Of Doubts and Flooded Drains

The Artistry in Defining an Urban Overland Flowpath

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+ Allan Gear
Acknowledgement: The Hills Shire Council

Apology: Dorothea Mackellar
• The idea of a “local overland flowpath” infused into floodplain management debate in NSW in 2001

• Impetus for project: the regular amendments to planning certificate requirements since 2007, and

• Implementation of the regularly amended Codes SEPP since 2008

• Flood Control Lot – Land (in several landuse categories) where a flood related development control applies
• Problem initially: Where does a flood related development control apply?

• For THSC, the MECHANISMS which TRIGGERED a control were not just related to flood affectation

• Needed a new Flood Controlled Land DCP, rationalising triggers

• Needed GIS based mapping for process automation

• Problem compounded: Define, model and map overland flowpaths in urban areas
TECHNICAL INFORMATION

• DEM Cell Size – 2m
• Peak 100yr ARI discharges at each cell
• S.I.P where 100 yr peak = 0.9m3/s
  - 0.5m3/s overland
  - 0.4m3/s conveyed in pipes

and/or

• With topographic intensity (or terrain incision)
Next Step: Identify Flood Controlled Land to support DCP, CDC and Planning Certificates

gearisms
• Next Step: Identify Flood Controlled Land to support DCP, CDC and Planning Certificates

• Hierarchy of mapping
  - H-N extent provided by State Government
  - Growth Centres
  - FpRM Study and Plan adopted by THSC
  - Adopted Masterplans
  - Office of Water Stream Order Riparian Corridor – Buffers (1st order excluded)
  - Overland Flowpath Buffers

(associated with a 600mm pipe or greater)
Overland Flowpath

Buffers

(associated with pipes 600mm or greater)

Allowing Parcel Based Mapping
Exhibited 2013
DCP adopted March 2014
• New Project Stage
  - Refinement of Urban Overland Flowpaths
  - Reflect language in Codes SEPP and DCP
  - Flowpath one of five parameters to be understood, but is not well understood at all
  - How is it defined?

• Two dimensional hydraulic model
  Rainfall on grid, study area 68sq km
  Pipe systems included, buildings schematised
  Fences ignored, 4 metre grid size
- Mapping initiation points
  - Remove all depths less than 0.1m (noise)
  - First pass, rely on FDM description
  - Depths > 0.3m

<table>
<thead>
<tr>
<th>major drainage</th>
</tr>
</thead>
<tbody>
<tr>
<td>councils have discretion in determining whether urban drainage problems are associated with major or local drainage. For the purposes of this manual major drainage involves:</td>
</tr>
<tr>
<td>- the floodplains of original watercourses (which may now be piped, channelised or diverted), or sloping areas where overland flows develop along alternative paths once system capacity is exceeded; and/or</td>
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<tr>
<td>- water depths generally in excess of 0.3m (in the major system design storm as defined in the current version of Australian Rainfall and Runoff). These conditions may result in danger to personal safety and property damage to both premises and vehicles; and/or</td>
</tr>
<tr>
<td>- major overland flowpaths through developed areas outside of defined drainage reserves; and/or</td>
</tr>
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<td>- the potential to affect a number of buildings along the major flow path.</td>
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</tbody>
</table>
Depths > 0.3m only
Further criteria

- hazardous flow, risk to life
- \( D^*V > 0.4m^2/s \), ARR projects
- depth, kerb heights, BCA requirement
- velocity, FDM 2m/s, damage to structures
- equation of stability for small passenger vehicles
  \( D^*V > 0.3m^2/s \), limiting stillwater depth 0.3m, ARR

- can link to Council’s asset management strategy for prioritising urban flash flood reduction projects
- risk to life, risk to property, risk to infrastructure
• Adopted secondary criteria for flowpath definition

- **Boolean Relationship**
- if \( D > 0.17\text{m} \) and \( D^*V > 0.4\text{m}^2/\text{s} \)
  then area included as flowpath

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<table>
<thead>
<tr>
<th>DV (m/s)</th>
<th>Infants, small children: (H.M.≤25) and frail/older persons</th>
<th>Children*: (H.M.&gt;25 to 50)</th>
<th>Adults*: (H.M.&gt;50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Safe</td>
<td>Safe</td>
<td>Safe</td>
</tr>
<tr>
<td>0–0.4</td>
<td>Safe</td>
<td>Low-Hazard1</td>
<td>Low-Hazard1</td>
</tr>
<tr>
<td>0.4–0.6</td>
<td>Significant-Hazard: Dangerous to most</td>
<td>Moderate-Hazard: Dangerous to some1</td>
<td>Moderate-Hazard: Dangerous to some1</td>
</tr>
<tr>
<td>0.6–0.8</td>
<td>Extreme-Hazard: Dangerous to all</td>
<td>Significant-Hazard: Dangerous to all</td>
<td>Significant-Hazard: Dangerous to all</td>
</tr>
<tr>
<td>0.8–1.2</td>
<td>Extreme-Hazard: Dangerous to all</td>
<td>Extreme-Hazard: Dangerous to all</td>
<td>Extreme-Hazard: Dangerous to all</td>
</tr>
<tr>
<td>&gt; 1.2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Proposed DRAFT INTERIM criteria for stationary vehicle stability**

<table>
<thead>
<tr>
<th>Class of vehicle</th>
<th>Length (m)</th>
<th>Kerb Weight (kg)</th>
<th>Ground clearance (m)</th>
<th>Limiting still water depth(^1)</th>
<th>Limiting high velocity flow depth(^2)</th>
<th>Limiting velocity(^3)</th>
<th>Equation of stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small passenger</td>
<td>&lt; 4.3</td>
<td>&lt; 1250</td>
<td>&lt; 0.12</td>
<td>0.3</td>
<td>0.1</td>
<td>3.0</td>
<td>( DV \leq 0.3 )</td>
</tr>
<tr>
<td>Large passenger</td>
<td>&gt; 4.3</td>
<td>&gt; 1250</td>
<td>&gt; 0.12</td>
<td>0.4</td>
<td>0.15</td>
<td>3.0</td>
<td>( DV \leq 0.45 )</td>
</tr>
<tr>
<td>Large 4WD</td>
<td>&gt; 4.5</td>
<td>&gt; 2000</td>
<td>&gt; 0.22</td>
<td>0.5</td>
<td>0.2</td>
<td>3.0</td>
<td>( DV \leq 0.6 )</td>
</tr>
</tbody>
</table>

\(^1\) at velocity = 0 ms\(^{-1}\); \(^2\) at velocity = 3ms\(^{-1}\); \(^3\) at low depth
D > 0.3m and
if D > 0.17m and D*V > 0.4m²/s

BUT

Casual observer would query a lack of continuity in flowpath, so

Return all flows deeper than 0.1m
Not floodway, not flood storage

“Fringing Flow”
Next Steps: Mapping of Flood Controlled Land

- Nominal freeboard is 0.5m
- Use vertical offset provided by BCA
- Trial of freeboard 0.35m for Flood Planning Area
- Respect nominal building line setback – set 6m
• TAKE HOME MESSAGES

- This work is a landuse planning task, but provides traditional flood intelligence
- Begin with the vision in mind
- Understand the problem to be solved
- Use of advanced technology will help
- Listen to good ideas. Have good ideas!
- Consider the accrued benefits
- This work is a landuse planning task
- The art world is considering their position