# 6. FLOOD EMERGENCY RESPONSE ARRANGEMENTS

Emergency response measures are an effective means of reducing the costs of flooding and managing the continuing and residual risks in an area. Current emergency response arrangements for the Manly Lagoon catchment are discussed below.

## 6.1. Emergency Response Planning Documentation

Manly Lagoon catchment is covered by the 2011 Manly Warringah Pittwater Local Disaster Plan (DISPLAN). The plan covers and details arrangements for the prevention, preparation, response and recovery from emergencies within the area. It identifies Mona Vale Road as the primary access route to be maintained during an emergency. Other major arterial roads (located within the Manly Lagoon catchment area) include:

- Warringah Road;
- Pittwater Road;
- Condamine Street;
- Burnt Bridge Creek Deviation;
- Wakehurst Parkway (which is noted to often close due to flooding);
- Sydney Road; and
- Manly Road.

Flooding as a result of Manly Dam is recorded to be a major, but remote likelihood threat; coastal inundation a moderate and possible likelihood threat, and severe storms/floods, a major and high likelihood threat.

The DISPLAN identifies the roles and responsibilities of the relevant agencies for each identified hazard (for flooding this is Council and the SES). Three high level mitigation strategies are listed:

- Regulate property development and construction through Local Environment Plans and Development Control Plans;
- Prepare Storm and Tempest Sub Plans; and
- Develop public education programs.

There is currently no Local Flood Plan for the area, although this is currently being drafted by the NSW SES.

## 6.2. Northern Beaches Flood Warning System

The Northern Beaches Flood Warning System is a joint venture between Northern Beaches Council (formerly, Pittwater, Warringah and Manly Councils), with support from the Bureau of Meteorology (BoM) and the Office of Environment and Heritage (OEH).

The aim is to provide a basic flash flood warning system to the community, through live publishing of rainfall and water level gauges. As part of the project, additional gauges have been installed across the area. The information is provided on a public website (*http://www.mhl.nsw.gov.au/users/NBFloodWarning/).*

As well as publishing live and historical gauge information the website provides some emergency planning information. Current advice is to watch out for 70mm rainfall in 3 hours and/or 150mm rainfall in 24 hours and states that "*when flash flooding is likely, leave low-lying homes and businesses well before any flooding begins. Evacuation is the best action to take, but only if it is safe to do so".*

The warning system provides a wealth of data, although it is not specifically tied to consequences for properties or specific locations. Without this link, the warning system becomes a data display too rather than a risk management tool.

Improving the system is not simply a matter of creating these links, or identifying key thresholds. Flood liability in the Manly Lagoon floodplain varies across the catchment and results from various mechanisms. This means that each area of flood liability may have a different metric that needs to be used to set threshold values. Further, given the limited catchment size and its fast response rate, the question remains as to what is to be done in times of flooding for those properties at risk. The current system provides advice that evacuation should occur whenever flash flooding is deemed likely. However, without the link to consequences of heavy rain, very few people are likely to self-evacuate given the system's criteria for them doing so (rainfall depths over specific periods of time). Furthermore, whilst evacuation is generally the preferred option, it may not be achievable and encouraging people to be in a vehicle during a flood is not recommended (discussed further in Section 6.4).

As such, it is recommended that this system is integrated with SES and Council activities such as road closures and evacuations. This would be best achieved through the implementation of a local SES flood plan.

## 6.3. Flood Emergency Response Classifications

The Floodplain Development Manual (Reference 2) requires flood studies to address the management of continuing flood risk to both existing and future development areas. As continuing flood risk varies across the floodplain so does the type and scale of the emergency response problem and therefore the information necessary for effective Emergency Response Planning (ERP). Classification provides an indication of the vulnerability of the community in flood emergency response and identifies the type and scale of information needed by the State Emergency Services (SES) to assist in ERP.

Criteria for determining flood ERP classifications and an indication of the emergency response required for these classifications are provided in the Floodplain Risk Management Guideline, 2007 (Flood Emergency Response Planning: Classification of Communities). Reference 2

summarises the response required for areas of different classification. However, these may vary depending on local flood characteristics and resultant flood behaviour, i.e. in flash flooding or overland flood areas.

Table 5: Response Required for Different Flood ERP Classifications

| Classification | Response Required | | |
|---|---|---|---|
| | Resupply | Rescue/Medivac | Evacuation |
| High Flood Island | Yes | Possibly | Possibly |
| Low Flood Island | No | Yes | Yes |
| Area with Rising Road Access | No | Possibly | Yes |
| Area with Overland Escape Routes | No | Possibly | Yes |
| Low Trapped Perimeter | No | Yes | Yes |
| High Trapped Perimeter | Yes | Possibly | Possibly |
| Indirectly Affected Areas | Possibly | Possibly | Possibly |

The ERP classifications for regions within the hydraulic model extent have been defined for the 1% AEP and PMF flood events, shown in Figure 26 and Figure 27. The classification has been undertaken on a precinct basis rather than lot-by-lot and is targeted at those areas which may require evacuation or assistance during a flood event. These are described in Table 6 below.

Table 6: ERP Categorisation for Hotspot Locations PMF event

| Area* | Emergency Response Planning Categorisation |
|---|---|
| Hotspot A – Kenneth Rd & Balgowlah Rd | Low Flood Island |
| Hotspot B - Balgowlah | Low Trapped Perimeter and Low Flood Island |
| Hotspot C – Manly Lagoon North Bank | Low Flood Island |
| Hotspot D - Brookvale | Rising Road Access |

* refer Figure 8 for Hotspot locations

## 6.4. Access and Movement during Flood Events

Any flood response measure suggested as part of this study must take into account the availability of flood free access, and the ease with which movement may be accomplished. As part of the current study, a review of the access roads and evacuation arrangements has been undertaken and is discussed in the following sections.

### 6.4.1. Access Road Flooding

The details of flood affectation of 20 access roads across the catchment area are provided below, and shown in Figure 28.

Table 7: Flood Affected Road Locations

| ID | Road Location |
|---|---|
| **1** | Pittwater Bridge |
| **2** | Intersection Kenneth and Balgowlah Road |
| **3** | Intersection Balgowlah Road and Golf Parade |
| **4** | M8 at Brookvale Creek |
| **5** | Intersection Kenneth and Roseberry Road |
| **6** | Pittwater Road at Riverview Parade |
| **7** | William Street |
| **8** | Intersection Condamine Street and M8 |
| **9** | M8 at Kitchener Street |
| **10** | Kenneth Road next to swimming pool |
| **11** | Clearview Place |
| **12** | Old Pittwater Road Bridge |
| **13** | Cross Street at Warringah Mall |
| **14** | Intersection Cross and Green Street |
| **15** | M8 at Manly Creek |
| **16** | Sloane Crescent |
| **17** | Warringah Road |
| **18** | Intersection Condamine Street and Balgowlah Road |
| **19** | Intersection Burnt Bridge Creek Deviation and Sydney Road |
| **20** | Wakehurst Parkway near Warringah Aquatic Centre |

* refer Figure 28 for road locations

Table 8: Inundation of Access Road

| Location | Road Level (mAHD) | First Event Flooded (AEP) | Peak Velocity 1% AEP (m/s) | Rate Of Rise 1% AEP (cm/min) | Time Of Inundation 1% AEP (hour) | Peak Flood Depth (mAHD) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 20% AEP | 5% AEP | 2% AEP | 1% AEP |
| **1** | 2.08 | 20% | 0.73 | 1.32 | 4.67 | 0.29 | 0.58 | 0.73 | 0.87 |
| **2** | 2.05 | 50% | 0.72 | 1.09 | 5.16 | 0.41 | 0.70 | 0.84 | 0.97 |
| **3** | 2.05 | 50% | 0.49 | 1.37 | 6.43 | 0.72 | 1.00 | 1.15 | 1.27 |
| **4** | 8.37 | 50% | 1.75 | 1.89 | 1.10 | 0.22 | 0.36 | 0.43 | 0.49 |
| **5** | 6.26 | 50% | 0.23 | 2.54 | 1.80 | 0.50 | 0.78 | 0.87 | 0.94 |
| **6** | 2.00 | 50% | 0.43 | 1.52 | 4.33 | 0.49 | 0.76 | 0.91 | 1.03 |
| **7** | 9.62 | 50% | 0.75 | 1.63 | 3.23 | 0.75 | 0.88 | 0.97 | 1.03 |
| **8** | 10.22 | 20% | 1.39 | 11.16 | 0.87 | 0.22 | 0.82 | 0.88 | 0.87 |
| **9** | 25.60 | 20% | 3.48 | 2.09 | 0.40 | 0.12 | 0.26 | 0.37 | 0.39 |
| **10** | 2.30 | 50% | 0.40 | 0.92 | 2.83 | 0.31 | 0.41 | 0.55 | 0.68 |
| **11** | 17.92 | 50% | 2.26 | 3.86 | 0.64 | 0.27 | 0.50 | 0.64 | 0.79 |
| **12** | 14.18 | 50% | 1.60 | 5.55 | 0.37 | 0.19 | 0.30 | 0.38 | 0.43 |
| **13** | 11.57 | 2% | 1.99 | Shallow | Shallow | 0.00 | 0.00 | 0.14 | 0.16 |
| **14** | 9.18 | 50% | 0.41 | 3.71 | 1.87 | 0.66 | 0.94 | 1.10 | 1.25 |
| **15** | 5.1 | 5% | 0.40 | Shallow | Shallow | 0.00 | 0.05 | 0.06 | 0.06 |
| **16** | 7.52 | 5% | 2.83 | Shallow | Shallow | 0.00 | 0.05 | 0.12 | 0.16 |
| **17** | *Flood free* | | | | | | | | |
| **18** | *Flood free* | | | | | | | | |
| **19** | *Flood free* | | | | | | | | |
| **20** | *Flood free* | | | | | | | | |

### 6.4.2. Evacuation Planning

During a flood which triggers evacuation, locations will need to be identified which are safe and able to accommodate the affected individuals. Details of evacuation centres are not provided in the DISPLAN. Due to the short warning time and relatively short durations of flooding, formal evacuation is unlikely to be possible for most residents. The Emergency Response Classification (see Section 6.3) identified that rising road access routes, or overland escape routes, are available for the majority of the residents, however it did identify two residential and one commercial area of concern – these have been as classed Low Flood Islands. For these properties, there are no flood free access routes and land and building inundation occurs. As formal evacuation is unlikely to be able to occur in time, sheltering in place (remaining in situ) becomes the most likely default scenario.

In order to safely shelter in place, residents would need to be able to promptly access a building which has some floor area above the PMF. A review of the floor level information for residential properties in the areas identified as Low Flood Islands has been undertaken. For the area between Riverview Parade and Pittwater Road (121 properties), there were no public buildings. There are also no private buildings with floor levels above the PMF. Four properties had floor

levels higher than the 1% AEP level (but lower than the PMF), however all four had ground inundation from the 2y ARI event.

For the area on the southern side of the lagoon, around Eurobin Avenue (65 properties), seven properties had floor levels above the 0.1% flood (but less than the PMF). Ground levels for these properties were first inundated from events ranging between the 2y ARI to the 2% AEP. There were another eight properties with floor levels above the 1% AEP level, again with ground levels inundated from events varying between the 2y ARI and 2% AEP event. Sheltering-in-place may be possible for floods up to approximately the 1% AEP level. This does, however, assume that neighbours with raised floor levels would be willing to act as shelters for others in their community, and that access between properties was possible.

The other issue is whether buildings are able to withstand the forces of floodwater, buoyancy and debris in large events, and remain safe for the entire duration of a flood. It is beyond the scope of this study to assess this on a building by building basis. In general however, light-framed weatherboard or timber dwellings sitting on stumps are at greater risk of being removed from their foundations, and brick, two-storey dwellings would generally be preferred as local refuges.

Isolation is another consideration. The tolerability of isolation reduces as the duration of flooding increases. In the modelled 1% AEP event affected residents would generally be isolated for no more than 6 hours. Whilst this is not ideal, and may be uncomfortable for residents, it is a tolerable duration of time to remain in situ.