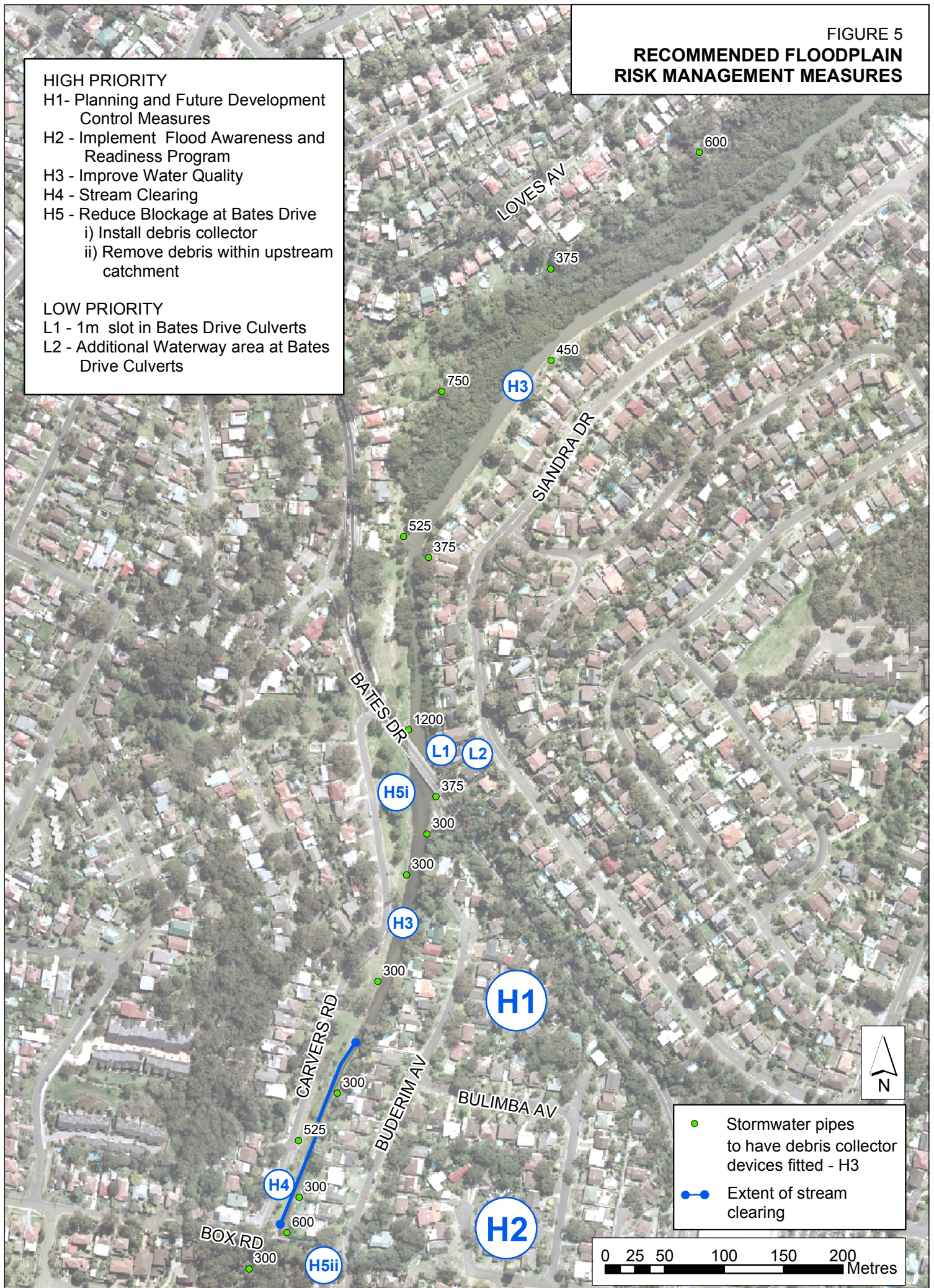
FIGURE 5
**RECOMMENDED FLOODPLAIN
RISK MANAGEMENT MEASURES**

HIGH PRIORITY

- H1- Planning and Future Development Control Measures
- H2 - Implement Flood Awareness and Readiness Program
- H3 - Improve Water Quality
- H4 - Stream Clearing
- H5 - Reduce Blockage at Bates Drive
 - i) Install debris collector
 - ii) Remove debris within upstream catchment

LOW PRIORITY

- L1 - 1m slot in Bates Drive Culverts
- L2 - Additional Waterway area at Bates Drive Culverts



Note: Size and location of pipes indicative only