

Title:  
**Manly Lagoon Flood Study - Climate Change Scenarios:  
 1% AEP Catchment Derived Event + 0.4 m SLR + Rainfall Intensity Increase**

Figure:  
**A-63**

Rev:  
**A**

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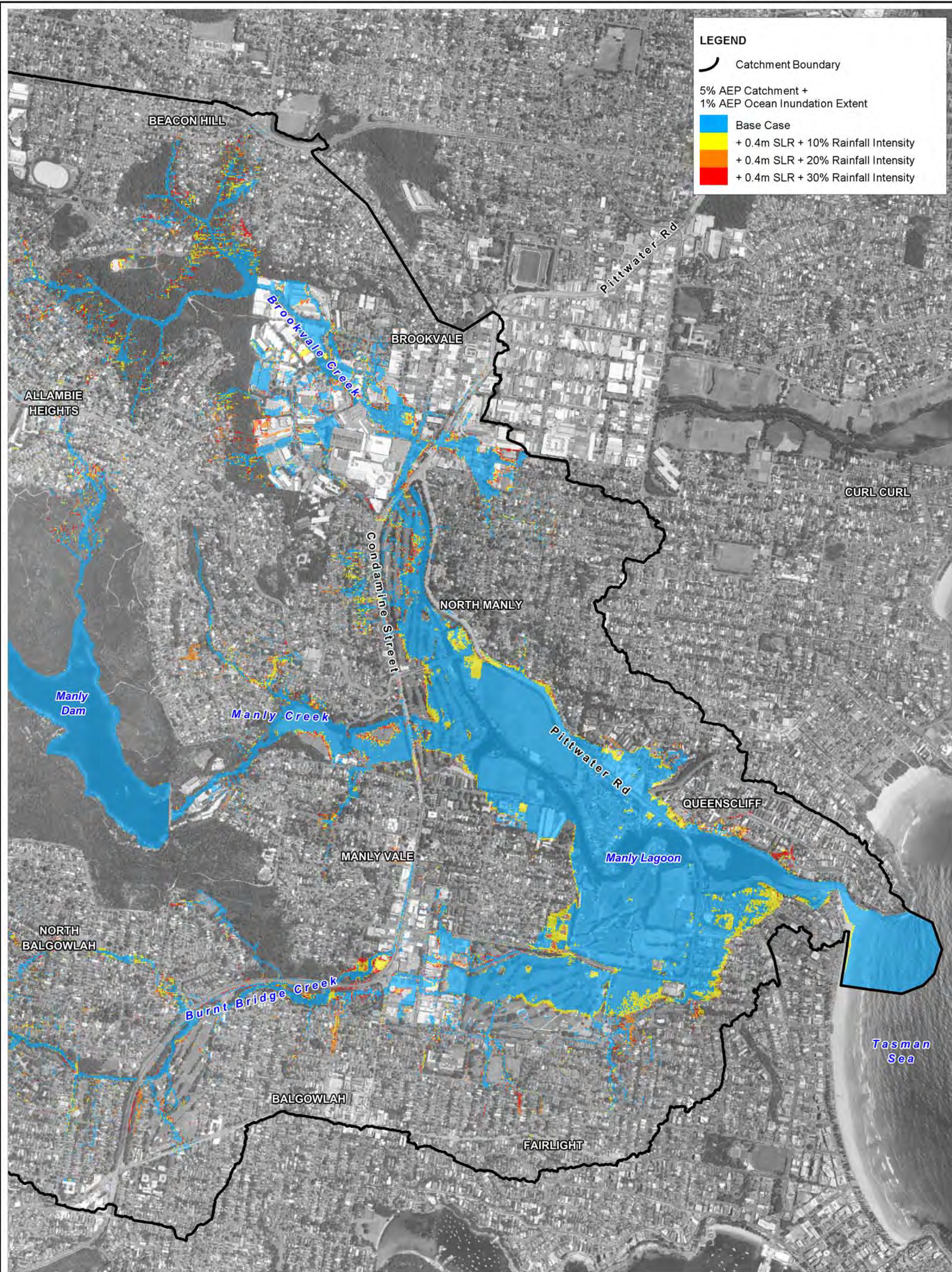


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Title:  
**Manly Lagoon Flood Study - Climate Change Scenarios: 5% AEP Catchment + 1% AEP Ocean Coincident Event + 0.4 m SLR + Rainfall Intensity Increase**

Figure:  
**A-64**

Rev:  
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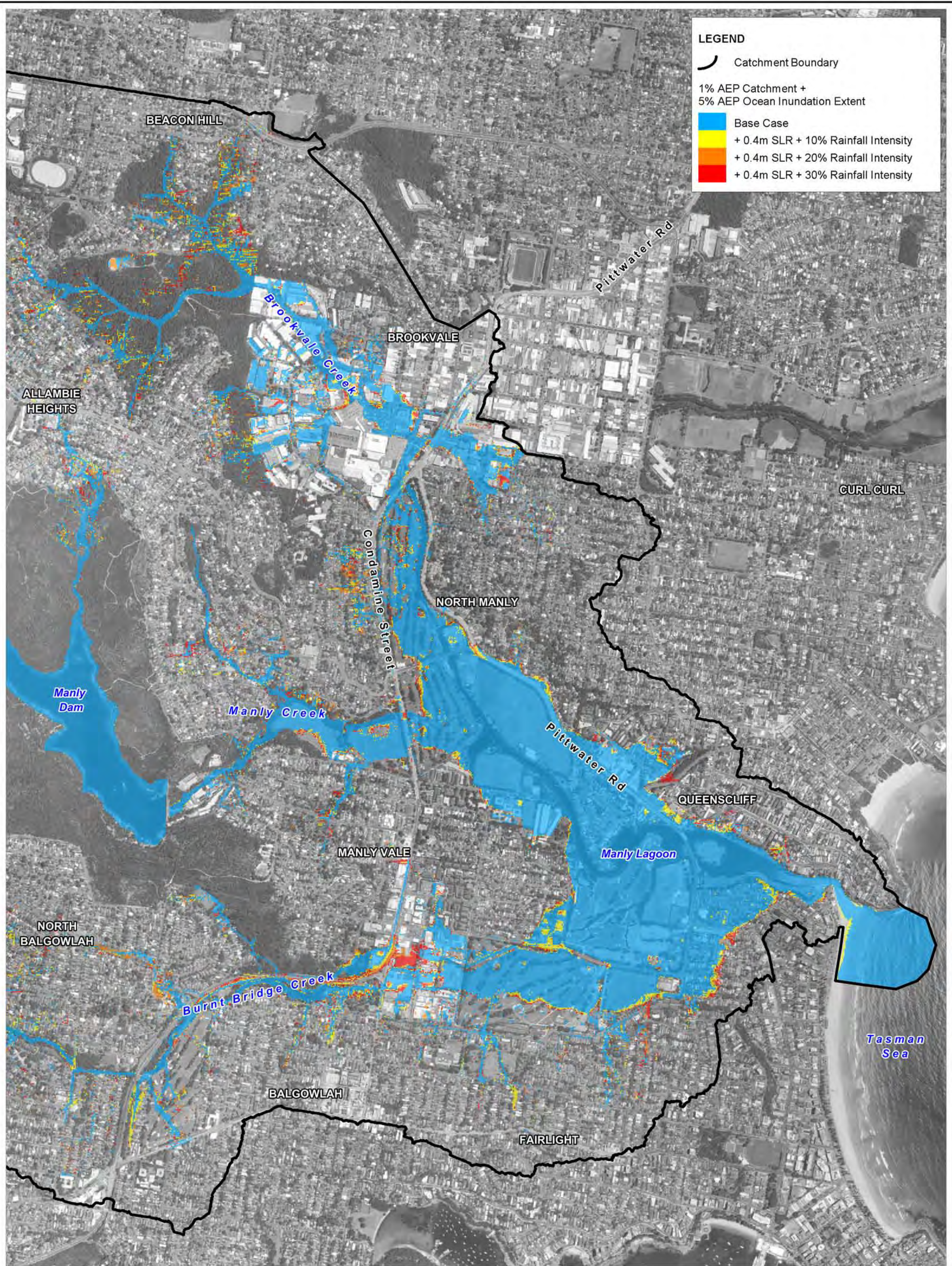


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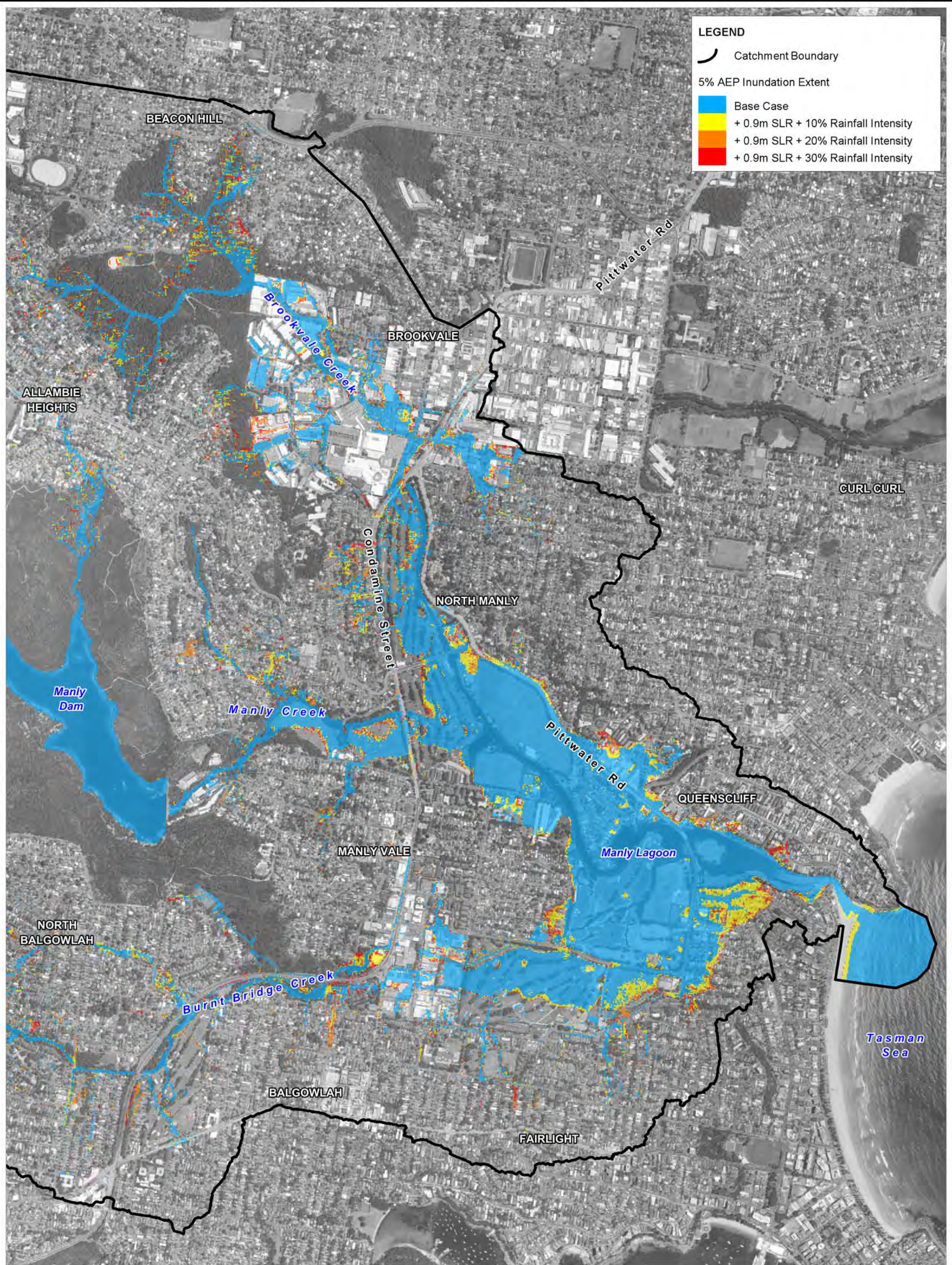
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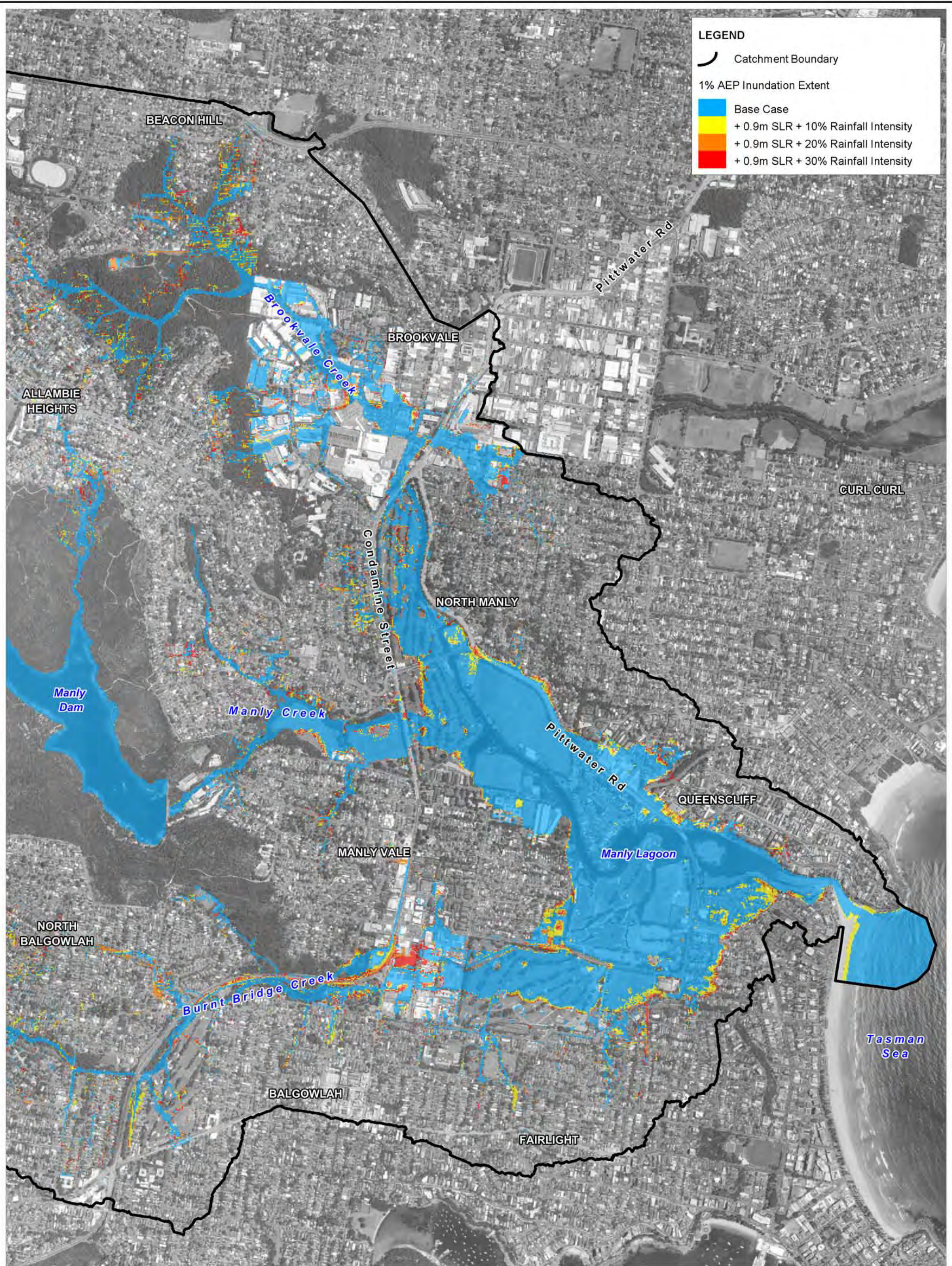
<p>Title:</p> <p><b>Manly Lagoon Flood Study - Climate Change Scenarios: 1% AEP Catchment + 5% AEP Ocean Coincident Event + 0.4 m SLR + Rainfall Intensity Increase</b></p>	<p>Figure:</p> <p><b>A-65</b></p>	<p>Rev:</p> <p><b>A</b></p>
<p>BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.</p>	<div data-bbox="793 2783 850 2864" data-label="Image"> </div> <div data-bbox="1039 2783 1432 2873" data-label="Figure"> </div>	<div data-bbox="1570 2745 1984 2884" data-label="Image"> </div>
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<p>Title:</p> <p><b>Manly Lagoon Flood Study - Climate Change Scenarios: 5% AEP Catchment Derived Event + 0.9 m SLR + Rainfall Intensity Increase</b></p>	<p>Figure:</p> <p><b>A-66</b></p>	<p>Rev:</p> <p><b>A</b></p>
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Title:

**Manly Lagoon Flood Study - Climate Change Scenarios:**  
**1% AEP Catchment Derived Event + 0.9 m SLR + Rainfall Intensity Increase**

Figure:

**A-67**

Rev:

**A**

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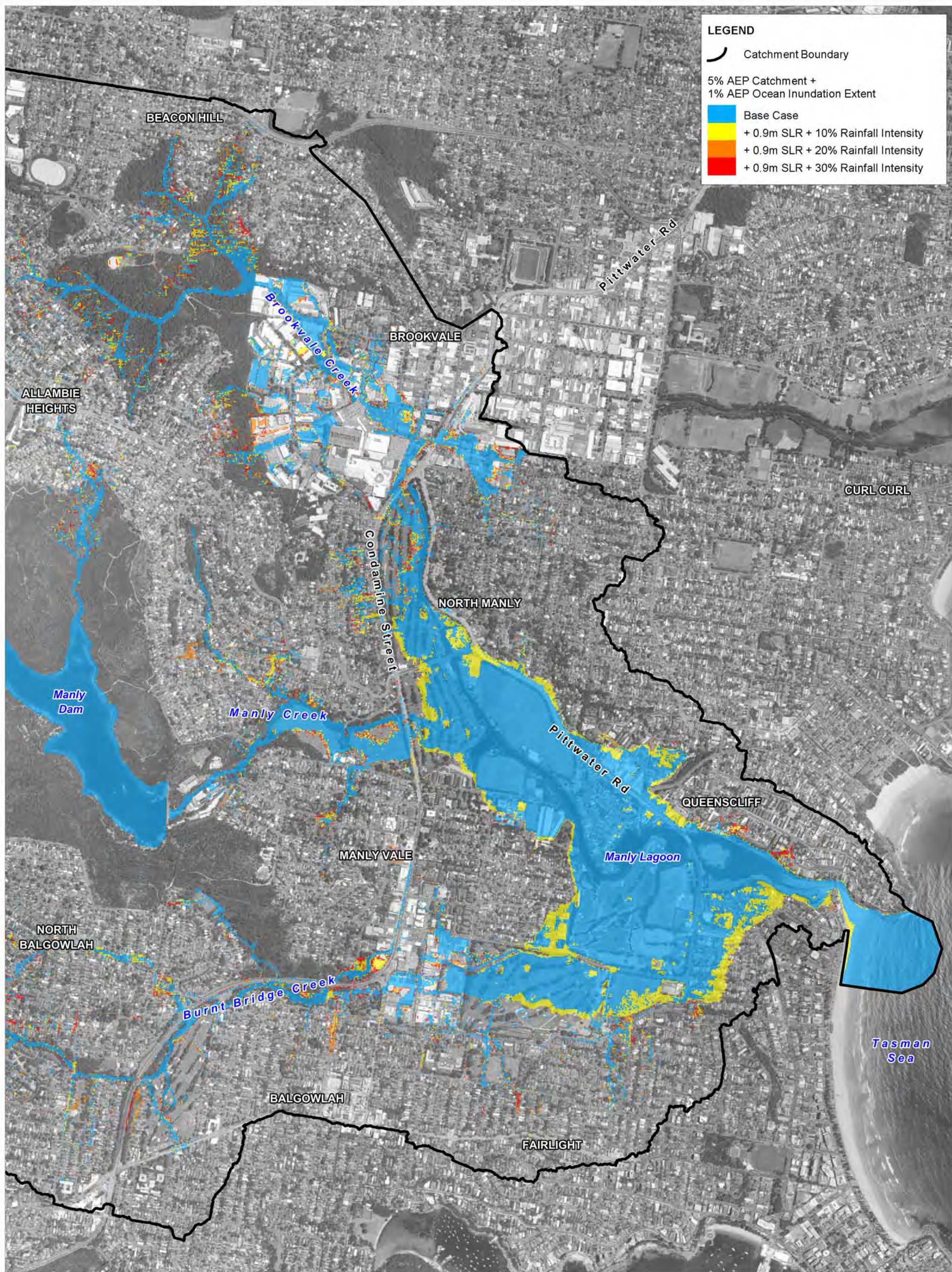
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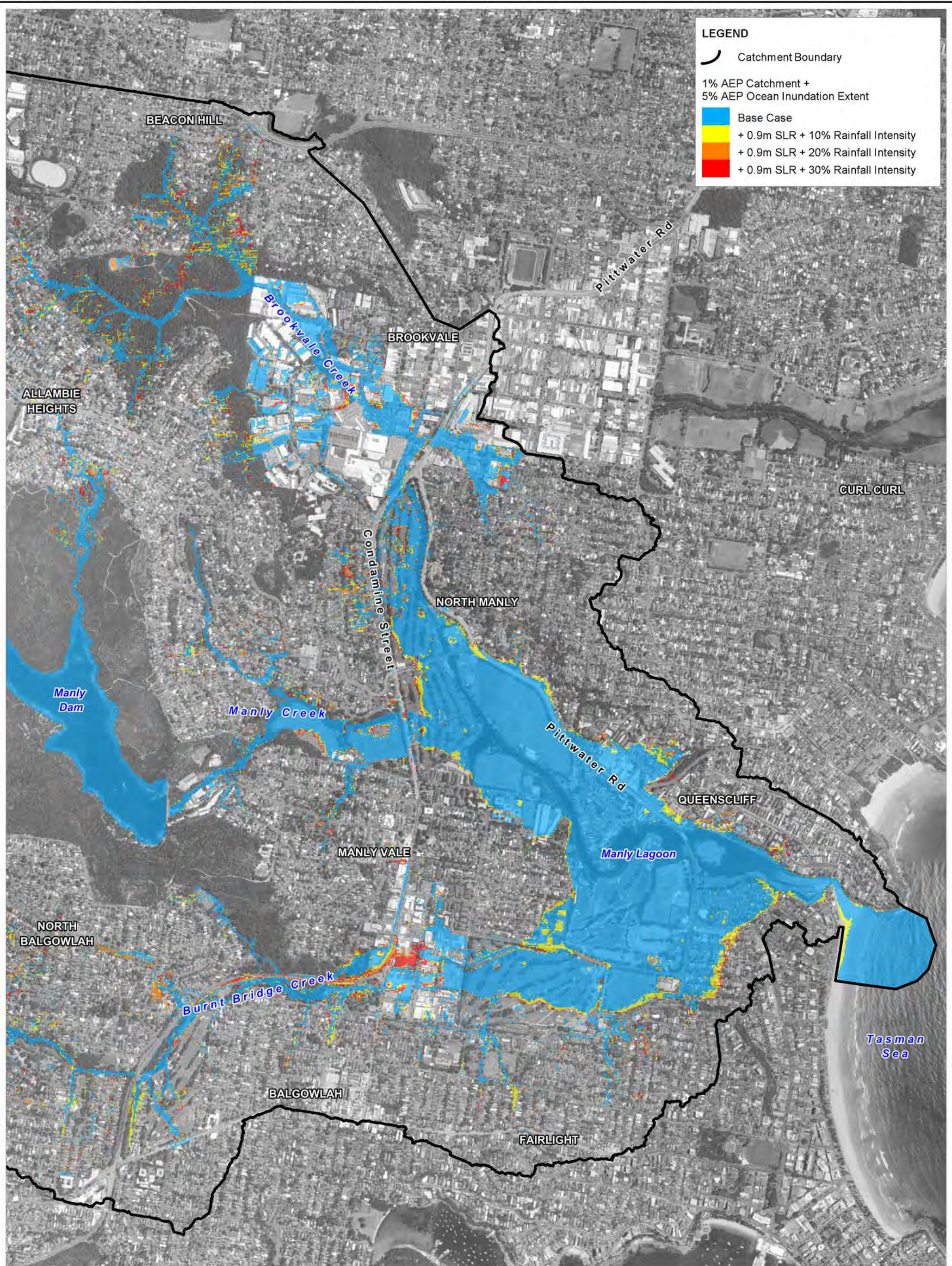



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<p>Title:</p> <p><b>Manly Lagoon Flood Study - Climate Change Scenarios: 1% AEP Catchment + 5% AEP Ocean Coincident Event + 0.9 m SLR + Rainfall Intensity Increase</b></p>		<p>Figure:</p> <p><b>A-69</b></p>	<p>Rev:</p> <p><b>A</b></p>
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# Manly Lagoon Flood Study - Flood Planning Levels

Manly Council

Final Report:

R.N2069.006.02\_Manly

August 2013









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	<b>Client :</b> Manly Council <b>Client Contact:</b> Michael Galloway <b>Client Reference</b>

<b>Title :</b>	Manly Lagoon Flood Study – Flood Planning Levels Report
<b>Author :</b>	Darren Lyons
<b>Synopsis :</b>	Report for the Manly Lagoon Flood Study covering the establishment of flood planning levels.

### REVISION/CHECKING HISTORY

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1	12/08/2013	DJL		DJL	
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# 1 INTRODUCTION

The Manly Lagoon Flood Study (BMT WBM, 2013) has been prepared for Manly and Warringah Councils to define the existing flood behaviour in the Manly Lagoon catchment and establish the basis for subsequent floodplain management activities.

This study updates the previous studies on the Lagoon including the Manly Lagoon Flood Study (MHL, 1992) and smaller localised flood studies, providing a holistic assessment of flooding within the catchment. The current flood study considers land use changes subsequent to previous modelling investigations, the influence of the Manly Lagoon entrance on flood behaviour and the influence of potential climate change.

## 1.1 Flood Planning Levels

Land use planning and development controls are key mechanisms by which Manly Council (Council) can manage flood-affected areas within the Manly Lagoon catchment. Such mechanisms will influence future development (and redevelopment) and therefore the benefits will accrue gradually over time. Without comprehensive floodplain planning, existing problems may be exacerbated and opportunities to reduce flood risks may be lost.

Flood Planning Levels (FPLs) are used for planning purposes, and directly determine the extent of the Flood Planning Area (FPA), which is the area of land subject to flood-related development controls, as described below.

Council's Development Control Plan (DCP) has been developed with the aim to reduce the likelihood that dwellings are inundated by flooding and to reduce the likelihood of people being exposed to dangerous flood situations. The DCP specifies how the FPL is applied to new development. For instance, floor levels of new development within the FPA are typically required to be at or above Council's adopted FPL.

The FPL is defined by an established design flood level of selected magnitude combined with a specified freeboard considered appropriate for the land use in question. The purpose of the freeboard is to account for the risk associated with various uncertainties in the predicted flood level. These risks may include variation between flood modelling results and actual flood events, the effect of localised factors on flood levels and potential wave action.

Council's adopted FPL is based on the 1% Annual Exceedance Probability (AEP) flood level + 0.5m freeboard. This is as per the guidelines from the NSW Government's Floodplain Development Manual (2005). For the Manly Lagoon catchment, the design 1% AEP event conditions are based on the coincident occurrence of both catchment and ocean derived flooding. This scenario incorporates a 1% AEP catchment rainfall condition with a 5% AEP ocean water level condition (storm surge scenario).

The FPL can be based on different flood magnitudes and different freeboards, if there is sufficient justification. It is also possible to have a graded set of FPLs in place, dependent on the nature of the development and the relevant flood risk classification. Council's FPLs will be reviewed during the subsequent Floodplain Risk Management Study.



## 1.2 Flood Planning Area

The design flood levels and inundation extents determined through the detailed modelling undertaken in the Manly Lagoon Flood Study (BMT WBM, 2013) provides the basis for establishing the Flood Planning Level (FPL) and associated Flood Planning Area (FPA).

The FPA is the area of land below the FPL and thus subject to flood-related development controls. The FPA for the Manly Lagoon catchment is shown in Figure 1-1.

In deriving the FPA from the flood study results, consideration has been given to the flood severity and risks both on a catchment wide and property basis, as well as the resolution of the computer modelling. The following provides a summary of the various filters used to refine the mapping of the FPA:

- Areas with depth of flooding at the 1% AEP magnitude less than 0.15m are not included;
- Overland flowpaths with minor flows (velocity x depth product < 0.2 m<sup>2</sup>/s) are not included;
- Overland flow path defined using above filters are required to be contiguous; and
- Properties with less than 2% of the cadastral lot area within the FPA are not included.

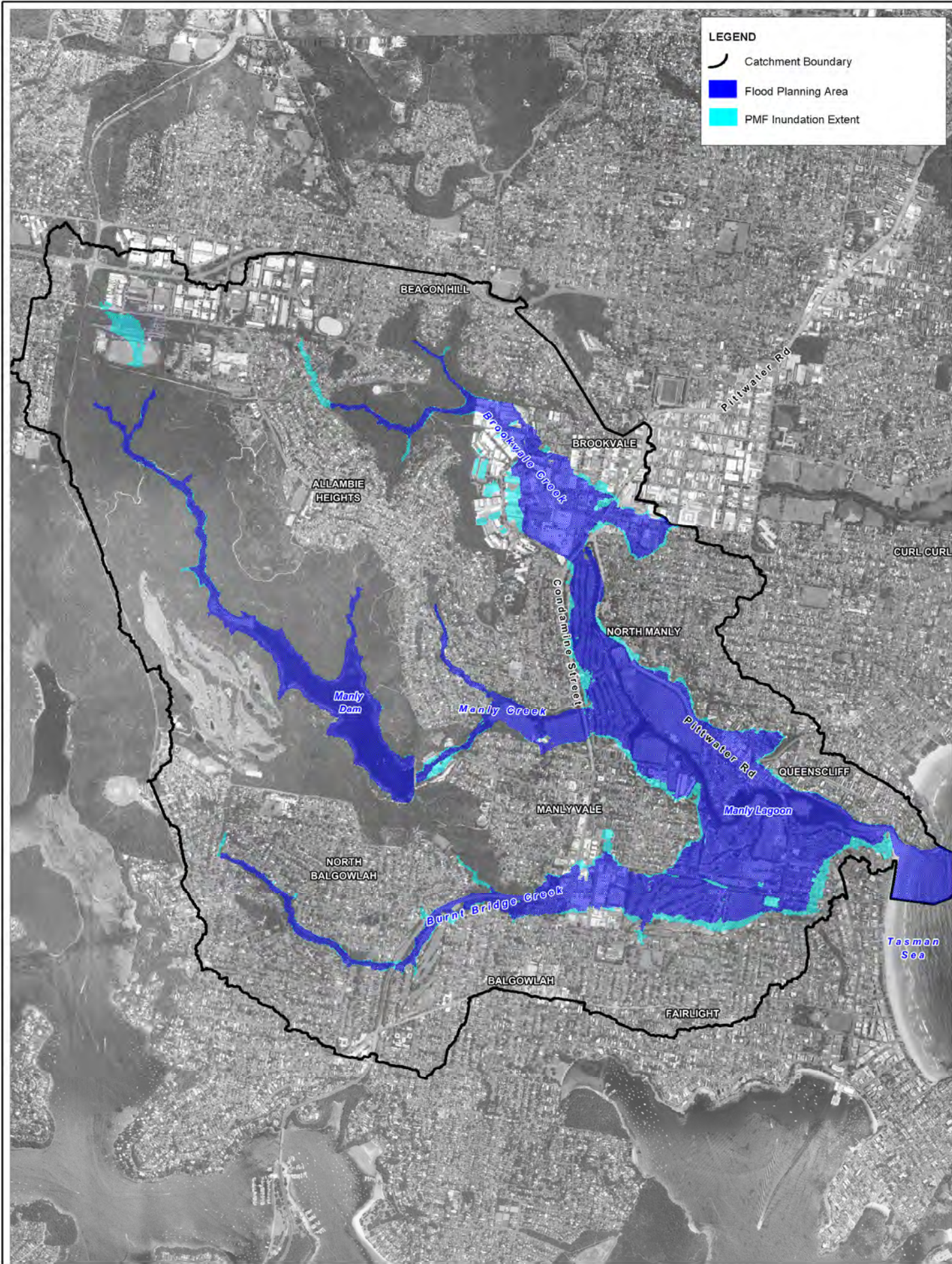
## 1.3 The Probable Maximum Flood

The Probable Maximum Flood (PMF) is the largest flood that could conceivably occur at a particular location, incorporating the worst flood producing catchment conditions. The PMF defines the extent of flood prone land, that is, the floodplain (NSW Floodplain Development Manual, 2005).

Whilst flood-related development controls for residential development are only applied to new development on land below the FPL, consideration is also given to rarer floods up to and including the PMF event in certain other circumstances. Typical examples of where floods of this magnitude are used to inform floodplain risk management actions include emergency management and response activities, and siting of critical infrastructure (e.g. hospitals).

The PMF extent is shown in Figure 1-1. As with the FPA, consideration has been given to the magnitude and severity of local flow conditions in mapping the adopted PMF extent. A similar filtering process has been adopted as for the FPA, albeit with a higher threshold of 0.3m for inundation depth.





Title:  
**Manly Lagoon Flood Study - Flood Planning Area and PMF Extent**

Figure:  
**1-1**

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**A**

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Approx. Scale



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## 2 REFERENCES

BMT WBM (2013). *Manly Lagoon Flood Study*. Prepared for Warringah Council and Manly Council, NSW.

Manly Hydraulics Laboratory (1992). *Manly Lagoon Flood Study Report MHL603*. Public Works Department NSW. Prepared for Warringah Council and Manly Council. NSW.

NSW Department of Infrastructure, Planning and Natural Resources (DIPNR) (2005) *Floodplain Development Manual*.



# **(Draft) Interim Policy – Flood Prone Land 2013**

Administrative Guidelines for Development and Use of Land within the Flood Planning Level (FPL) Area

Manly Council

File No: MC/13/96673

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## A1 General Aims and Objectives of the Interim Policy

### **1.1 Replacement of the Former Interim Policy**

- 1.1.1 This Interim Policy consolidates relevant provisions from the former adopted policy '*Interim Policy and Administrative Guidelines for Development and Use of Land Affected by a 1 in 100 year Flood – Manly Lagoon (Appendix A: Manly Lagoon Floodplain Management Study 1996)*'. (File No: MC/13/9427)
- 1.1.2 This Interim Policy replaces and updates the former Interim Policy for consistency with the Adoption of the Manly Lagoon Flood Study 2013. The structure and numbering of the former Interim Policy has been preserved in this Interim Policy. Updated from the Interim Policy 1996, are shown in **bold text**. This formatting should be retained.
- 1.1.3 This Interim Policy in particular is intended to provide interim continuing guidance in the development and use of land within the updated Flood Planning Level Area, as defined by the Council Manly Lagoon Flood Study 2013, prior to Council's development of updated Floodplain Risk Management Studies, Plans, and Development Controls.



## 1.2 General Aims and Objectives

- 1.2.1 To alert the community **in the Flood Planning Level Area** of the extent and hazard of the 1 in 100 year event.
- 1.2.2 To inform the community of Council's **Interim Policy** in relation to the development and use of land within the **Flood Planning Level Area**.
- 1.2.3 To encourage occupation, development, and construction, that is compatible with the flood hazard.
- 1.2.4 To reduce the risks and costs of flooding to existing areas.
- 1.2.5 To inform the community of flood warning and evacuation procedures.
- 1.2.6 To ensure, whenever possible, that buildings and services required for evacuation and emergency needs are sited above known flood levels.
- 1.2.7 To provide directions and guidelines relating to development of flood affected land.

This is in accordance with guidelines and requirements given by the Department of Planning and Infrastructure, the Department of Public Works, the Local Government Act 1993, and the Environmental Planning and Assessment Act 1979.



## A2 Interim Policy Statement

2.1 Manly Council and the community will continue to develop **Floodplain Risk Management Studies and Plans** for the **Flood Planning Level Area**.

2.2 The **Flood Planning Level** is defined in Council's **Manly Lagoon Flood Study 2013**, as the combination of a design flood level (1 in 100 year flood), and a freeboard (0.5 metres). A 1 in 100 year event has a 1% probability of occurring in each and every year. The **Manly Lagoon Flood Study 2013** addresses both mainstream and overland flooding.

2.3 The planning, building and development controls, contained in this **Interim Policy**, are related to the **adopted Flood Planning Level**.

2.4 Appropriate development controls to minimize the potential for flood losses are introduced through adoption and application of this **Interim Policy**. The **Interim Policy** will enable development decisions to be consistent and direction until such time as **Council's development and/or implementation of updated Floodplain Risk Management Studies, Plans, and Development Controls**.

2.5 Subdivision, rezoning, development, and applications will be assessed on their merits and in accordance with the NSW Floodplain Development Manual and the **Interim Policy**.

2.6 The flood levels for a 1% flood, **relevant Flood Planning Level, and Flood Planning Level Area, are defined in The Manly Lagoon Flood Study 2013**.

Council will make available upon request, information with regard to the possibility of flooding, indicated in **The Manly Lagoon Flood Study 2013**, whether or not specific controls are imposed on the subject application.

2.7 A freeboard height of 0.5 metres has been adopted. Appropriate **Flood Planning Levels** are determined through application of the 'Assessment Procedures' given in the **Interim Policy**.

2.8 Manly Council will inform applicants that specific building and development controls may apply and that applicants may be required to furnish additional survey information at their expense.



## A2.1 Applicable Land

**The Interim Policy applies to development and use of land within the updated Flood Planning Level Area, as defined by the Manly Lagoon Flood Study 2013.**

## A2.2 Definitions

As defined in the NSW Floodplain Development Manual **2005**.

**Flood Planning Level: is the combination of design flood level, and a freeboard. The Flood Planning Level, design flood levels, and freeboard, are defined in the Council's Manly Lagoon Flood Study 2013. The Flood Planning Level supersedes the 'standard flood event' concept in the 1986 Manual and the former 'Interim Policy'.**

**Freeboard: the factor of safety usually expressed as a height above the standard flood. The freeboard provides reasonable certainty that the risk exposure selected in deciding on a particular flood chosen as the basis for the Flood Planning Level is actually provided. Freeboard is included in the Flood Planning Level.**



### A3 Interim Administrative Guidelines

These guidelines apply to the assessment of development and applications for those properties within the area specified in the 'Applicable Land' category. The guidelines are to be read in conjunction with the **Interim Policy**.

#### A3.1 Assessment Procedures

##### a) General (Advice to Applicants before Application)

#### **Council has adopted the Flood Planning Level in the Manly Lagoon Flood Study 2013.**

Council recommends that the design of structures incorporate pier/pile footings, in lieu of the use of enclosed structures or land filling. This is to minimize loss of flood storage and to minimize impacts of surface water flow.

Whilst all applicants will be considered on their relative merits, for major re-development proposals which extend the life of a structure and increase the number of occupants in the floodplain, there may be a requirement to raise the existing floor level/s to the **Flood Planning Level**.

##### b) Major and Minor Development

The following information may be required prior to consideration of a development application within the 'Applicable Land' category:

The applicant is to provide a plan of the site showing existing ground levels, existing and proposed floor levels, and any other relevant information Council considers necessary. All levels are to be specified relative to Australian Height Datum (AHD) and are to be provided by a Registered Surveyor at the applicant's expense.

##### c) Advice to Applicant

The following advice is to be included with all consents and approvals within the **Applicable Land**:

The property is in an area where there is likely to be a risk of flooding from a 1 in 100 year flood. It should be noted that this is not the **probable maximum flood (PMF)**. The **minimum floor level should be set at or above the Flood Planning Level. This incorporates the 1 in 100 year flood**, and a freeboard safety of 0.5 metres, **derived from information contained in the Manly Lagoon Flood Study 2013.**

Council strongly recommends that if not specified in the conditions of approval, effective precautions be taken at least to the **Flood Planning Level**, to reduce any potential risk to personal safety and to minimize any property damage to the structure, its fixtures and contents. These precautions may include: raising of floor levels; provision of levees, barriers or waterproofing of the structure to prevent ingress of floor waters; use of flood compatible building materials; relocation of wiring, fuel supply lines and storage of hazardous materials, plant equipment, stock and other items that are susceptible to water damage, above the



specified level. It should be noted that flood waters may rise rapidly with little warning, inhibiting evacuation of and emergency access to the site.

d) Major or Minor Developments – Definitions and Conditions

Development proposals are to be categorized as major or minor in accordance with the following definitions and conditions:

i) Minor Development

DEFINITION: Minor development includes ancillary structures such as garden sheds, swimming pools, carports, fences, pergolas, awnings, verandahs, porches, or minor once-off additions/conversions of 30m<sup>2</sup> or less.

The following conditions(s) or requirement(s) may be applied to minor development:

12R Storage of any hazardous material, items of plant, equipment of stock and any other item which may be susceptible to water damage shall be located above the **Flood Planning Level**.

All new construction and services shall be designed and constructed to withstand flooding up to a minimum level of the **Flood Planning Level**. This shall be in accordance with the requirements specified in the NSW Floodplain Development Manual. The class of construction, methods and materials are to be approved by Council prior to construction. Buoyancy, flowing water with debris, wave action, the flood compatibility of materials, and waterproofing shall be addressed in accordance with the Manual.

ii) Major Development

DEFINITION: Major development includes, inter alia, new dwellings including garages, commercial and industrial development, subdivisions, and where proposed alterations and additions involving habitable rooms (other than where it is a minor development) or any redevelopment which extends the life of the building.

One or more of the following conditions may be applied to major development, unless it can be otherwise demonstrated to Council's satisfaction, that such conditions are not appropriate:

9R The minimum furnished floor levels shall be **at or above the Flood Planning Level**.

11R All electrical equipment, wiring, and fuel lines shall be watertight below **the Flood Planning Level** and shall be certified upon completion by a Licensed Electrical Contractor.

12R Storage of any hazardous material, items of plant, equipment of stock and any other item which may be susceptible to water damage shall be located above the **Flood Planning Level**.

13R Sewerage system to be constructed to prevent surcharge of sewerage during times of flooding up to the **Flood Planning Level** and shall be certified upon completion by a Licensed Plumber and Drainer.



All new construction and services shall be designed and constructed to withstand flooding up to a minimum level of the **Flood Planning Level**. This shall be in accordance with the requirements specified in the NSW Floodplain Development Manual. The class of construction, methods and materials are to be approved by Council prior to construction. Buoyancy, flowing water with debris, wave action, the flood compatibility of materials, and waterproofing shall be addressed in accordance with the Manual.

9U The requirements of conditions(s) shall be supervised during the works by a registered surveyor who shall certify compliance to Council's satisfaction prior to occupation or to the issue of a certificate of classification.

e) Special requirements

The following requirements may be applied where the requirements in c) and d) above are deemed inappropriate, eg, certain changes to existing use rights or strata subdivision of existing buildings:

1. The application is to demonstrate that the floor levels of the premises which may be affected by flooding, shall only be used for such purposes which could withstand periodic inundation up to the **Flood Planning Level**. In addition, the plan should show usage of the building.
2. Council may require the premises to be made watertight up to the **Flood Planning Level**, and the provision of a safe method of exiting from the ground floor of the premises, without disrupting the watertight seal, shall be provided.
3. The applicant shall be required to furnish advice from a suitably qualified engineering consultant, showing that the proposed structure is capable of withstanding the effect of inundation to the **Flood Planning Level**.
4. 'Flood Awareness' signs shall be provided and maintained in perpetuity, to Council's satisfaction and shall be adequately visible to occupiers of the development.

Where a significant development in the catchment is proposed which may adversely affect the nature of flooding for surrounding areas, the applicant shall be required to furnish advice from a suitably qualified engineering consultant showing the flood impacts of the proposed development on surrounding areas.



f) Assessment Procedures

The following Assessment Procedure should be used as a guide in the assessment of development applications in flood prone areas. It should be emphasized that all applications are considered on their merits.

**Flood Planning Levels** for areas identified in the 'Applicable Land' category of the **Interim Policy**, shall be provided by the **Manly Lagoon Flood Study 2013**.

In the majority of cases, habitable floor levels will be required to conform with **(be situated at or above)** the **Flood Planning Level** calculated for that site. This may also include raising the existing ground floor levels, where first floor additions are proposed.

Where the existing floor level of a dwelling involved in an application for additions/alterations is below the **Flood Planning Level**, Council shall have regard to the following factors:

1. The existing and proposed ground and floor levels of the site
2. Information on predicted **Flood Planning Level** as **provided in the Manly Lagoon Flood Study 2013**
3. Whether or not the addition constitutes major or minor development, and/or habitable or non-habitable rooms.
4. The type of land use or development proposed, i.e. rezoning, commercial, residential building or residential additions or alterations.
5. To determine floor levels for residential buildings:
  - Where proposed additions do not include any works to the existing structure, e.g. a family room, or kitchen extension at the back of side of a house, a floor level condition may be applied to the addition only.
  - For additions/alterations which include works to the existing structure, eg new roofing, brick veneering, replacement of external walls, windows etc, a floor level condition may be applied to the whole structure (ie existing structure plus proposed additions).

If applications do not clearly fall within either of the above categories, an overall assessment is to be made of whether it is reasonable to condition only the extension/addition or the whole structure.

6. For commercial/industrial buildings:
  - Given the insurance opportunities for commercial properties and owner's ability to absorb stock losses, minimum floor level requirements may be relaxed for additions/alterations to commercial and industrial buildings.
7. The proposed method of achieving the minimum floor level requirement, i.e. piling or filling.



**Classification of Public Exhibition Written Submissions**  
**- Manly Local Government Area**

Submission #	Property Suburb	Property Flooding Extent Identified	Property Local Flooding Mechanism	Submission Issue Reference			
				1	2	3	4
1	BALGOWLAH	FPL	Mainstream Flooding	X			
2	MANLY	FPL	Mainstream Flooding			X	
3	MANLY	FPL	Mainstream Flooding			X	
4	MANLY	FPL	Mainstream Flooding			X	
5	FAIRLIGHT	FPL	Mainstream Flooding				X
6	BALGOWLAH	FPL	Mainstream Flooding		X		
7	SEAFORTH	FPL	Mainstream Flooding		X		
8	MANLY	FPL	Mainstream Flooding		X		
9	MANLY	FPL	Mainstream Flooding			X	
10	MANLY	FPL	Mainstream Flooding			X	
11	MANLY	FPL	Overland Flooding		X		
12	MANLY	FPL	Overland Flooding		X		
13	MANLY	FPL	Overland Flooding		X		
14	MANLY	FPL	Overland Flooding		X		
15	SEAFORTH	FPL	Overland Flooding		X		
16	SEAFORTH	FPL	Overland Flooding		X		
17	MANLY	FPL	Overland Flooding	X			
18	MANLY	FPL	Overland Flooding		X		
19	MANLY	PMF	Mainstream Flooding				X
20	MANLY	PMF	Mainstream Flooding				X

**Submission Issue Reference**

- 1 Representation of Local Conditions in Underlying Data
- 2 Mapping representation of overland flow pathways
- 3 Mapping representation of mainstream boundary conditions
- 4 Extreme Events - PMF / Climate Change