The Flood Planning Area (FPA) and Overland Flow: Why “stretching” won’t work (and what to do instead)

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Planning frameworks often require the consent authority to identify land subject to flood-related development controls. In New South Wales, most Local Environment Plans (LEPs) identify such land within a Flood Planning Area (FPA), or below the Flood Planning Level (FPL). In the model clause for the standard LEP, the FPL is defined as the 1% AEP flood level plus 0.5 m freeboard.

Automated procedures exist for adding 0.5 m freeboard to modelled design flood levels, then “stretching” this surface to identify additional land that is above the estimated flood level, but below the FPL. However there are several circumstances where these approaches do not work. In particular, in steeper areas of overland flow, the land adjacent to the flow path does not rise more than 0.5 m above the flow surface. Adding 0.5 m and stretching leads to erroneous identification of areas that are not flood prone, even in the PMF. The primary goal of this “tagging” process to identify flood prone land should be to determine which lots are at risk of significant overland flow from upstream area, so that those flows can be managed and development can mitigate against damage. The process should not seek to manage intra-lot drainage and minor overland flows from neighbouring properties that can be managed relatively easily without Council intervention.

What doesn’t work:

**Stretched won’t work, regardless of whether you add 0.5m freeboard, 0.3m freeboard or even no freeboard at all**

Various GIS tools are available to add a freeboard to the flood surface, then “stretch” this surface over the adjacent terrain. These tools work well for mainstream flood behaviour on larger rivers and creeks, but simply do not work in steeper areas of overland flow. There is often a desire to use these automated methods as a starting point, so as to be seen to be complying with the wording of the LEP, then to apply limits on the “stretching” to minimise the above problems and produce reasonable outcomes. However applying such limits generally requires arbitrary modification of the result, using capricious methodology to leads to outcomes that are inconsistent, irreplicable or indefensible when challenged.

**Figure 2** – Result from adding 0.5 m freeboard to the water surface and stretching

**Figure 3** – Result from stretching with no freeboard added to the water surface

**Suggested alternative:**

Various GIS tools are available to add a freeboard to the flood surface, then “stretch” this surface over the adjacent terrain. These tools work well for mainstream flood behaviour on larger rivers and creeks, but simply do not work in steeper areas of overland flow. There is often a desire to use these automated methods as a starting point, so as to be seen to be complying with the wording of the LEP, then to apply limits on the “stretching” to minimise the above problems and produce reasonable outcomes. However applying such limits generally requires arbitrary modification of the result, using capricious methodology to leads to outcomes that are inconsistent, irreplicable or indefensible when challenged.

**Figure 2** shows the result from adding 0.5 m to the water level in Figure 1, then attempting to stretch that surface across the surrounding terrain using WaterRIDE. The result is nonsense, not because of any problem with the software or the stretching algorithm, but because of the nature of the topography and overland flow characteristics. The ground falls away steeply from the gutter that contains flow in the upper part of the catchment. Adding a small amount of freeboard to the water surface results in a level that exceeds the gutter, and stretches unbounded across the entire catchment. Even if a lower amount is added to the surface (e.g. 0.3 m, or no addition at all), the same problem exists. Figure 3 shows the result from simply stretching the water level grid, with no freeboard. The surface stretches along the contour lines parallel to the weir cells in the model, creating a tiered effect.

**Figure 5** – “Tagged” flood control lots prepared using the recommended methodology below. Lots were identified using 1% AEP results including sensitivity assessment and ground truthing. The blue shading is the 1% AEP flood extent. The red areas are the tagged cadastral “flood control” lots.

**Figure 4** – PMF flow scenario, which produces more overland flow breakouts from the gutters than the 1% AEP scenario.

**Table 1**

<table>
<thead>
<tr>
<th>Tag Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tag Inferred</td>
<td>Tag initially inferred to be flood prone within a property, ground truthing indicated that the assumption was incorrect. Tag removed.</td>
</tr>
<tr>
<td>Tag Added</td>
<td>Tag initially inferred to be flood prone, ground truthing confirmed that the flow was present within the property boundary.</td>
</tr>
<tr>
<td>Tag Removed</td>
<td>Tag initially inferred to be flood prone, ground truthing indicated that the flow was not present within the property boundary.</td>
</tr>
<tr>
<td>Tag Not Tagged</td>
<td>Tag initially inferred to be flood prone, ground truthing indicated that the flow was not present within the property boundary.</td>
</tr>
</tbody>
</table>

**Ground Truthing:**

Some potentially flooded lots may not identified from the automated GIS Analysis process, due to the approximations required to construct the computational model of the catchment (such as blocking out buildings or insufficient resolution of local overland flow paths), and due to the sensitivities of GIS processing. Furthermore, some lots may be initially identified as flood control lots, which in reality are unlikely to be subject to significant flooding. Ground truthing was undertaken first through desktop analysis, and then a site visit for properties requiring detailed investigation. The outcomes of this process can be transparently documented by assigning ground truthing categories, such as those shown in the table to the right.