

SUTHERLAND SHIRE COUNCIL

Sutherland Shire
COUNCIL



KURNELL FLOODPLAIN RISK MANAGEMENT PLAN

FINAL STUDY







Level 2, 160 Clarence Street
Sydney, NSW, 2000

Tel: 9299 2855
Fax: 9262 6208
Email: wma@wmawater.com.au
Web: www.wmawater.com.au

KURNELL TOWNSHIP FLOODPLAIN RISK MANAGEMENT PLAN

FINAL REPORT JULY, 2013

Project Kurnell Township Floodplain Risk Management Plan		Project Number 26086
Client Sutherland Shire Council		Client's Representative Joga Jayanti
Authors M Retallick M Babister		Prepared by 
Date 31 July 2013		Verified by 
Revision	Description	Date
7	Final Report – Critical drainage path refinements	JULY 2013
6	Final Report Incorporating Committee Comment	APRIL 12
5	Final Report	JULY 11
4	Draft for Public Exhibition	APRIL 11
3	Draft For Public Exhibition	SEPTEMBER 10
2	Final Draft Report	AUGUST 10
1	Draft Report	APRIL 10

KURNELL TOWNSHIP FLOODPLAIN RISK MANAGEMENT PLAN

TABLE OF CONTENTS

	PAGE
FOREWORD	i
EXECUTIVE SUMMARY	ii
1. INTRODUCTION	1
1.1. Floodplain Risk Management Process.....	1
1.2. Catchment Description	1
1.3. History of Development	1
2. EXISTING FLOOD ENVIRONMENT	3
2.1. Flooding Mechanism.....	3
2.2. Previous Flood Mitigation Measures Considered	3
2.3. Community Consultation.....	3
3. FLOODPLAIN RISK MANAGEMENT MEASURES	4
3.1. Introduction.....	4
3.2. High Priority	4
3.3. Medium Priority.....	6
3.4. Low Priority.....	6
4. ACKNOWLEDGEMENTS.....	7
5. REFERENCES	8

LIST OF TABLES

Table i):	Summary of flood damages	ii
Table ii):	Floodplain Management Measures included in the Kurnell Township Floodplain Risk Management Plan	iv

LIST OF FIGURES

- Figure 1 Study Area
- Figure 2 Peak Flood Levels – 1% AEP Event
- Figure 3 Peak Flood Levels – PMF Event
- Figure 4 Flood Liable Buildings
- Figure 5 Critical Drainage Pathways

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 four sequential stages:

- 1. Flood Study**
 - determines 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 Kurnell Township Floodplain Risk Management Plan constitutes the third stage of the risk management process for the catchment area. It has been developed for Sutherland Shire Council's Floodplain Risk Management Committee by WMAwater (formerly Webb, McKeown & Associates) for the future management of flood liable lands in the Kurnell Township catchment. Funding for this study was provided by Sutherland Shire Council and the Department of Environment and Climate Change and Water.

EXECUTIVE SUMMARY

KURNELL TOWNSHIP CATCHMENT

The Kurnell Township catchment has an area of approximately 6.5 square kilometres and lies entirely within the boundaries of Sutherland Shire Council. It drains into Botany Bay (to the north) and Quibray Bay north of Sir Joseph Banks Drive (to the west). The catchment is bounded by Botany Bay National Park to the south and east. The lower reaches of the catchment are low lying with ill defined drainage paths. The catchment area is made up of approximately 25% national park, 15% residential, 20% wetland, and 40% industrial. The low lying nature of the town and its proximity to the Bay also makes it susceptible to flooding from tidal inundation.

FLOOD STUDY

The Kurnell Township flood study was initiated as a result of an *Initial Subjective Assessment of Major Flooding* report prepared for Sutherland Shire Council (Council) in 2004 (Reference 2), where the Kurnell Township subcatchment was given a very high priority within the Council area in terms of the extent and frequency of flooding. The Kurnell Township Flood Study (Reference 2) was prepared by WMAwater in 2009 for Sutherland Shire Council. The main outcomes of the Flood Study were as follows:

- full documentation of the methodology and results,
- preparation of flood level and hazard maps for the Kurnell Township,
- assessment of the potential impacts of climate change on flooding, and
- a modelling platform to form the basis for the Floodplain Risk Management Study.

EXISTING FLOOD PROBLEM

A flood damages assessment for existing development in the Kurnell Township was undertaken across a range of design events. This assessment was based on a detailed survey of building floor levels. Table i) indicates the estimated number of building floors which are likely to be flooded for a range of event magnitudes and the corresponding tangible damages. No consideration has been given for damages to public structures or utilities (bridges, roads, pumping stations) or for the complete collapse of structures due to flooding.

Table i): Summary of flood damages

Event	Number of Buildings Inundated above Floor Level		Total Tangible Flood Damages*
	Residential	Non-Residential	
20% AEP	40	12	\$1,187,234
5% AEP	59	15	\$1,795,721
1% AEP	83	17	\$2,505,362
PMF	459	73	\$20,043,314
		Average Annual Damages	\$523,758

Note: * Excludes all damages to public assets. Includes external damages which may or may not occur with building floor inundation.

FUTURE DEVELOPMENT

Based on recommendations from the *Kurnell Peninsula Land Use Safety Study*, it would appear that extensive new development in Kurnell is unlikely in the near future (Reference 3). However, Sutherland Shire Council noted in the Project Brief for this study that there is still potential for redevelopment of the Kurnell Township.

FLOODPLAIN RISK MANAGEMENT STUDY

A list of all possible floodplain risk management measures which could be applied in the study area were initially developed for consideration in the Floodplain Risk Management Study. The assessment extended to examination of potential future development and its possible adverse impacts on flows and water quality. The measures were then assessed in terms of their suitability and effectiveness for reducing social, ecological, environmental, cultural and economic impacts. As part of this process a number of measures were identified as not being worthy of further consideration. A range of floodplain management measures was analysed in the Kurnell Township Floodplain Risk Management Study and from this the proposed measures (Table ii) were developed.

The key outcomes of the study were:

- identification of development and planning controls to regulate redevelopment in the flood affected properties and to ensure that future re-development does not significantly add to the overall potential damage,
- recommendations for clauses in Council's Section 149 Certificate,
- recommendations to adopt Flood Planning Levels (FPL) appropriate for the catchment,
- an investigation of available floodplain risk management measures along with prioritisation, staging of works and preliminary costings.

Table ii): Floodplain Management Measures included in the Kurnell Township Floodplain Risk Management Plan

MEASURE/DESCRIPTION	COST	Funding & Responsibility
High Priority:		
LOCAL DRAINAGE ISSUES - To identify and reduce local drainage problems. Maintain the existing flooding/drainage issues database.	Low	Council
IMPROVE EVACUATION PLANNING - Enable people to evacuate in a safe and efficient manner and reduce actual flood damages.	Low	Council & SES
PUBLIC INFORMATION AND RAISING FLOOD AWARENESS - Educate people to minimise flood damages and reduce the flood problem. A cheap effective method but requires continued effort.	Depends on nature of the program	Council & SES
WATER QUALITY DEVICES - To improve water quality. Opportunity to install a GPT at the inflow points to Marton Park Wetland (particularly Cook Street) and Botany Bay. To identify other potential sites.	About \$200,000 per unit (GPT)	Council
DEVELOPMENT CONTROL PLANNING - Reduce potential hazard and losses. Already in place but can be enhanced. A number of suggestions have been made in this Management Plan.	Low	Council
Medium Priority:		
CHANNEL MODIFICATIONS - Initiate maintenance scheme to reduce the likelihood of blockage.	\$20,000 - \$50,000 depending on the channel size	Council
STORM SURGE, WAVE RUNUP - To identify the effects of ocean anomalies in Botany and Quibray Bays.	Study - \$20,000	Council
Low Priority:		
LEVEES, FLOOD GATES AND PUMPS – Levees could be built along the western side of Ward St, along Quibray Bay and around Marton Park wetland. However, their practicality needs to be investigated.	High	Council
VOLUNTARY HOUSE PURCHASE – Not considered necessary unless houses need to be removed to restore flow paths.	Of the order of \$2 million	Council & DECCW
FLOOD PROOFING – Suitable only for commercial premises.	High	Businesses

Note: Measures are not in any particular order within each category.

1. INTRODUCTION

The Kurnell Township catchment has an area of approximately 6.5 square kilometres. The catchment area is predominately occupied by national park and urban development (both residential and industrial).

1.1. Floodplain Risk Management Process

As described in the *Floodplain Development Manual* (Reference 1), the Floodplain Risk Management Process entails four sequential stages:

- Stage 1: Flood Study.
- Stage 2: Floodplain Risk Management Study.
- Stage 3: Floodplain Risk Management Plan.
- Stage 4: Implementation of the Plan.

The Kurnell Township Floodplain Risk Management Plan constitutes the third stage in the process and follows the completed Kurnell Township Floodplain Risk Management Study. The Kurnell Township Flood Study was completed in 2009 (Reference 2). A combination of hydrologic and hydraulic models was used in the Flood Study to determine design flood levels and flood extents for the Kurnell Township catchment. The impacts of both catchment flooding and ocean flooding were considered.

1.2. Catchment Description

The study area consists of the Kurnell Township (Figure 1). Its catchment area extends further east and south of the township, and is bounded by Botany Bay to the north, Quibray Bay to the west, and Botany Bay National Park to the east and south.

The extent of the catchment area has been defined in consultation with Council, and covers the area draining to Quibray Bay north of Sir Joseph Banks Drive. This includes the entire township of Kurnell, as well as the Caltex Oil Refinery and part of the Botany Bay National Park.

The catchment encompasses an area of approximately 6.5 km², of which approximately 25% is national park, 15% is residential, 20% is swamp or wetland, and 40% is industrial. The upper reaches of the catchment are predominantly steep, particularly within the Botany Bay National Park where slopes of up to 25% can be found. However, the lower reaches of the catchment, including Kurnell Township itself, is typically flat and low lying. Elevations are generally below 3 m Australian Height Datum (AHD) with the exception of the north east corner, which reaches approximately 19.5 mAHD.

1.3. History of Development

Kurnell is the site of Captain James Cook's first landing along the east coast of Australia in 1770. However, it was not until 1815 that the first land holding was taken. Minimal development occurred during the 1800's, with the majority of land owned by only a few individuals. There was

no direct access to Kurnell in the 1800's and early 1900's other than by a small track, which limited development of the area. The introduction of a ferry service from Kurnell to San Souci in 1903 and to La Perouse in 1912 encouraged some expansion of the village. During the 1930's and 40's, Kurnell became a small fishing village with a population of less than 300 residents. It was not until the construction of the oil refinery and access road in the 1950's that Kurnell's development greatly advanced. By 1961, the population had reached 1424 (Reference 3).

Despite rapid growth following construction of the Caltex Oil Refinery, there has only been relatively minor development since the late 1980's. This would appear to be at least partly due to a risk assessment for Kurnell Peninsula (*Kurnell Peninsula Land Use Safety Study*), which was initially conducted in 1986, and was last updated in 2007 (Reference 4). The assessment found that the likelihood of catastrophic failure of the oil refinery and other industries was minimal. However, the impacts were considered potentially severe should failure occur. This in combination with the provision of only a single evacuation route via Captain Cook Drive resulted in residential development restrictions being imposed through regional planning controls. Consequently, the population had stabilised to just over 2000 residents by the 2001 Census (Reference 5).

Based on recommendations from the Land Use Safety Study, it would appear that extensive new development in Kurnell is unlikely in the near future (Reference 4). However, Sutherland Shire Council noted in the Project Brief for this study that there is still potential for redevelopment of Kurnell Township. Land use and development is controlled under the Sydney Regional Environmental Plan No. 17 – Kurnell Peninsula.

2. EXISTING FLOOD ENVIRONMENT

2.1. Flooding Mechanism

Flooding within the Kurnell catchment may occur as a result of a combination of factors including:

- An elevated water level in Botany and Quibray Bays (high tide and/or storm surge).
- Elevated water levels within the open channel which runs beside Captain Cook Parade and along roads and through private property as a result of intense rain over the Kurnell catchment. The water level in the channel and elsewhere may also be affected by constrictions (e.g. culverts, blockages, fences, buildings).
- Local runoff over a small area accumulating (ponding) in low spots. The relatively flat topography with limited potential for drainage lends itself to this form of flooding. This type of flooding may be exacerbated by inadequate or blocked local drainage provisions and restricted overland flow paths.

These factors may occur in isolation or in combination with each other.

The Kurnell Township Flood Study (Reference 2) provides the most up to date information on flooding and this is shown on Figures 2 and 3. The Kurnell Township Floodplain Risk Management Study (Reference 6) identified the buildings inundated above floor level for each design event and these areas are shown on Figure 4.

2.2. Previous Flood Mitigation Measures Considered

Whilst a number of different drainage schemes have been developed over the years, these have had varying success, and flooding remains an issue in Kurnell. In some cases, partial implementation of a scheme has had a detrimental effect, such as the creation of localised depressions by partial filling due to the 1957 Blair and Stuckey scheme. The *1980 Revised Drainage Scheme* (Reference 3) provided a number of more appropriate recommendations, some of which have since been implemented. These included the improvement of drainage in the Cook Street area, with the construction of a 375 mm pipe running from Cook Street Swamp to Cook Street. A 1050 mm diameter pipe has also been constructed along the northern side of Captain Cook Drive, adjacent to the National Park. However, the recommendation to fill Cook Street Swamp and provide tidal protection along Balboa and Torres Streets has not been carried out.

2.3. Community Consultation

A rigorous public consultation program was carried out as part of this study. This included:

- letter to residents and stakeholders,
- follow up telephone calls to key respondents,
- floodplain management committee meetings,
- workshop/site inspection and interviews,
- public exhibition of material.

3. FLOODPLAIN RISK MANAGEMENT MEASURES

3.1. Introduction

An assessment of all floodplain risk management measures was undertaken in the Floodplain Risk Management Study (Reference 6). The recommended floodplain management measures for the Kurnell catchment are summarised in Table ii) in the summary and discussed in the following sections.

The priority ranking is based upon a combination of reduction in flood risk, ease of implementation and cost/funding implications. There is no particular order of the measures within each priority categorisation.

3.2. High Priority

Local Drainage Issues: Council should maintain and where possible improve the existing database of reported local drainage issues and review the required actions following each major rainfall event (say an event of magnitude occurring once or twice a year).

Improve Evacuation Planning: A Local Flood Plan for Kurnell Township should be prepared as well as a detailed evacuation plan (combining flood awareness and preparedness) for the childcare facility in Marton Park and Kurnell Public School. The SES role in flooding on Kurnell is likely to occur before (awareness program) and after the event (clean up) due to the limited response time available and likely demand on resources from other areas flooding concurrently. The communities' response during an event is critical in reducing the flood damages and risk to life and thus, even if emphasised as a 'self help' approach, should be formulated in conjunction with/by the SES.

Public Information and Raising Public Awareness: Based on feedback and general discussions, the residents of Kurnell catchment have a low level of flood awareness and preparedness. This is especially true of younger/newer residents. This can be improved upon through implementation of an effective Council or SES run flood awareness program. The extent of the program can vary from year to year depending upon the circumstances.

A suitable Council wide flood awareness program should be implemented by Council using appropriate elements as discussed in Reference 6. The details of the program and necessary follow up should be properly documented to ensure that they do not lapse with time and to ensure that the most cost effective means of communication is undertaken.

Water Quality Devices: There is the opportunity to install a GPT (Gross Pollutant Trap) at the inflow points to Marton Park Wetland (particularly Cook Street) and Botany Bay. The installation of GPTs within the catchment was promoted by the *Marton Park Wetland Plan of Management* (Reference 7). This would be an offline structure. Constructing it as part of a wetland would incorporate a nutrient absorption function. The cost of this structure may be \$200,000. It would provide significant environmental benefit with no adverse hydraulic impacts and potentially some social benefits. There may be other potential sites for GPTs and these should be considered

where appropriate.

Development Control Planning: In order to ensure consistency the Flood Planning Levels (FPL) specified in Council's *Sutherland Shire Development Control Plan 2006* should be applied across the entire LGA regardless of whether the area has a Floodplain Risk Management Plan. The only exception would be if the Floodplain Risk Management Plan proposes a change to these FPLs.

It is recommended that Council further consider the restriction of development (either redevelopment or new development) in the critical drainage pathways shown in Figure 10. Restricting development will ensure that these important critical drainage pathways are not blocked and water drains quickly from Kurnell. Within these critical drainage pathways restriction should be placed which does not allow fill within the designated critical drainage pathways area (identified on Figure 5) that restricts the flow path width to less than 3m. Careful consideration should be given to making sure the DCP restrictions and critical drainage pathways locations are not overly restrictive on development, which has been a major concern of residents, without compromising the purpose of the flow paths. To assist in the effectiveness of the flowpaths a pipe will be required from the end of the flow path which ends in the middle of Balboa Street to the bay, given the road is higher than the adjacent properties in this area. This would also assist with drainage of the area in existing conditions. Within the critical drainage paths are some properties which were legitimately filled in the 1970's. In some cases it may be necessary to remove some impediments to flow by regrading some high land to have low points which join to form a flow path.

Council should further develop the section on development on flood-labile land in its LEP and DCP to include the above planning control.

Council should continually review and optimise the policy on managing overland flow as information on the nature and extent of the problem arises.

Climate Change: Council should continue to monitor the available literature and reassess Council's Flood Policy as appropriate. At a minimum Council should obtain the most current information available from the Bureau of Meteorology and DECCW every two years.

Any management issues adopted for Kurnell should consider current and future climates. Some Council's in NSW have raised the Flood Planning Levels to account for the expected increase in flood level. This rise would be in addition to the 0.5 m freeboard. For new development the Flood planning level should be based on the 100yr flood levels incorporating the 2050 climate change scenario (0.4m sea level rise), with 0.5m freeboard. This issue should be canvassed with development of an LGA wide policy on climate change. However consideration should be given to the 100yr flood level incorporating the 2100 climate change scenario (0.9m sea level rise), with 0.5m freeboard.

Council should review this document after a significant flood event, a change in policy, 5 years time or when a significant change in the understanding of climate change occurs.

Development Intensification: The existing water quality policies of Council are supported. Council policies to manage the adverse effects of development on flooding are to be amended to include the following:

- any development which is proposed within the 100 year ARI flood extent must consider the potential impacts of the works on flood levels,
- proposed works on private lands within the 100 year ARI flood extent need NOT consider the potential impacts of the works on available flow paths (provided they are not within the flow paths identified on Figure 5) through the property. The loss of temporary floodplain storage should only be considered if the cumulative area to be lost since 2009 is greater than 10 m²,
- proposed works greater than 10 m² on public lands within the 100 year ARI flood extent must have a Flood Study undertaken by a professional engineer experienced in floodplain management. The nature and extent of the Flood Study will be determined by the engineer at the time.

Water Sensitive Urban Design: The installation of Water Sensitive Urban Design measures is supported.

3.3. Medium Priority

Channel Modifications: Channel modifications are undertaken as a means to reduce the flood levels by increasing the capacity or conveyance of the system. Council should consider further development and enhancing of its maintenance scheme to reduce the likelihood of blockage.

Storm Surge, Wave Runup: A study to assess the magnitude and impact of storm surge, wave runup and other causes of elevated levels in Botany and Quibray Bays should be undertaken.

3.4. Low Priority

Levees, Flood Gates and Pumps: These could be employed as a floodplain management measure within the catchment. A levee between Prince Charles Parade, along the western side of Ward St, along the edge of Quibray Bay to Captain Cook Drive and around Marton Park wetland would reduce ocean inundation in Kurnell. However, aesthetic and access issues may make the levee impractical. A detailed study of the practicality of such a measure needs to be undertaken.

Voluntary House Purchase: A voluntary purchase scheme is not considered necessary in Kurnell given that no properties are at extreme risk of high velocities or loss of life. This option should only be considered if the houses need to be removed to restore flow paths.

Flood Proofing: Flood proofing should be promoted as a means available to reduce flood damages for non-residential buildings.

4. ACKNOWLEDGEMENTS

This study was undertaken by WMAwater, and was funded by Sutherland Shire Council and the Department of Environment Climate Change and Water. The assistance of the following in providing data and input during the course of the study is gratefully acknowledged:

- Sutherland Shire Council,
- Kurnell Floodplain Risk Management Committee,
- NSW Department of Environment Climate Change and Water.

5. REFERENCES

1. NSW Government
Floodplain Development Manual
April 2005.
2. WMAwater
Kurnell Township Flood study
2009.
3. Warner, K
Kurnell Village Drainage Investigation
1980.
4. NSW Department of Planning
Kurnell Peninsula land Use Safety Study
2007.
5. Australian Bureau of Statistics
website: www.abs.gov.au
accessed 10/4/07.
6. WMAwater
Kurnell Township Floodplain Risk Management Plan
2010.
7. WMAwater and Molino Stewart
Marton Park Wetland Plan of Management
2009.



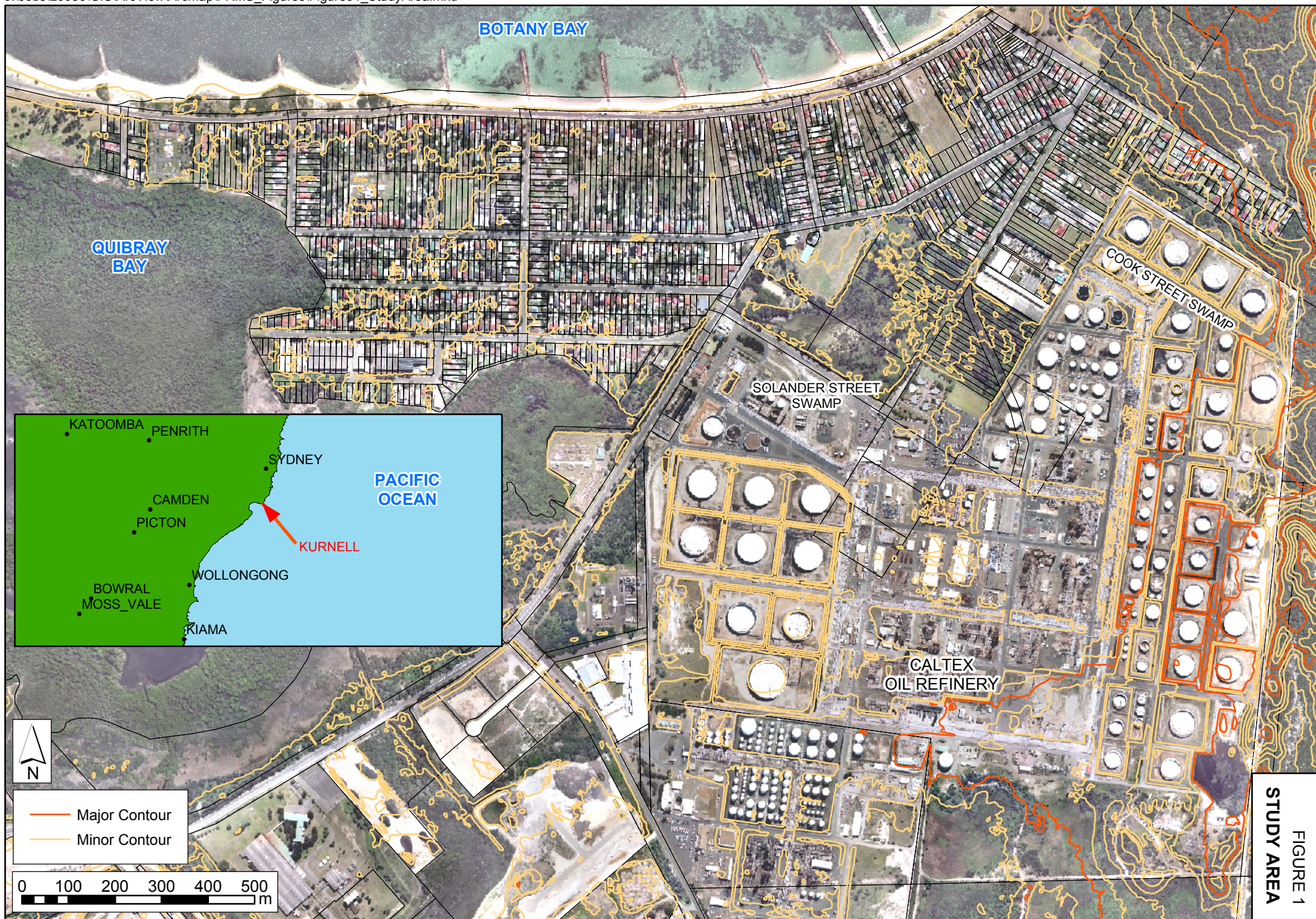


FIGURE 2
PEAK FLOOD LEVELS
1% AEP EVENT



FIGURE 3
PEAK FLOOD LEVELS
PMF EVENT



FIGURE 4
FLOOD LIABLE BUILDINGS

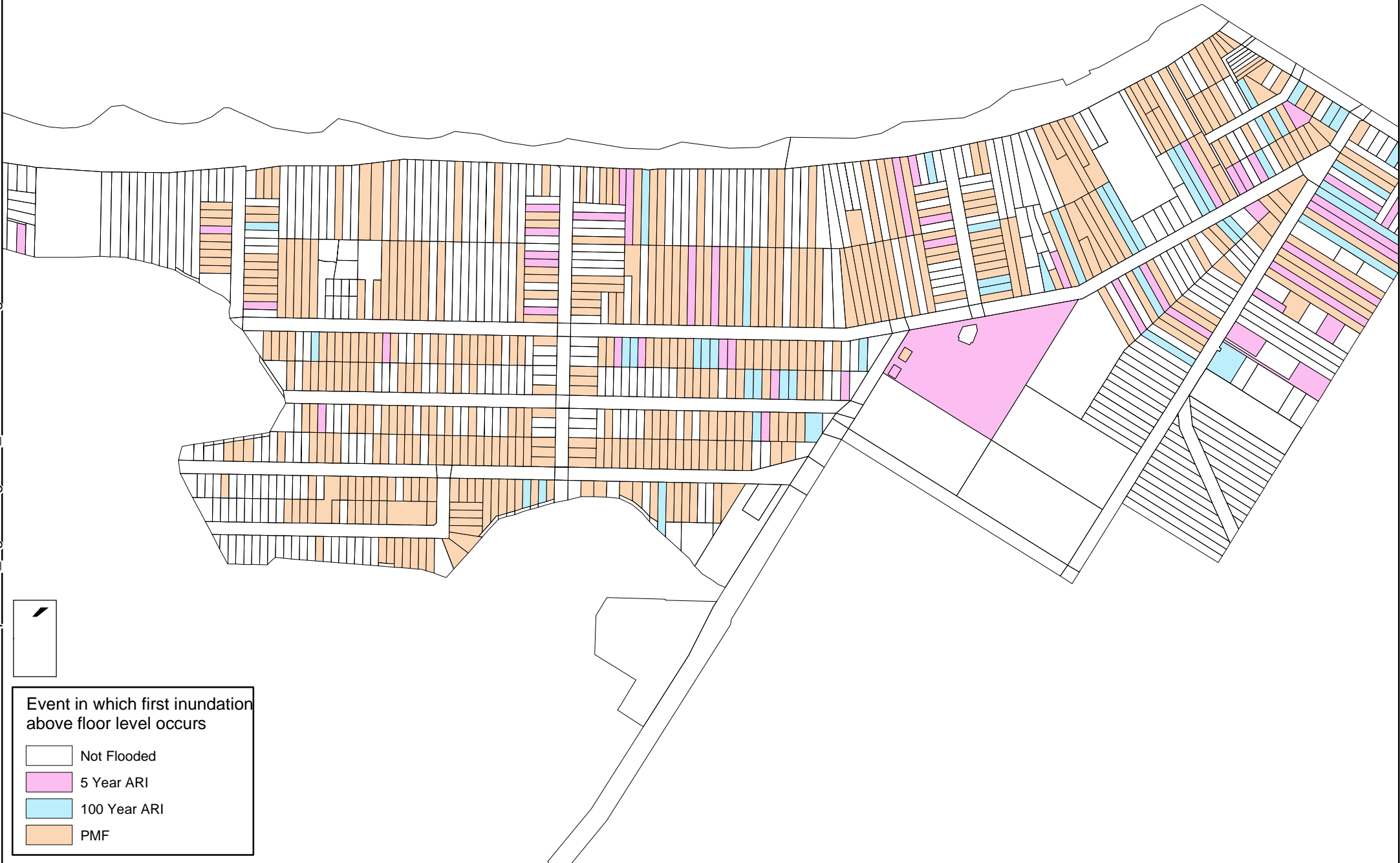




FIGURE 5
CRITICAL DRAINAGE
PATHWAYS