

Review of Allans Creek Flood Study

Review of Fairy & Cabbage Tree Creeks Flood Study

Floodplain Management Committee Meeting

Leon Collins, Senior Engineer

17th April 2018



www.advisian.com

Advisian (Worley Parsons Group)



Who we are

- | | |
|--|--------------------------------------|
| → Advanced Analysis | → People and Organisation |
| → Business Case | → Power Specialist Services |
| → Concept Design and Project Feasibility | → PPP and Procurement Strategy |
| → Contracting Strategy Expert Witness and Dispute Resolution | → Production Asset Value Enhancement |
| → Decision and Risk Analysis | → Project Delivery Services |
| → Decommissioning and Restoration | → Safety Consulting |
| → Environment and Society | → Strategy |
| → Extensions | → Transaction Services |
| → Investment Options Analysis - StepWise | → Transport Specialist Services |
| → Operational Excellence | → Water Specialist Services |

Advisian – Water Resources

§ Modelling

- Hydrologic, hydraulic, estuarine process, dispersion, nutrients, water balance, scour, sediment transport

§ River Engineering

- Geomorphology, scour, stream rehabilitation & bank stabilisation

§ Estuaries

- Estuary process & management studies
- Effluent disposal, dredging & disposal, salinity (including climate change)

§ Hydraulic Structures

- Bridges, spillways, basins & small dams, trunk drainage

§ Water Resources

- Surface & groundwater, water balance (mines, urban, rural), environmental flows, yield, re-use

§ Water Sensitive Urban Design

- MUSIC nutrient modelling & concept design

§ Flooding

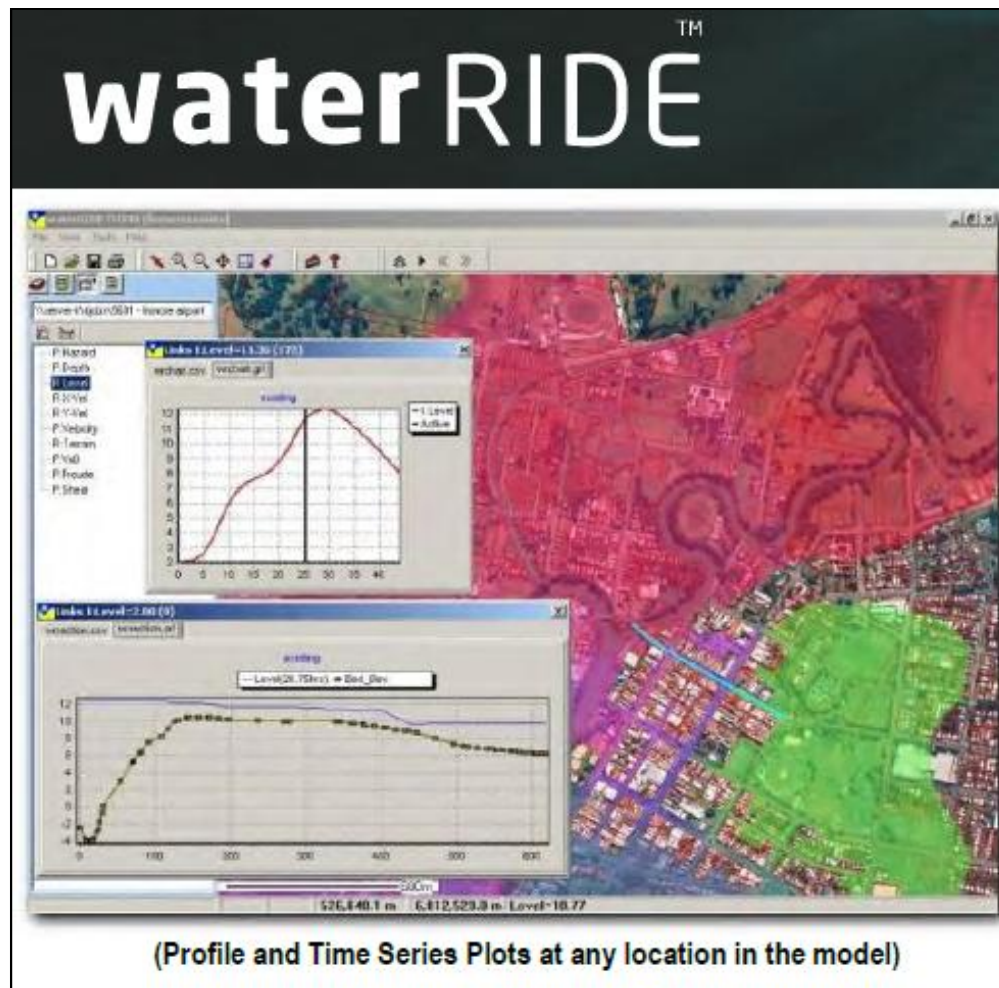
Creek Stabilisation



Concept & Detail Design

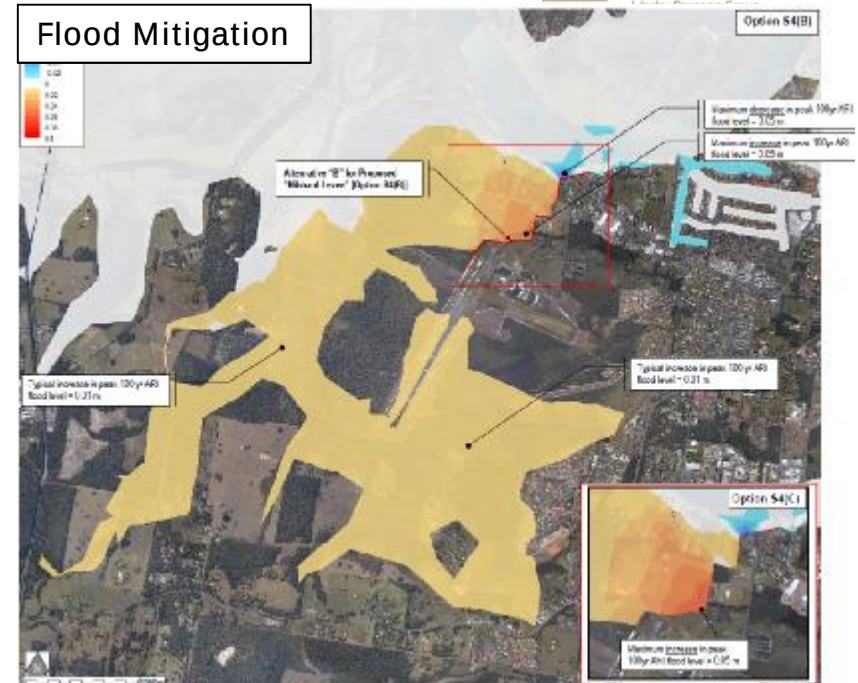


Advisian – Flooding

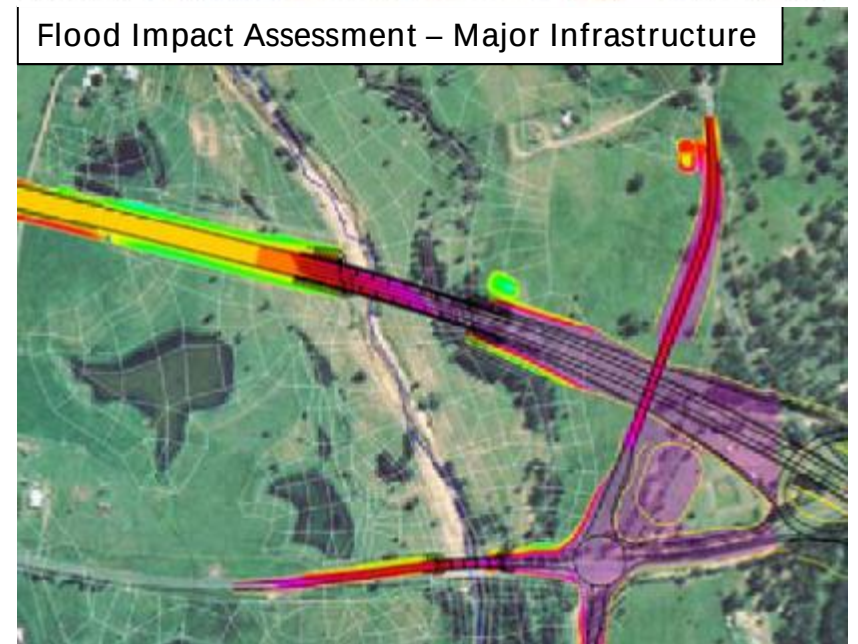


Advisian

Flood Mitigation



Flood Impact Assessment – Major Infrastructure



Advisian – Project Team

Project Director

Chris Thomas

Principal and Practice Lead, Water & Environment

Overview

- § Team manager / Principal for
- § Over 30 years' experience in environmental assessment and
- § Specialist in the fields of hydraulic stormwater management, environmental impact assessment and risk assessment.
- § Project Director and author responsible for the preparation of over 40 government funded Flood Studies and Floodplain Risk Management Studies for rivers and streams in NSW.

Qualification & Affiliations

- Bachelor of Engineering (Civil) (Hons), University of Newcastle
- Master of Engineering Science, University of New South Wales (candidate)
- Member, Engineers Australia, CPEng, NPER
- Member, Water Panel Sydney Division, Engineers Australia (current Chair)

Awards

- **Sternbeck Medalist 2010** for best paper and presentation at the 50th NSW Floodplain Management Authorities Conference, Gosford, February 2010

Additional Resources

10-15 years relevant experience

Warick Honour

Principal Engineer - Water Resources



Roy Golaszewski

Senior Engineer



modelling, management

hydraulic modelling, coastal processes for the preparation of

more than 10 government funded Flood Studies and Floodplain Risk Management Studies for rivers, streams & urban areas in NSW.

- § Hydrodynamic & dispersion modelling associated with effluent disposal, dredge design & disposal, river scour, lagoon breakout
- § Hydrometric data analysis, flood warning networks & predictive tools

Qualification & Affiliations

- Bachelor of Engineering (Civil) (Hons), University of Newcastle
- Bachelor of Engineering (Environmental) (Hons), University of Newcastle
- Member, Engineers Australia, MIEAust

Presentation Outline

Review of Allans Creek Flood Study

1. The Study Area
2. Background
3. Previous Study vs. Review
4. Hydrology: RAFTS vs. WBNM
5. Hydraulics: 1D vs. 2D
6. Progress Update
7. Next Steps

Review of Fairy & Cabbage Tree Creeks Flood Study

1. The Study Area
2. Background
3. Previous Study vs. Review
4. Progress Update
5. Next Steps

1. The Study Area



Catchment size

§ Allans Creek: 45 km²

§ Study area: 50 km²

Major tributaries

§ Byarong Creek

§ American Creek

Hydraulic controls

§ M1 Motorway

§ Princes Highway

§ Illawarra Railway

Historic floods

§ 17 August 1998

§ 23 October 1999

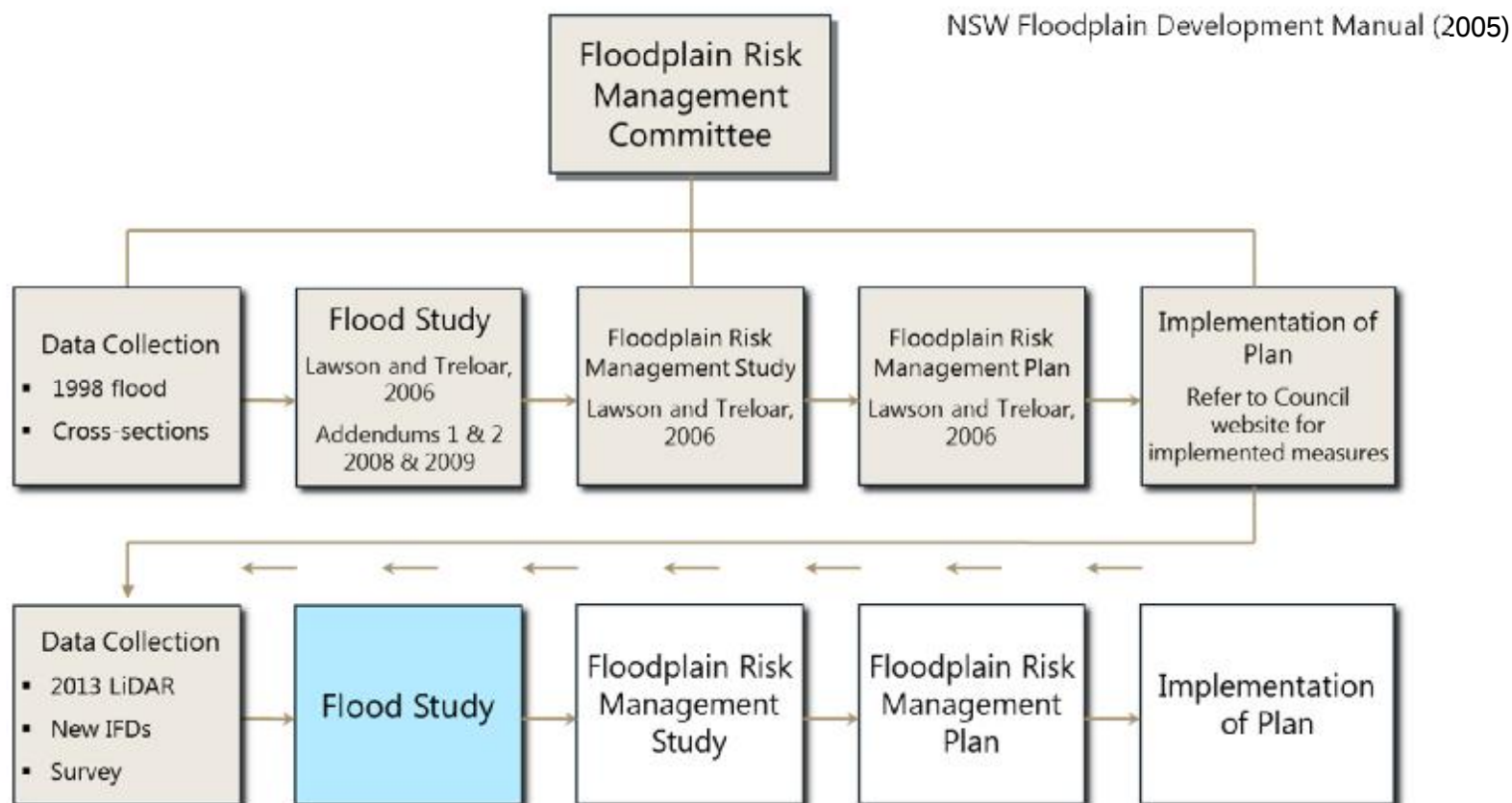
LEGEND

-  Allans Creek Catchment
-  Wollongong Catchment
-  Creeks / Watercourses
-  Major Roads
-  Railway
-  Cadastre

2. Background

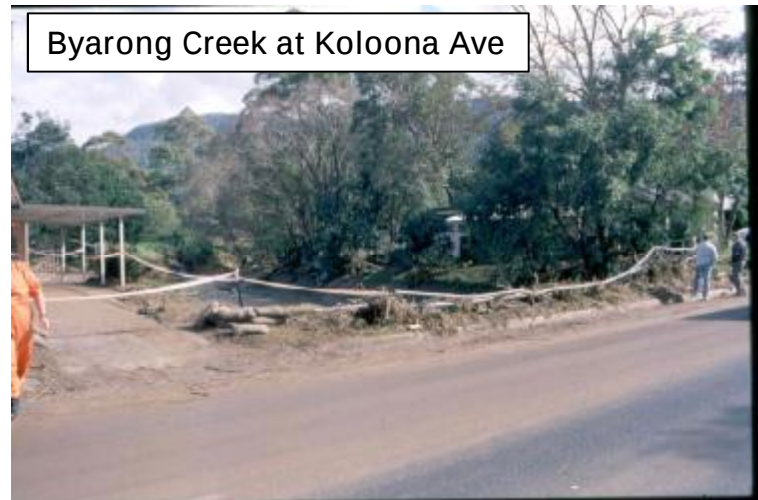
The Floodplain Risk Management Process

“A Flood Study is a comprehensive technical investigation of flood behaviour that defines the variation over time of flood levels, extent and velocity for flood events up to and including the PMF.”



2. Background

17 August 1998



23 October 1999



3. Comparison of Previous & Current Studies

Lawson and Treloar 2006/2008

Extent

Main tributaries to elevations of ~50mAHD

Hydrologic Model

XP-RAFTS, 93 sub-catchments

Hydraulic Model

MIKE-11 one-dimensional model

Topographic Data

Cross-sectional survey of channel & floodplain at 40 to 400m intervals

Design Rainfall

ARR 1987

Structural Blockages

WCC Blockage Policy, 2002

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Extent

Additional tributaries & overland flow paths

Extent of existing & future development (e.g. Mt Keira, Kembla Hts)

Hydrologic Model

WBNM2017, ~600 sub-catchments

(to resolve local overland flow)

Hydraulic Model

TUFLOW two-dimensional model

Linked 1D culverts, pits & pipes

Topographic Data

2013 LiDAR (1m DEM) supplemented by cross-sectional survey, Works As Executed plans, 2005

LiDAR

Design Rainfall

Revised Illawarra IFDs and ARR 2016 procedures

Structural Blockages

WCC Revised Blockage Policy, 2016

4. XP-RAFTS vs. WBNM2017

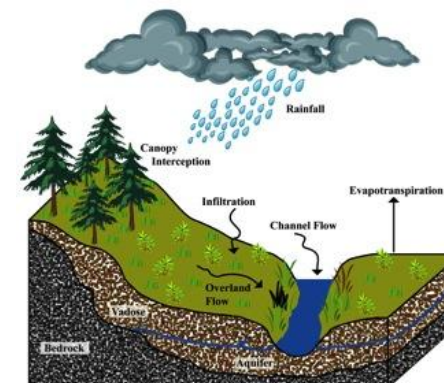
XP-RAFTS, 2006/2008

WBNM2017, 2018

Differences in runoff & stream routing procedures

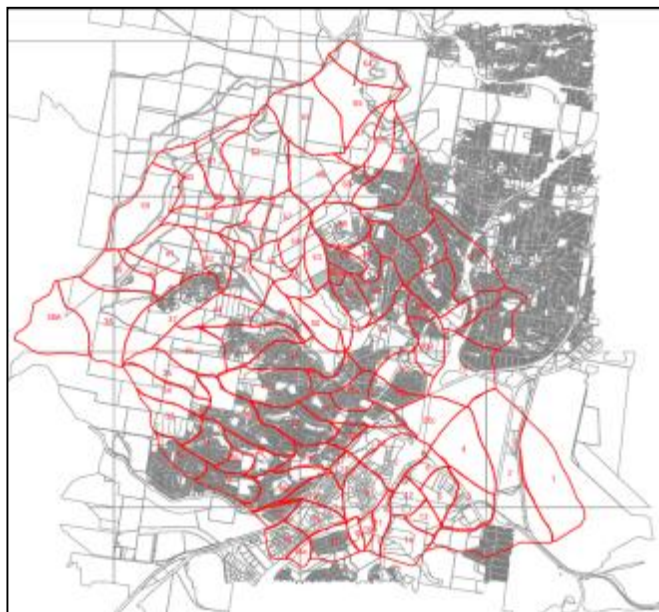
BUT

Same purpose & objective



§ 93 sub-catchments

§ ARR 1987



§ ~600 sub-catchments

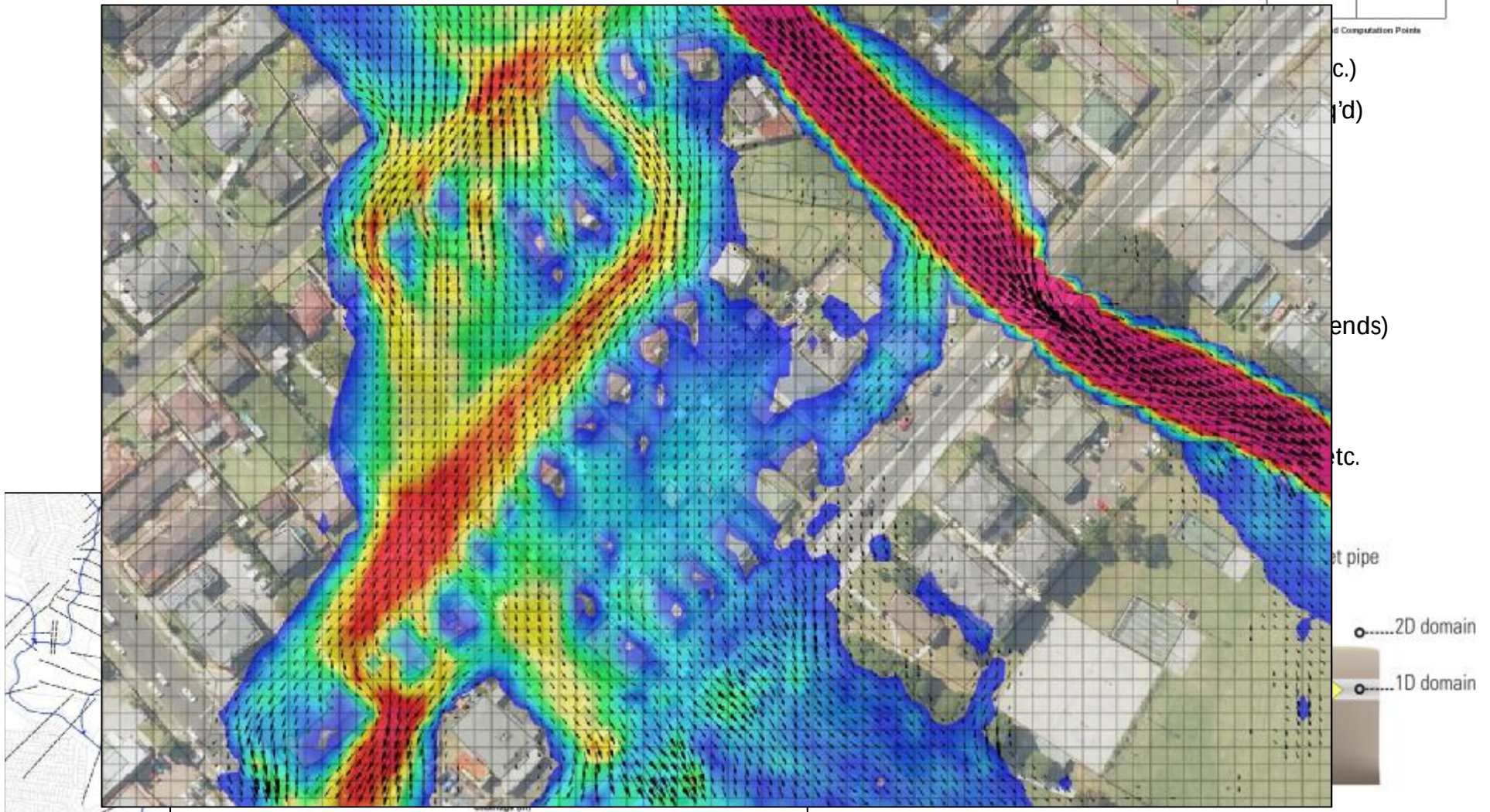
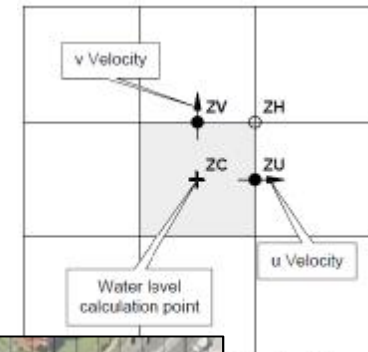
§ Revised Illawarra IFDs & ARR 2016



5. 1D vs. 2D Hydraulic Model

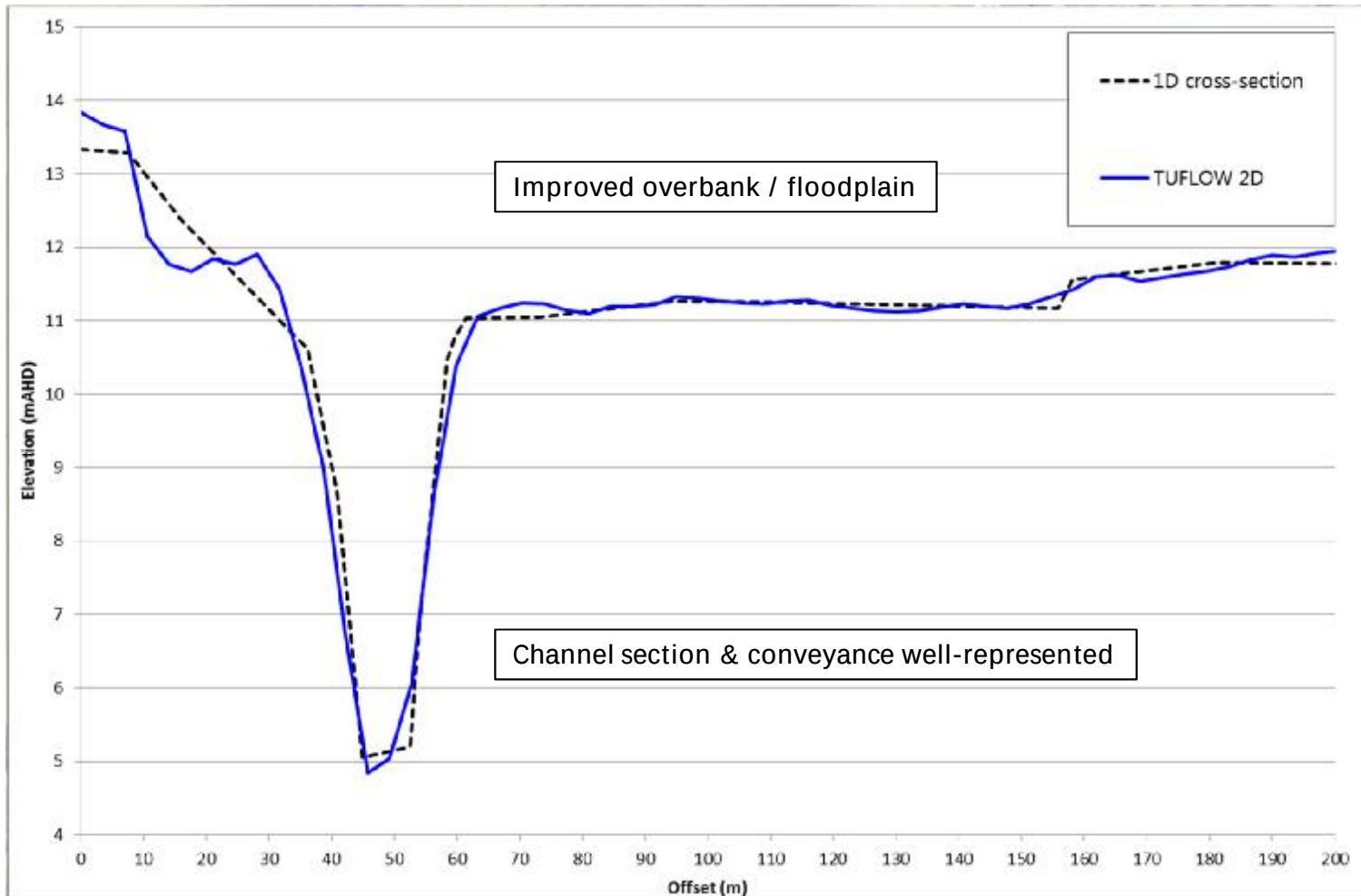
MIKE-11 1D, 2006/2008

TUFLOW 2D, 2018



5. 1D vs. 2D Hydraulic Model

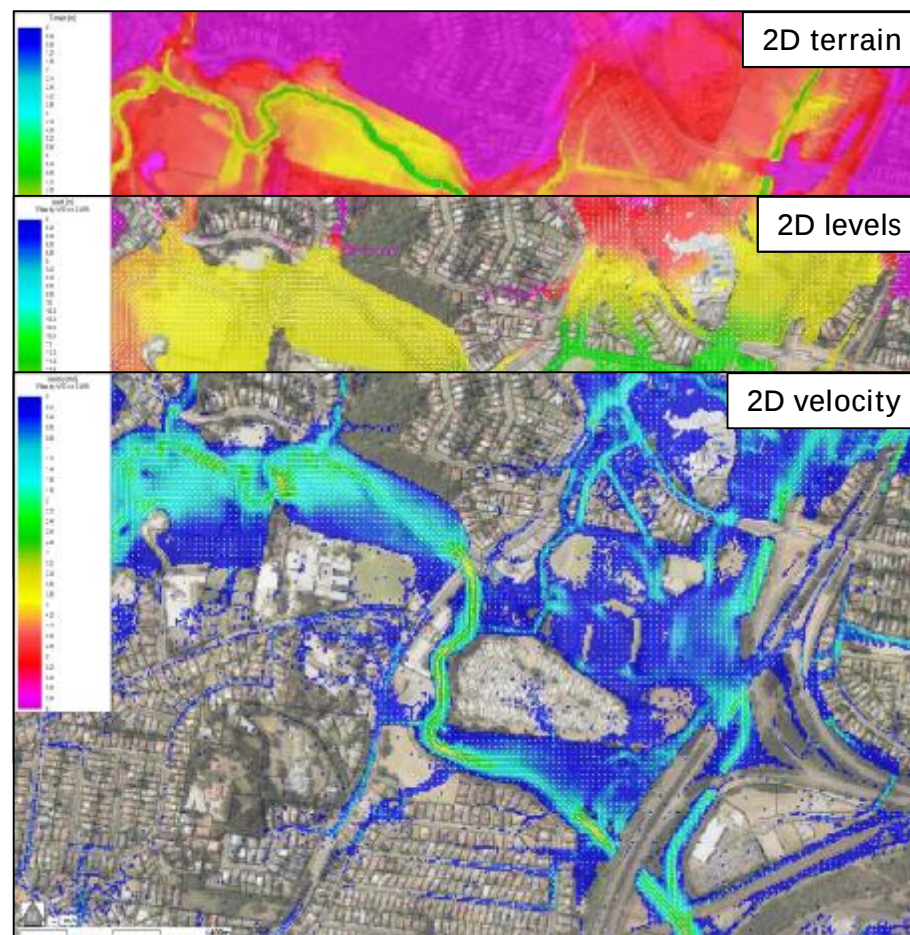
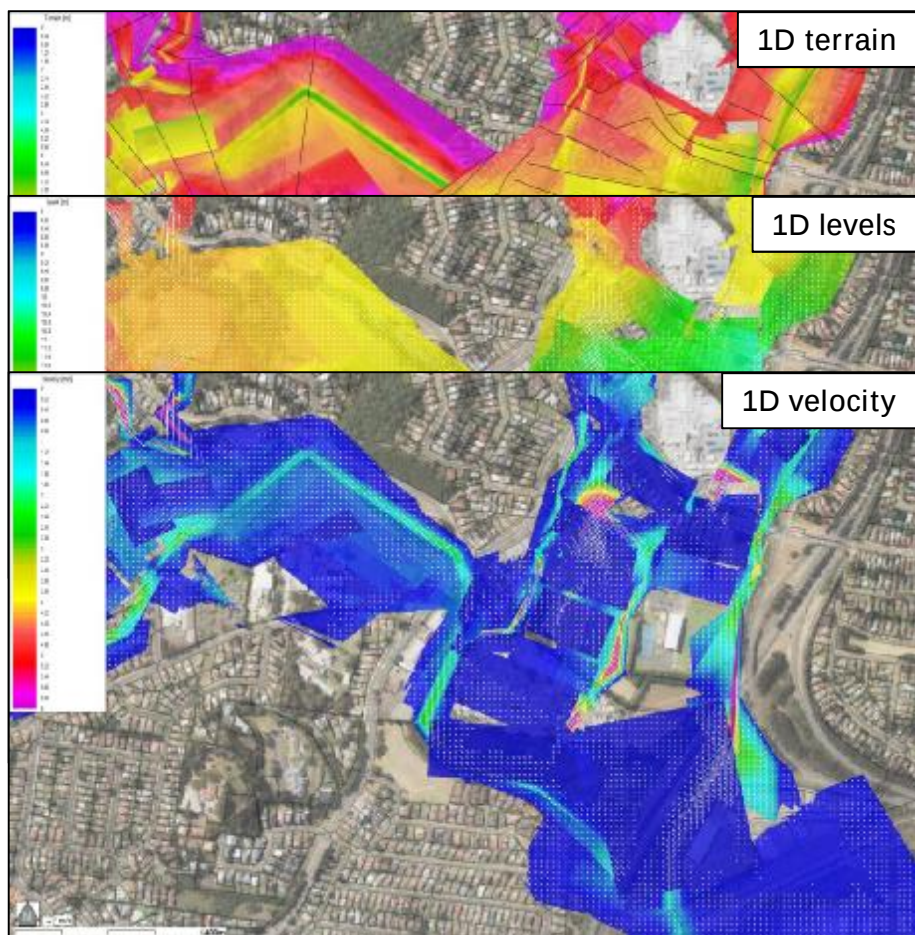
Cross-section of American Creek upstream of Princes Highway



5. 1D vs. 2D Hydraulic Model

MIKE-11 1D, 2006/2008

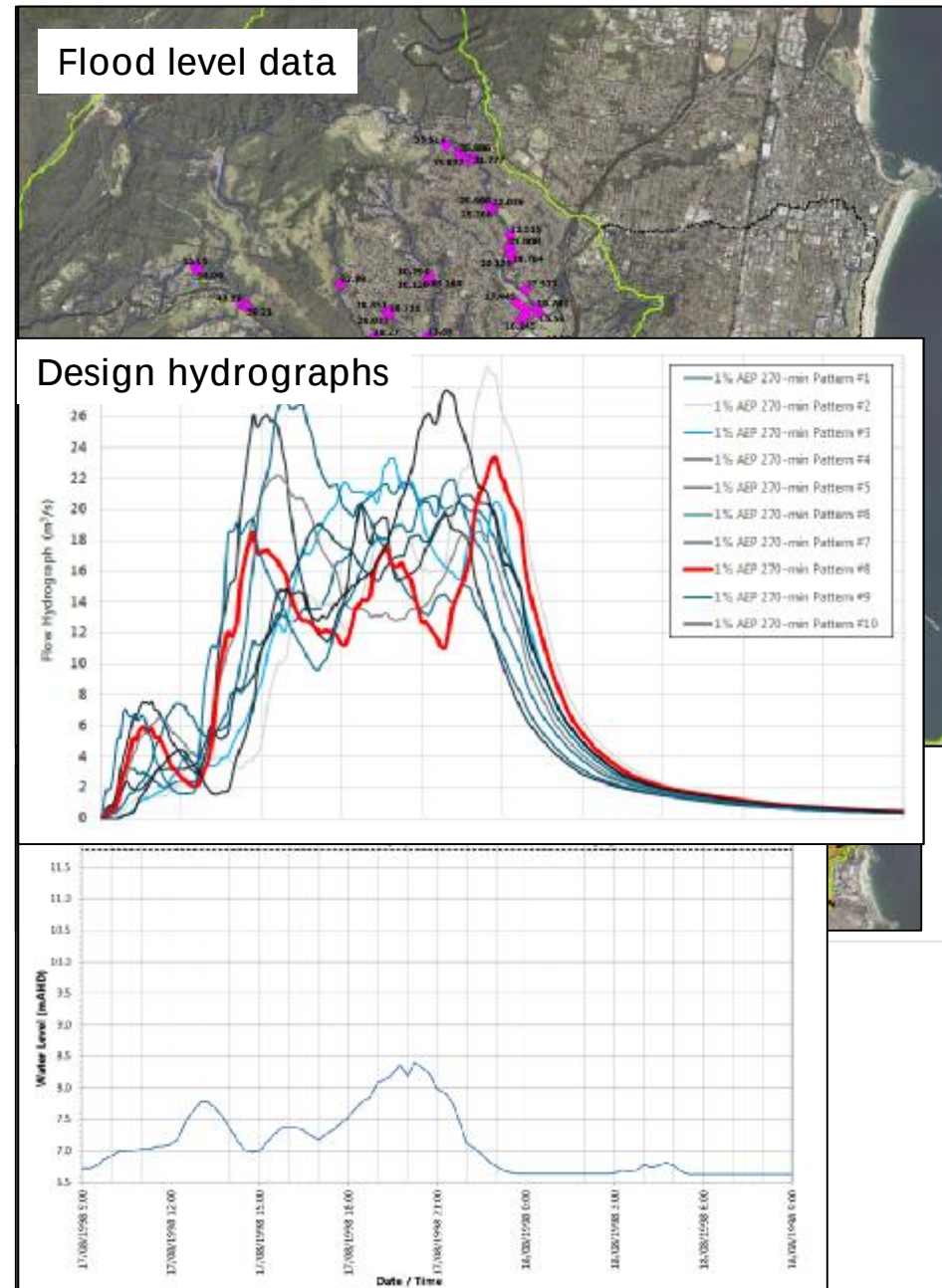
TUFLOW 2D, 2018



7. Next Steps

Stage 2 – Model Update / Development August 2018

- § Acquire additional survey data
- § Develop detailed WBNM hydrologic model
- § Develop detailed TUFLOW hydraulic model
- § Calibrate to August 1998 event
 - Input: recorded rainfall, recorded ocean levels
 - Flood data: Byarong Creek gauge,
99 surveyed flood levels
- § Verify to October 1999 & March 2011 events
- § Develop design flood hydrographs (Revised IFDs & ARR2016)



1. The Study Area

Catchment size

§ Fairy/Cabbage: 21 km²

§ Smith Street: 0.6 km²

Historic floods

§ 17 August 1998

§ 23 October 1999

Hydraulic controls

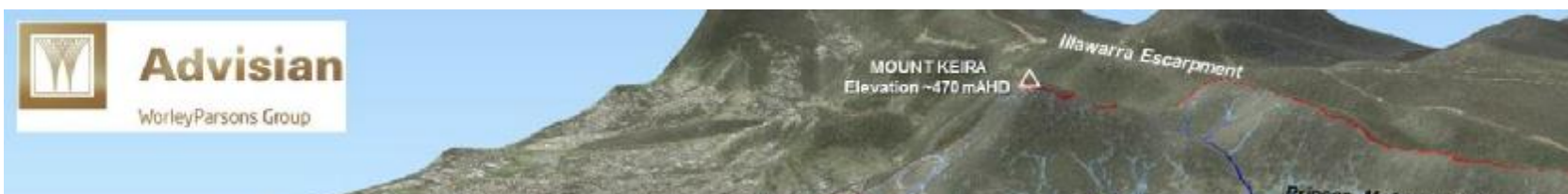
§ M1 Motorway

§ Memorial Drive

§ Illawarra Railway

§ Entrance berm

§ Detention basins



Brokers Road – constructed ~March 2000



Foothills Road

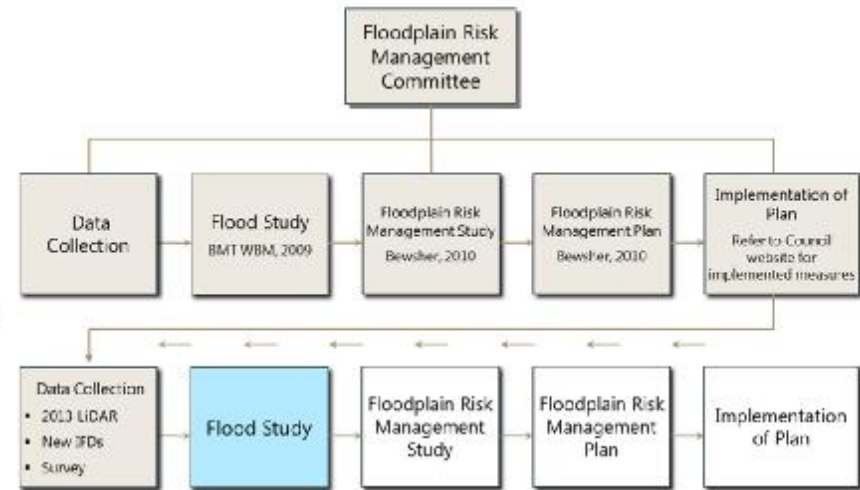


2. Background

The Floodplain Risk Management Process (3rd iteration)

“A Flood Study is a comprehensive technical investigation of flood behaviour that defines the variation over time of flood levels, extent and velocity for flood events up to and including the PMF.”

NSW Floodplain Development Manual (2005)



Previous Studies

- § Cabbage Tree Creek Flood Study (PWD 1991)
- § Fairy Creek Floodplain Management Study (Kinhill 1996)
- § Cabbage Tree Creek Floodplain Management Study (Willing & Partners 1997)
- § Fairy Lagoon Entrance Management Policy (Cardno Lawson Treloar 2007)
 - § Mechanical breakout at water level of 1.6 mAHD
- § Fairy & Cabbage Tree Creeks Flood Study (BMT WBM 2009)
 - § WBNM hydrologic model & 1D/2D TUFLOW hydraulic model
- § Fairy & Cabbage Tree Creeks Floodplain Risk Management Study & Plan (Bewsher 2010)

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Extent



Extent

Additional tributaries & overland flow paths



4. Progress

Data Collection & Review

- LiDAR (2005, 2013)
- Survey
- Past studies
- Hydrometric data
- WAE / design plans
- Drainage asset data

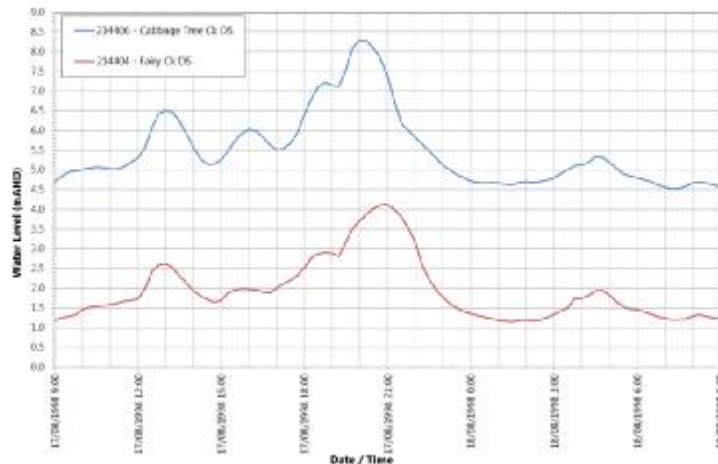
Preliminary Model

- TUFLOW direct rainfall model
- Inform flow paths & review data adequacy

5. Next Steps

Additional Survey

- Survey brief: cross-sectional, structural, detention basin, and ground survey



Stage 2 – Model Update / Development

- § Develop detailed WBNM hydrologic model
- § Develop detailed TUFLOW hydraulic model
- § Calibrate to August 1998 event
 - Input: recorded rainfall, recorded ocean levels
 - Flood data: Byarong Creek gauge, surveyed flood levels
- § Verify to October 1999 & February 2012 events
- § Develop design flood hydrographs (Revised IFDs & ARR2016)



Discussion



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