How to Ensure Technical Consistency and Excellence Throughout a Multi-year Flood Study Program

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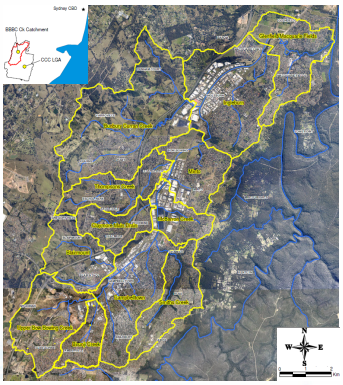
BBBC Creek Catchment Flood Study Areas

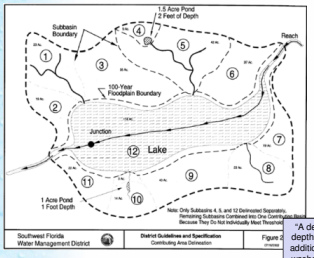
- Flood studies are being prepared for across the Bow Bowing / Bunbury Curran (BBBC) Creek catchment.
- BBBC Creek catchment was subdivided into 12 study areas.
- Discrepancies were identified between some flood studies.



The Importance of Technical Robustness & Consistency

- Preparing technically comprehensive, consistent and robust flood studies is important to ensure:
  - The studies stand the test of time;
  - Can be used in subsequent investigations;
  - Council can have confidence in the results;
- Technical guidance for flood study preparation in NSW is restricted to a handful of documents, e.g.,:
  - Floodplain Development Manual (2005);
  - OEH Guidelines;
  - Australian Rainfall & Runoff (1987);

Example Extract from SWFWMD/FEMA Guidelines



- Extracted from "*Southwest Florida Water Management District's Watershed Management Program Guidance for Digital Topographic Information, Watershed Evaluation and Watershed Management Plan*" (2002) .

"A depression that is 1 acre or greater in size and has an associated depth of 2-feet or more, shall have the contributing area delineated. In addition, local conveyance or collection systems (man-made channels, washes, etc.) that have a contributing area greater than or equal to 40 acres before discharging to a significant hydraulic control feature shall be broken out as a subbasin. Control features are defined as a depression area of 1 acre in size or greater with a capacity of 2-feet or more and structures such as bridges, culverts, dams, etc.). Local collection systems like driveway crossings and roadside swales, etc. are not to be inventoried. Multiple adjacent depressions, that are individually less than the one acre threshold but sum to or greater than the threshold volume, can be coalesced into one subbasin when deemed appropriate. Storage areas such as lakes, wetlands, ponds, and hydrated stormwater management storage areas (SMSAs) that are greater than or equal to five acres shall be broken out as a unique subbasin due to their uniform hydrology and their effect on direct runoff."

- 15 guidelines totalling 903 pages!!!

The Problem…

- NSW is comparatively huge.
- Not feasible for a technical document to be prepared for the whole of NSW.
- Therefore, differences can arise when different consultancies prepare a flood study.

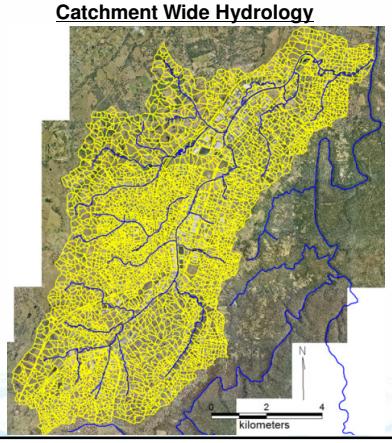
The Solution…?

- Increased opportunities for implementing detailed technical guidance over smaller geographic areas.
- Catchment wide investigations were commissioned aimed at ensuring consistency across all study areas.
- Investigations included:
  - Catchment-wide hydrology;
  - Stormwater inlet capacity calculations;
  - Hydraulic category definition;
  - Modelling of fences.

Catchment Wide Hydrology

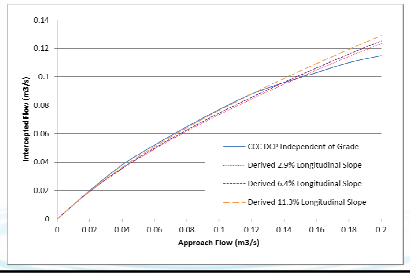
- Separate XP-RAFTS hydrologic models developed for the 12 flood study areas.
- > 4,000 subcatchments.
- > 90 flood storage basins.
- Parameterisation of model was completed in close consultation with Council.
- Simulation of all required design, sensitivity and climate change simulations.
- Council can distribute model results to consultants to use in future flood studies.

Catchment Wide Hydrology



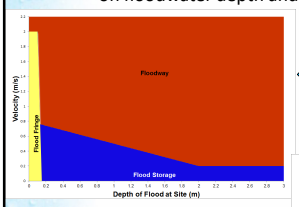
Stormwater Inlet Capacities

- Hydraulic models include complete stormwater system.
- Inlet capacity curves were prepared to define inflows to stormwater pits.
- ~90 inlet capacity curves developed.



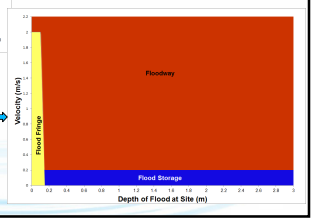
Hydraulic Categories

- Hydraulic category criteria were developed by Council based on floodwater depth and velocity as well as land use.



Adopted hydraulic categories for "drainage" areas

Adopted hydraulic categories for "urban" areas



Hydraulic Categories

- Criteria included within a custom TUFLOW dynamic link library (DLL).
- DLL can be distributed to flood study consultants and used to automatically apply Council's criteria.

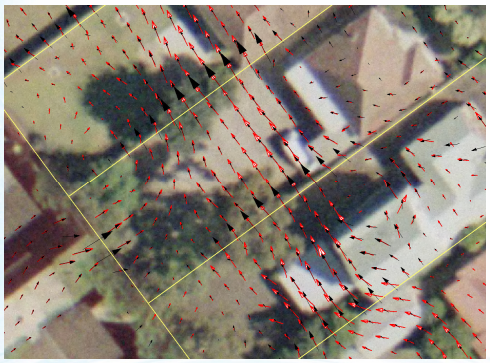
```
real Function Hazard_Z3 (v, d)  ! Z3 Originally based on Tweed River Flood Study. Updated to incorporate
                                ! custom hydraulic categories for 'drainage areas'. Criteria developed by
                                ! Campbelltown City Council.

!Z3 = 0 - dry (i.e., no hydraulic category)
!Z3 = 1 - Flood Fringe
!Z3 = 2 - Flood Storage
!Z3 = 3 - Floodway

!DEC$ ATTRIBUTES DLLEXPORT :: Hazard_Z3

real v, d
    Hazard_Z3 = 0  ! Initialise to Dry
    if (d.le.0.) then
        Hazard_Z3 = 0  ! Dry - no hydraulic category
    else if ((((abs(v)) + (40*d)).le.(6.0)).AND.((abs(v)).le.(2.0))) then
        Hazard_Z3 = 1  ! Flood Fringe
    else if ((abs(v).le.(-0.3*d+0.8)) .AND. (d.le.2.0)) then
        Hazard_Z3 = 2  ! Flood Storage
    else if ((abs(v)).le.(0.2) .AND. (d.ge.(2.0))) then
        Hazard_Z3 = 2  ! Flood Storage
    else
        Hazard_Z3 = 3  ! Floodway
    end if

End Function
```

Modelling of Fences

- Fences are abundant across BBBC Creek catchment.
- Fences included in all hydraulic models.
- A fence line layer was created based on commonly available GIS layers.
- Fences modelled as "flow constrictions" with a global fence height of 1.5 metres and a blockage factor of 75%.

Modelling of Fences

Modelling of Fences



Red velocity vectors = no fences Black velocity vectors = fences

Discussion

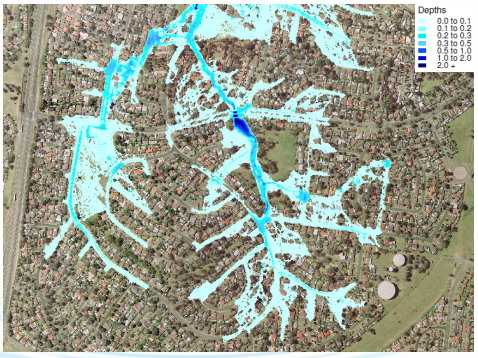
- Disadvantages:
  - Initial delays.
  - Additional up-front expenditure.
  - Lack of continuity.
  - Reduced opportunities for improved approaches to be applied in future.
  - Where do you 'draw the line'….?
- Advantages:
  - Consistency.
  - Improved confidence in results.
  - Cost and time savings over the long-term.

Conclusion

- Lack of definitive technical guidance can result in inconsistent approaches and results in flood studies.
- Campbelltown City Council completed a range of catchment-wide investigations aimed at reducing inconsistencies.
- Additional investigations provide Council with increased consistency and confidence in flood study results.

What Constitutes Flooding?

- Extent and depth of inundation at peak of the 100 year ARI flood (inclusive of all depths).



What Constitutes Flooding?

- Exact same event but with depths < 0.1 metres removed…

Questions?