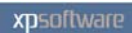


# Mapping of Floodways and Floodplain Development Zones Using 2D Models

Bill Syme, BMT WBM  
Colby Manwaring, XP-Software  
FMA Conference, San Diego, September 2011



## Overview

Different Approaches to zoning flood prone land

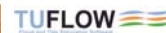
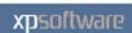
Approaches to delineating zones

- 1D representation

- 2D representation

Simple example for deriving Floodplain Development Zones

Tweed River, NSW, example



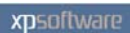
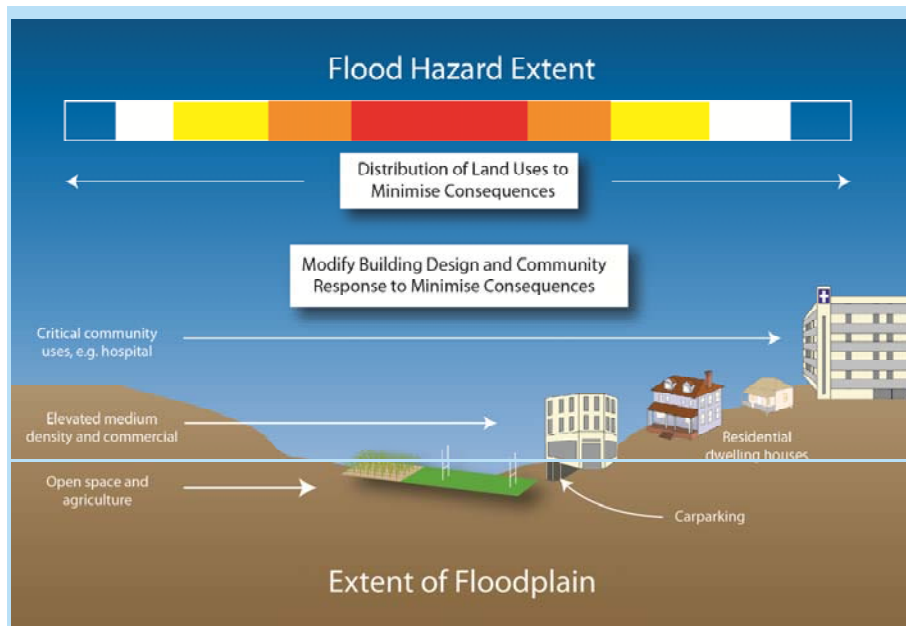
## Zoning Flood Liable Land

For floodplain managers to make informed decisions,  
flood liable land needs to be zoned according to

- risk to life-and-limb
- potential damage to property and infrastructure
- importance for conveying and storing (attenuating) flood waters

Future developments can then be confined to zones with

- low risk of flooding
- ease of evacuation during an extreme flood
- low hydraulic importance to minimise flood impacts



## NSW State Government, Australia

### Floodway

- High conveyance (carries majority of the flow)
- High values of velocity and depth

### Flood Storage

- High depths, low velocities
- Stores significant volumes of water
- Attenuates flood wave

### Flood Fringe

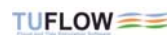
- Shallow depths and/or low velocities
- Minor importance hydraulically



## USA FEMA

### Regulatory Floodways

“A Regulatory Floodway means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height [nominally 1 foot]. Communities must regulate development in these floodways to ensure that there are no increases in upstream flood elevations.”



## UK Environment Agency (EA)

Zone 3: The 100 year fluvial event or 200 year tidal event

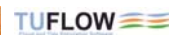
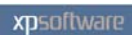
Zone 2: The 1,000 year event extent

Zone 1: The remainder (ie. > 1,000 year event)

Zone 3b: The “Functional Floodplain”  
(usually initially derived using the 20 year flood extent)

Zone 3a: Remainder

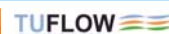
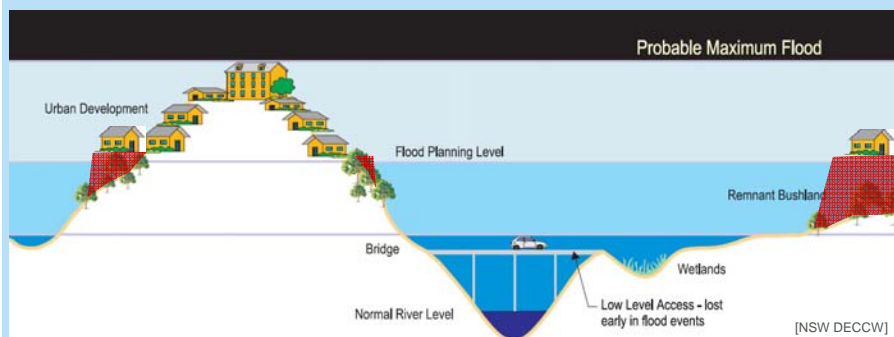
There is some correlation with the NSW approach where “Functional Floodplain”  
(Zone 3b) would be similar to combining the Floodway and Flood Storage Zones.  
Zone 3a would be the Flood Fringe.



## Future Urban Development

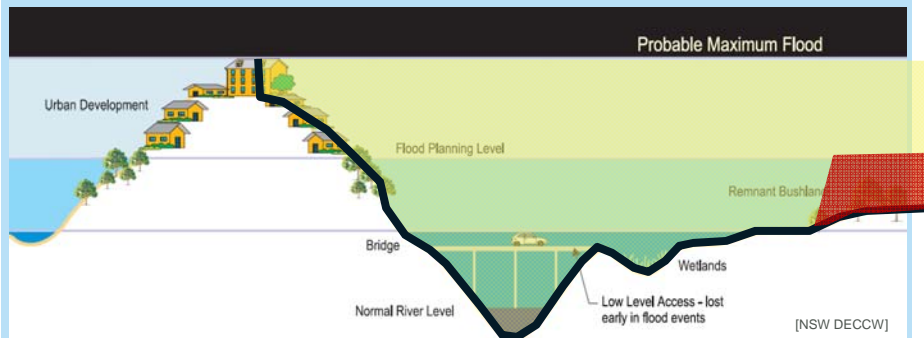
Where on the floodplain (if anywhere) can we fill for future urban growth?

Whilst minimising the flood risk AND the flood impacts.



## Mapping Floodplain Development Zones 1D Modeling

Reduce conveyance of cross-sections so as to  
comply with the impact acceptability criteria



xpssoftware



TUFLOW

## Mapping Floodplain Development Zones 2D Modeling

2D models don't use cross-sections

Therefore, conveyance is not readily quantified  
(especially in complex 2D flow patterns)

Use Velocity times Depth (VxD) to help identify

- Floodplain Development Zones, and
- Floodway, Flood Storage and Flood Fringe Zones

VxD is an excellent measure of hydraulic importance, and  
for mapping flood hazard categories  
(the higher the VxD value the greater the hydraulic importance and flood hazard)

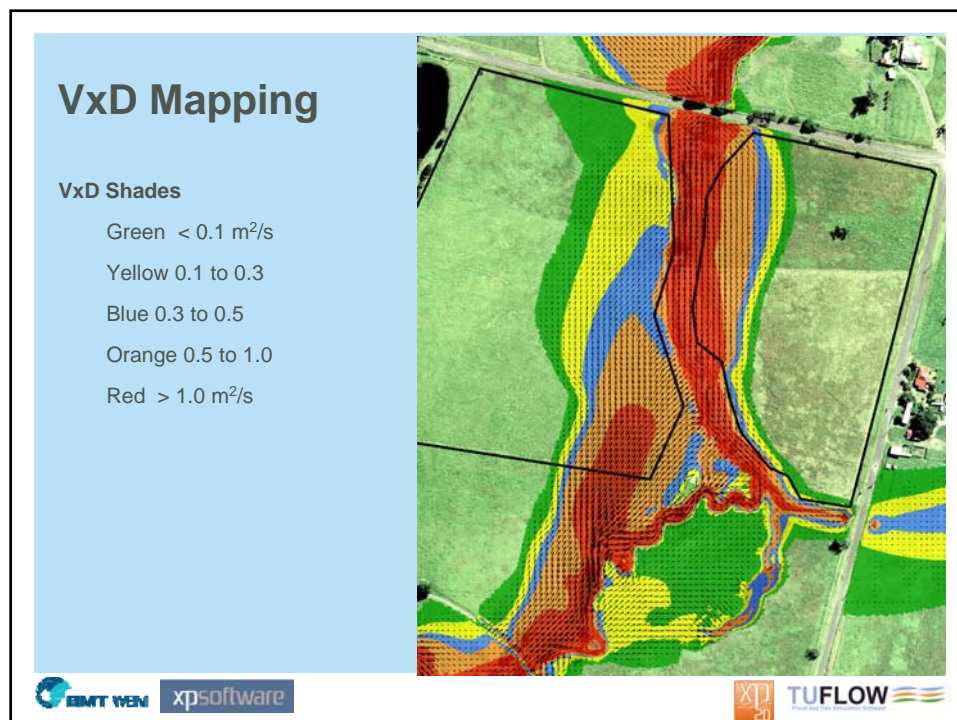
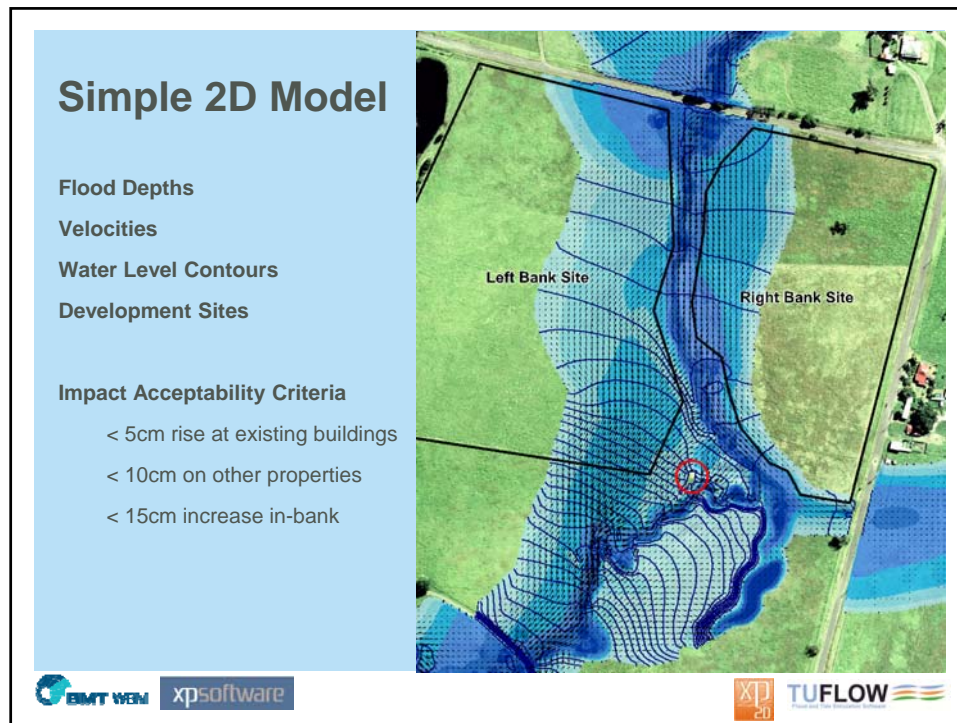
VxD also known as Unit Flow or "q" and has units of  $m^2/s$  or  $ft^2/s$



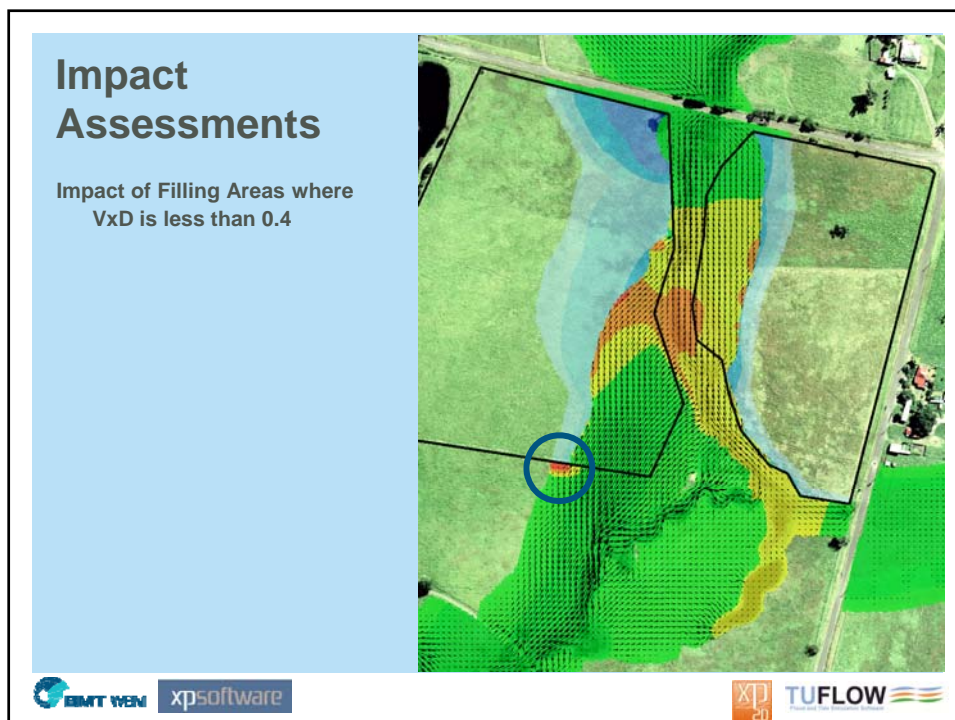
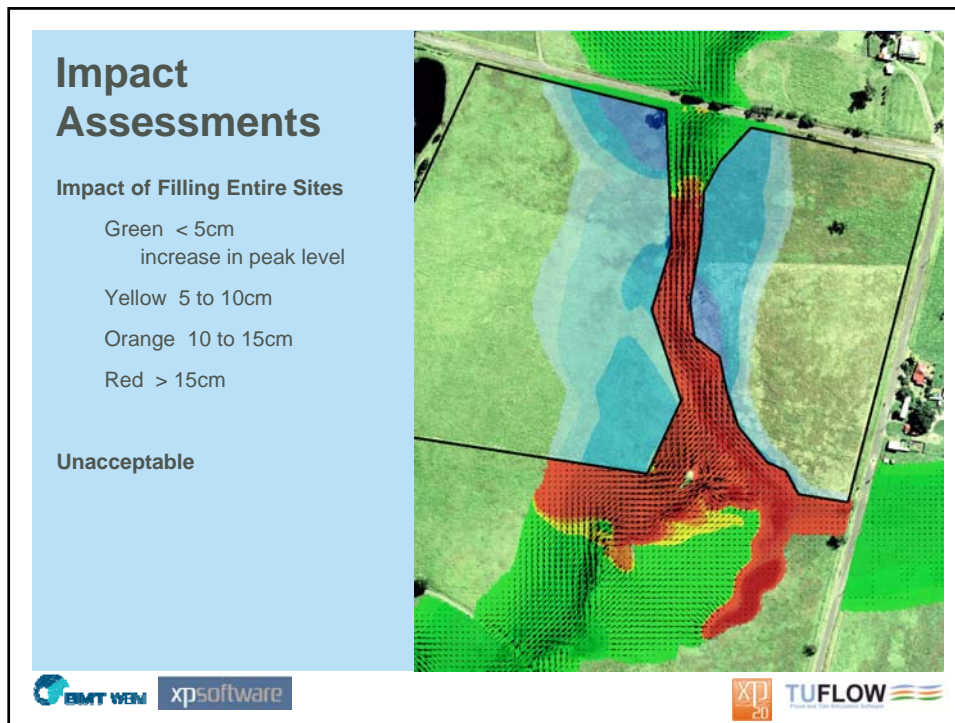
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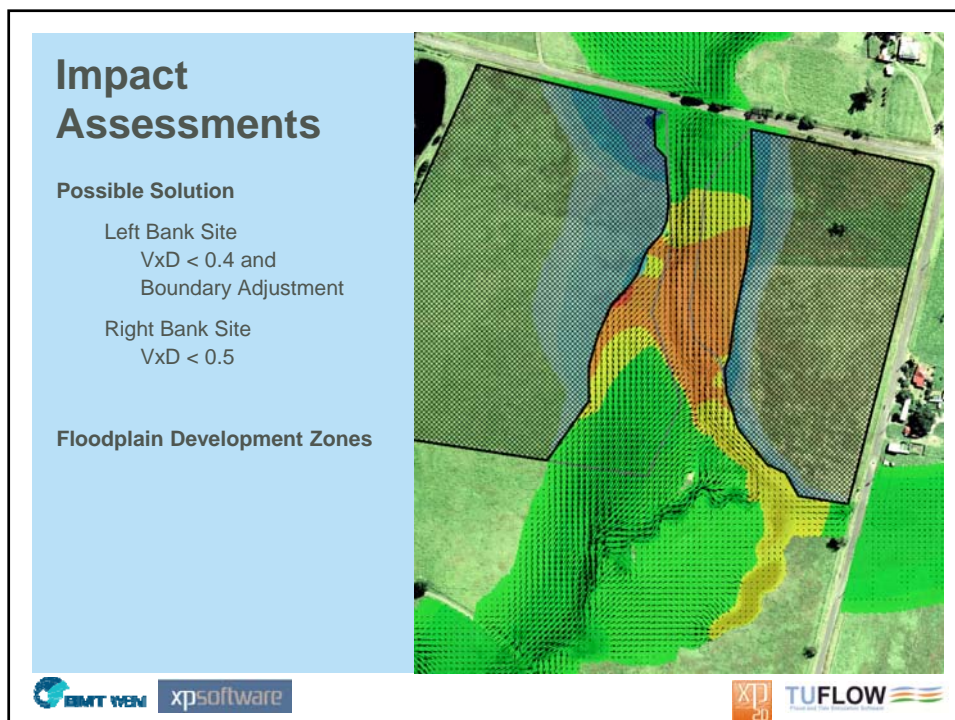
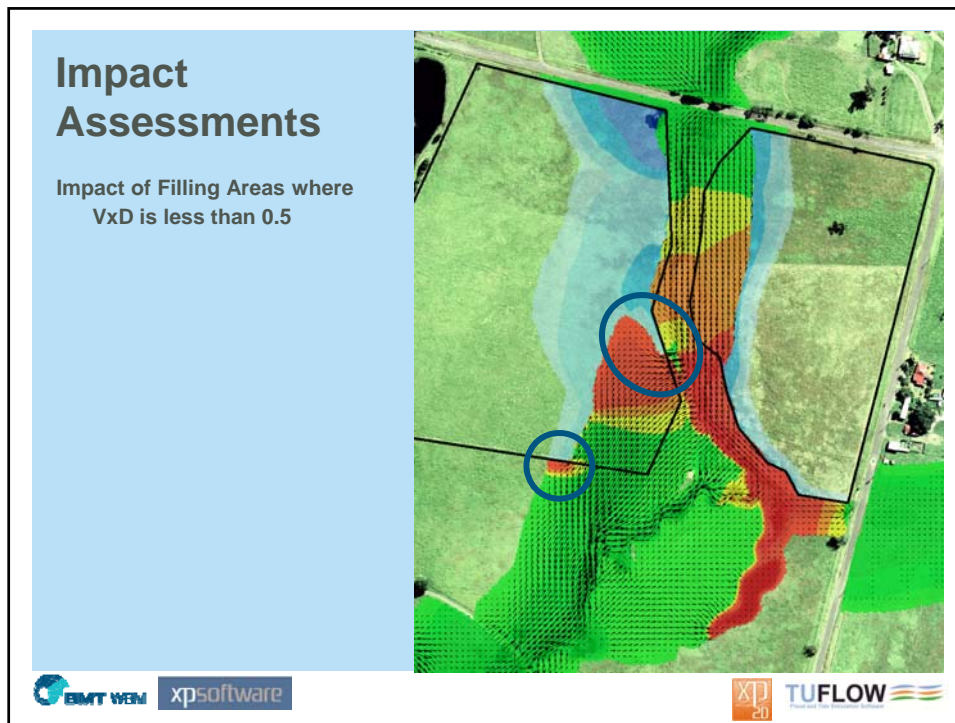


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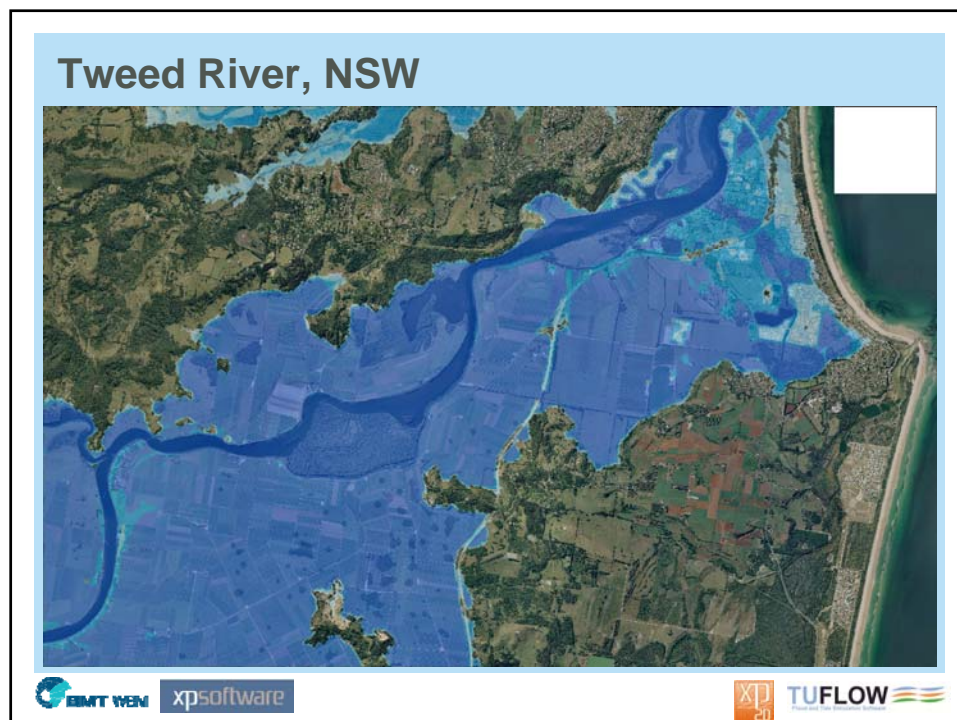
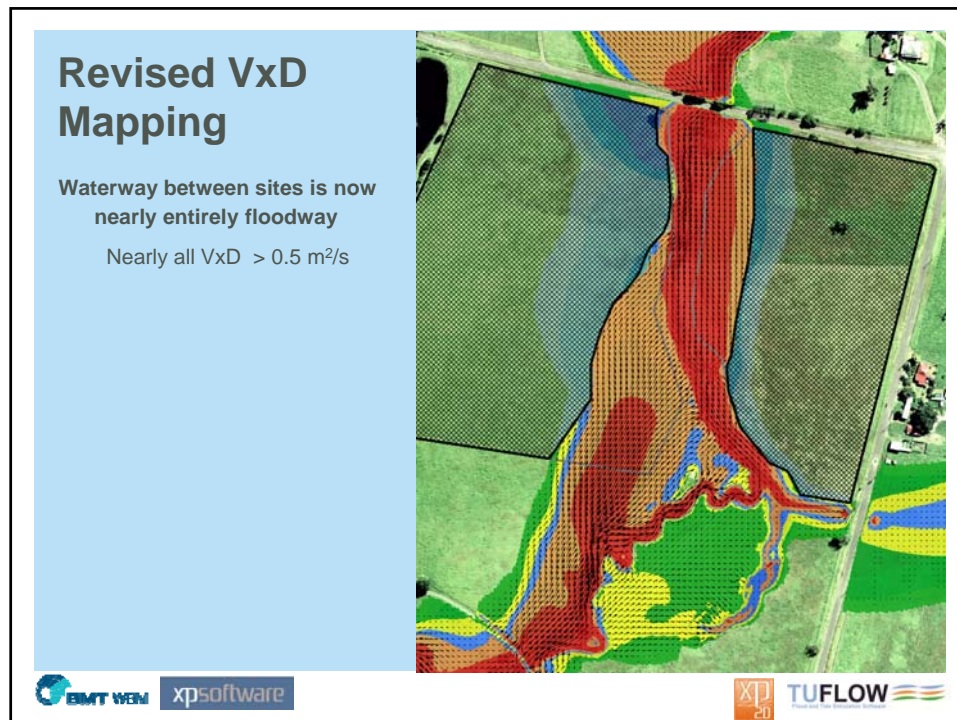


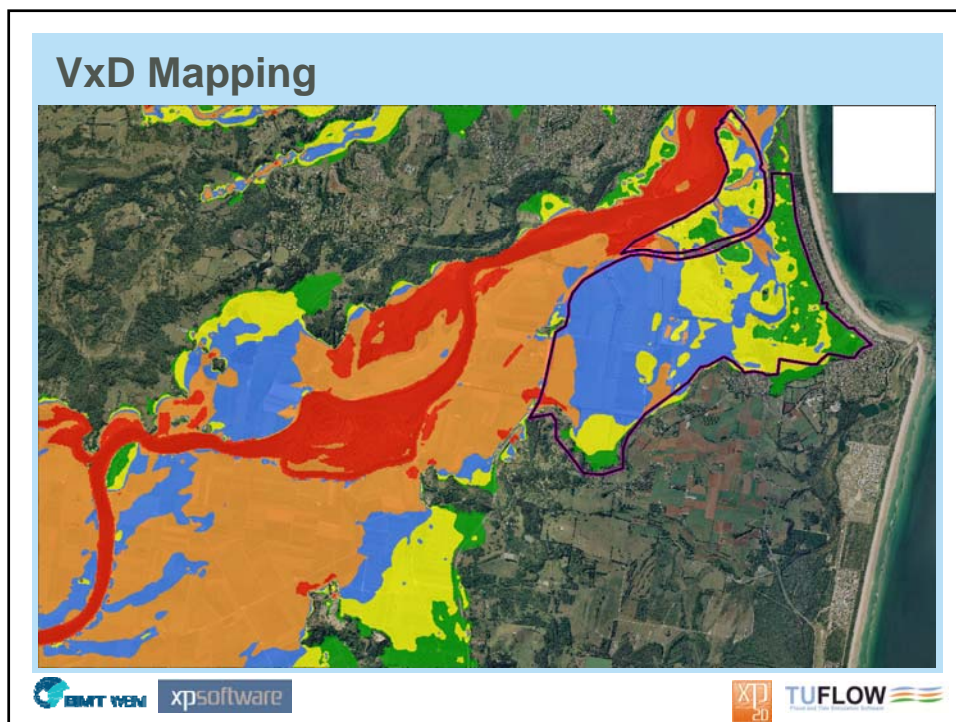
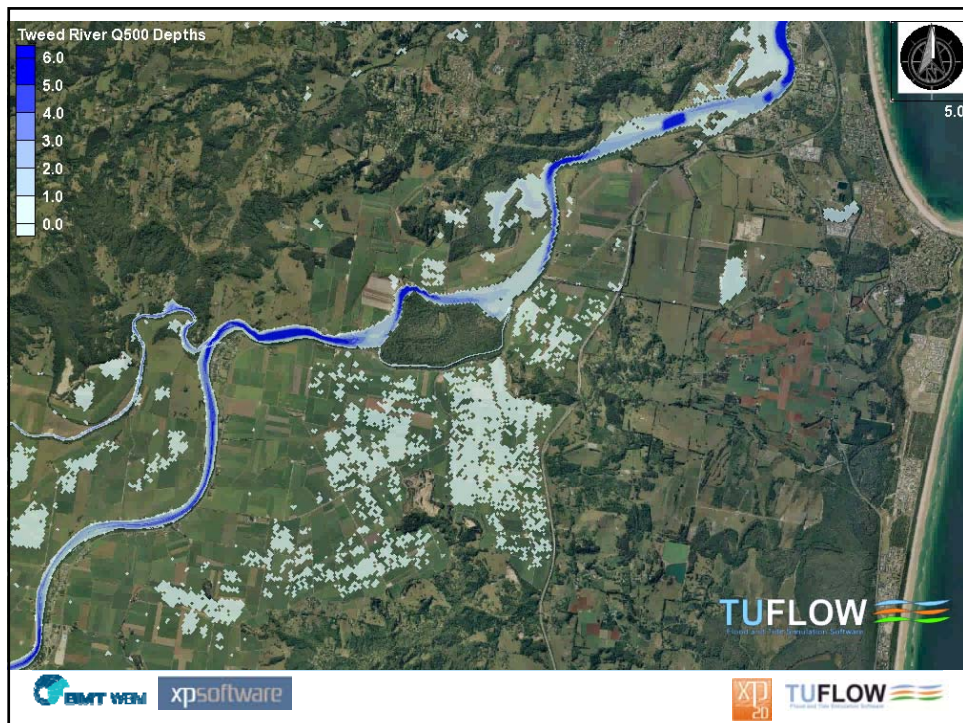




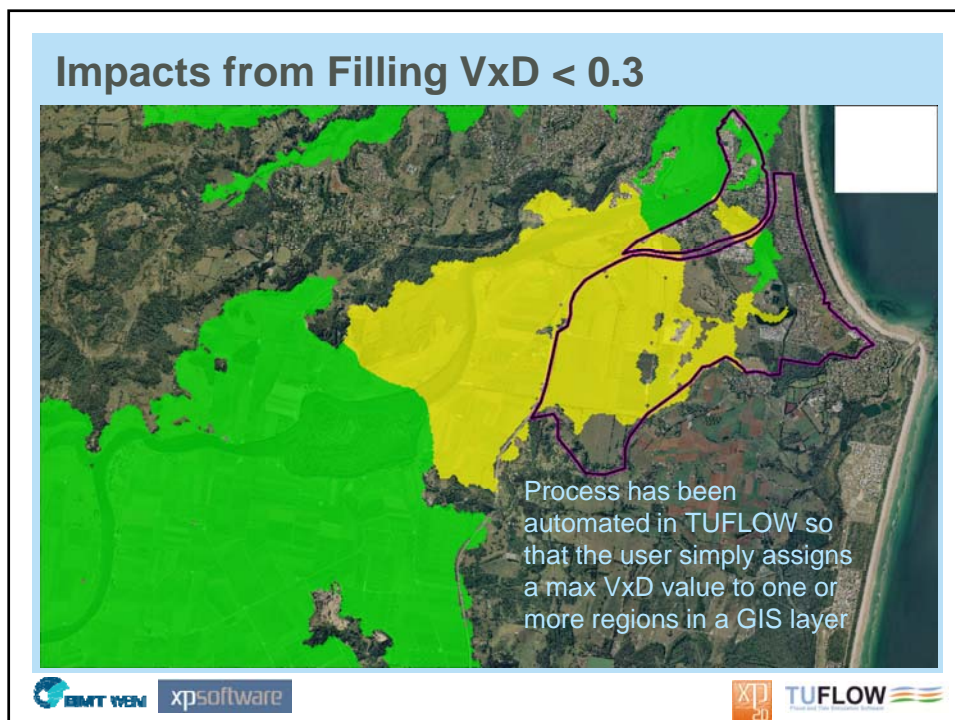
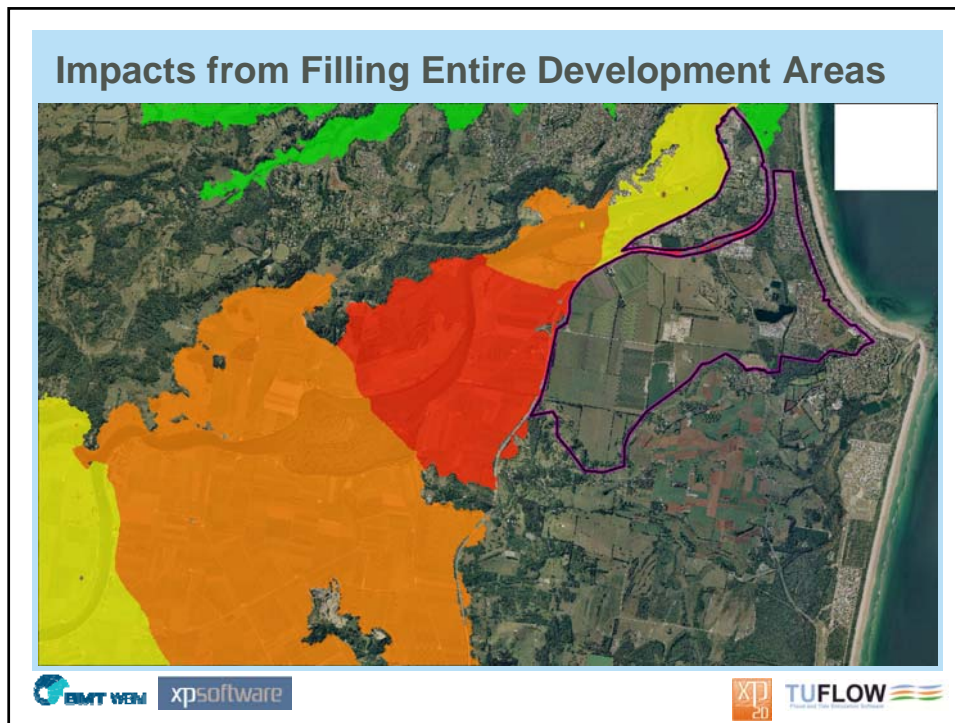












## Conclusions

### **VxD excellent parameter for helping define Floodway, Flood Storage and Flood Fringe Zones**

Ideally suited to 2D modelling

### **Strategic Planning needs to consider**

Long term cumulative effects of development

Define impact acceptability criteria

Focus on developing where VxD is small ( $< 0.3$  to  $0.5\text{m}^2/\text{s}$ )

Optimal solution – minimise flood impacts and maximise development area

### **Need to consider other criteria**

Evacuation – exclude areas that become isolated

Land-use changes (seasonal and perennial)

