Implications of engineering structures across the Namoi Floodplain: Gunnedah to Gins Leap Gap

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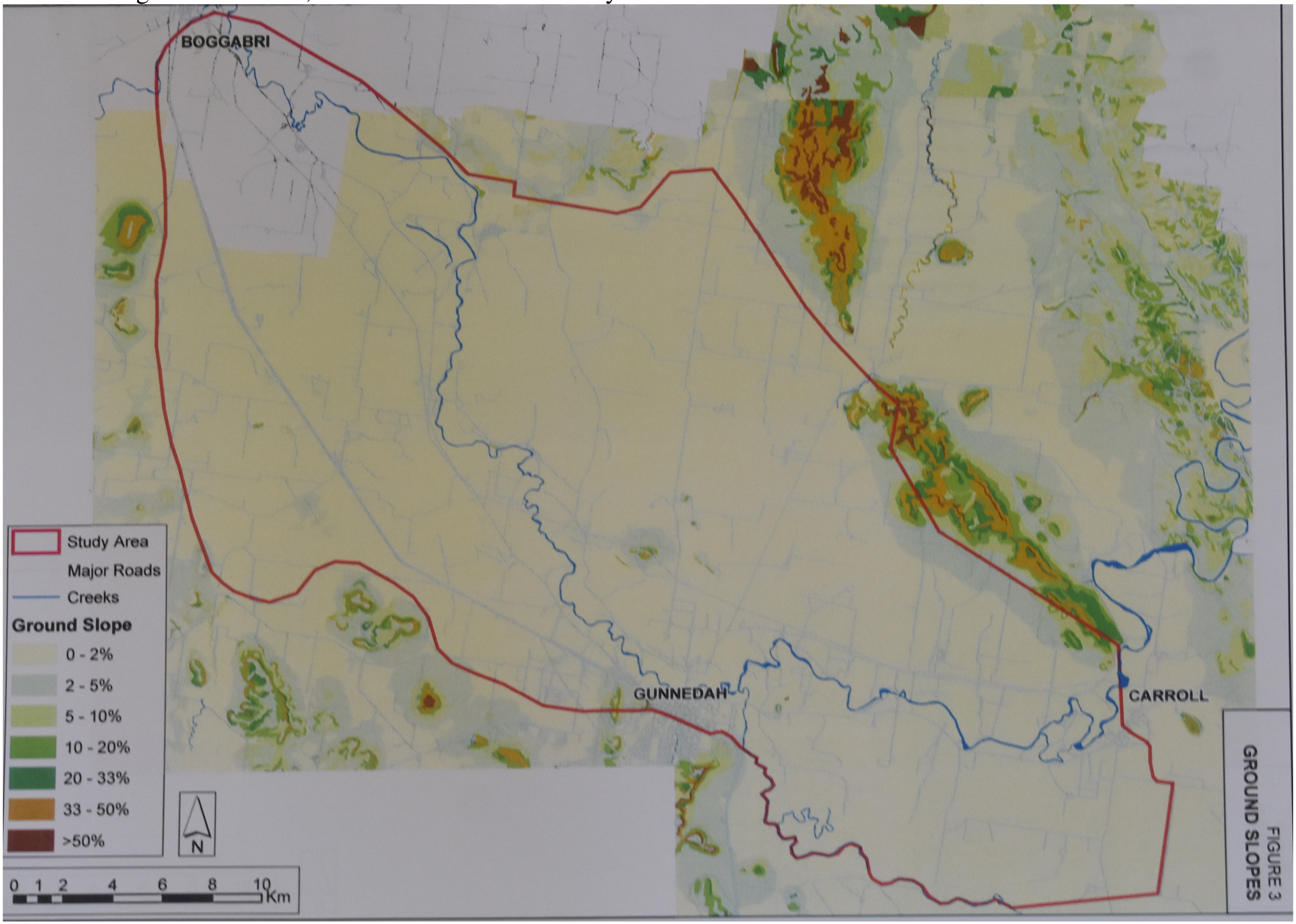
Introduction

In days to come, extreme weather events and climate change will pose a real threat to the environment of the northern part of the Liverpool Plains. This paper is a preliminary assessment of environmental risk in the area from Gunnedah to Gins Leap Gap. The floodplain is defined as land with a slope of less than 2% under the Water Management Act 2000 (WMA 2000) see Figure1. The floodplain may be vulnerable to erosive flooding and aquifer interference to groundwater recharge. The Namoi River must be thought of as an ecological system (Young, 2001).

The Namoi catchment is in the early stages of a coal mining and coal-seam gas boom. If agriculture and mining adopt the principles of ecologically sustainable development and cooperate in the valley, the whole community will benefit. There is a debate as to the potential of aquifer interference from large-scale open cut coal mines by way of reversing hydraulic gradients, when mines are too close to rivers and irrigation farms. The main environmental concern with large-scale coal-seam gas projects is aquifer interference and the risk to water quality both for irrigation and town drinking water supplies.

Mining infrastructure such as roads and railways sometimes poses an environmental risk of diverting water causing erosive flooding, and adverse effects on groundwater recharge. This is particularly the case if they cross the main body of the floodplain. At valley constrictions such as at the Gins Leap Gap they have a much lower impact, for reasons associated with the underground landscape. Hydraulic capacity in design, underneath the railway, is facilitated by elevated take-of points from each ridge on the valley sides. This is the most suitable site for a railway.

Figure 1 Floodplain shown in red ie landslope less than 2%
Image credit: Webb, McKeown & Associates Pty Ltd 2005



Consider the Liverpool Plains before the black soil was cultivated. Floodwater spread out, slowed down, infiltrated the soil and recharged the alluvial aquifers. Valuable sediment containing nutrients, fungal and microbial elements recharged soil fertility. Soil structure was improved and the water holding capacity increased. Considering the extensive nature of the plains below 2% landslope, the soil became a vast storehouse of water and nutrients. There was no soil erosion (Gunnedah District Technical Manual, Soil Conservation Service of NSW).

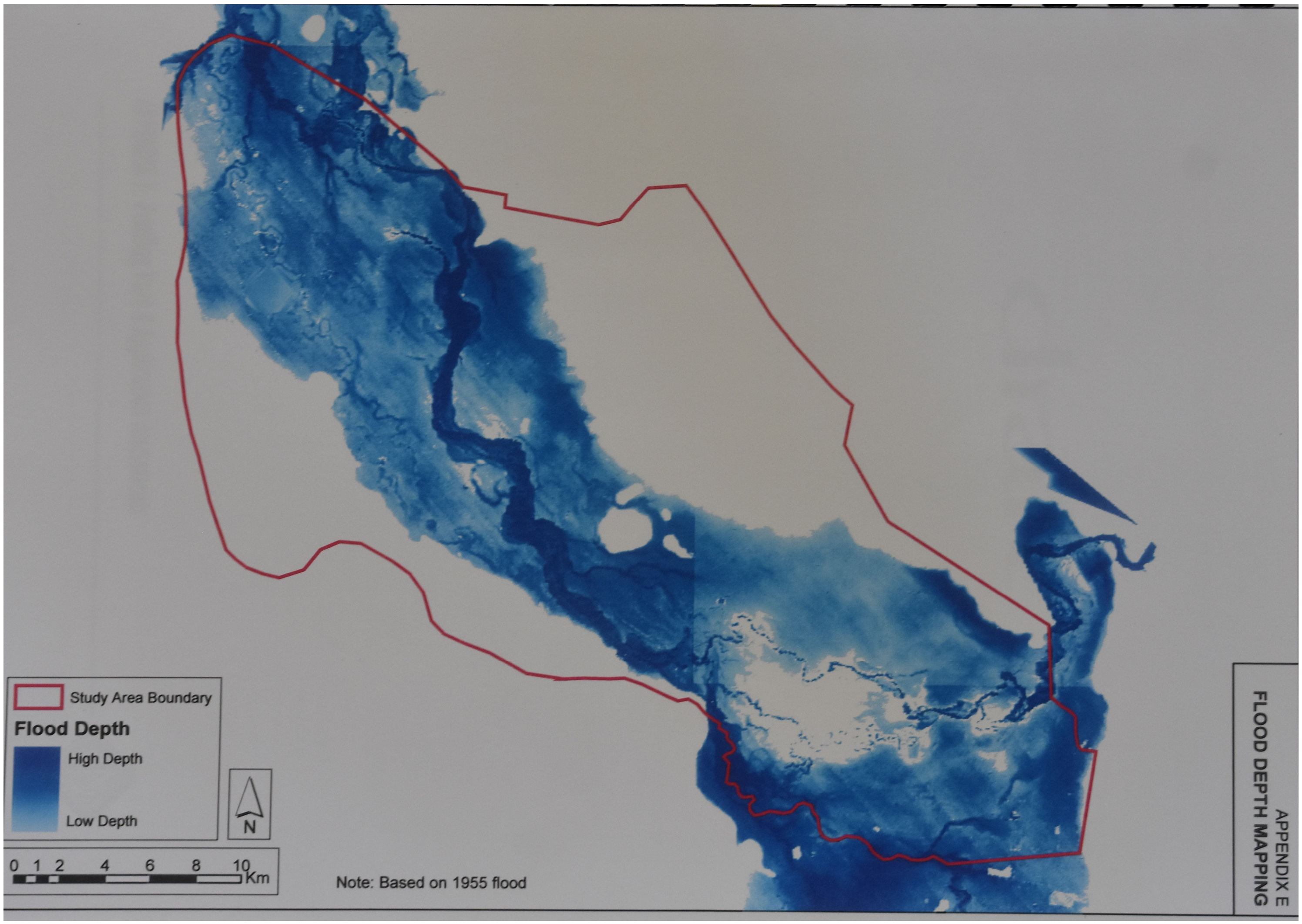
History repeats. In my early days as a Soil Conservationist in Gunnedah, the Soil Conservation Service of NSW was encountering legal problems with earthworks on country below 2% landslope. Illegal diversions were being caused by poorly designed earthworks with ill-defined catchments. A technique was developed called strip cropping using vegetative means to spread and slow down flood waters (Breckwolt, 1988). This proved very successful in combating soil erosion and avoiding legal problems on the Liverpool Plains.

The Darling Downs in Queensland had similar problems on the low-slope black soil. Water spreading allowed Strip Cropping methods to combat soil erosion. This was the key to maximising agricultural productivity and minimising environmental impact. Maximum height restrictions on roads and other structures were introduced (Marshall, 1993).

According to John Marshall in his booklet on Floodplain Management, published by the Queensland Government, cooperation is the key (Marshall 1993). He concludes by stating that 'It cannot be overstressed, however, that the main ingredient of successful floodplain management is cooperation. All land users must accept that each property has artificial boundaries and therefore cannot be managed in isolation. Poor management by one landholder in a catchment will affect others adversely, while good management and cooperation will work to everyone's advantage. Concentrated, fast moving flood water can spell disaster, both in crop losses and soil erosion, while a well spread, slow moving flow is a free irrigation for everyone'.

Coming back to the study area, we know from eye witness accounts that the floodway covers most of the floodplain in this area. This is confirmed by the Airborne Laser Survey (ALS) with 'draped over' hydraulic model representation of flood water depth (Webb, McKeown & Associates, 2005). see Figure 2

Figure 2 Airborne Laser Survey (ALS) representing depth of flooding: from Carroll-Boggabri Floodplain Management Study
Image credit: Webb, McKeown & Associates 2005



According to Webb, McKeown & Associates (2005),' The Airborne Laser Survey (ALS) was also utilized as part of this study. The flood level results obtained from the hydraulic model were "draped" over the digital terrain model produced by the survey data to obtain a representation of the depth of flooding across the study area'. See Figure 2.

There is a new awareness of extreme climatic events and the potential impact of engineering structures on our valley. The area from Gunnedah to Gins Leap Gap is a sensitive vulnerable area of international and national significance (Geoscience Australia 2015).The implications of engineering structures across the floodplain include: potential erosive flooding causing soil erosion and reducing groundwater recharge, increasing stream bank erosion and ecological disconnection between river and floodplain.

What is a Catchment Action Plan? ‘A Catchment Action Plan, or CAP, sets strategic targets and activities for a ten year period for natural resource management in a Catchment. All stakeholders in natural resource management within the Namoi Catchment are encouraged to adopt it.’(Namoi CAP, 2010). The Namoi CAP covers the period 2010-2020 so we still have two years to go before the review. The environmental resilience principles written down in this document set a good framework for understanding our valley.

Understanding the potential rainfall and deep drainage of sub-catchments in a valley is essential in calibrating numerical models. In the study area the ephemeral streams of Collygra Creek and Deadmans Gully are often underestimated for groundwater recharge and potential runoff (Banks 2009). Major structures across ephemeral streams with ill-defined catchments, steep slopes and extensive catchments create havoc under certain meteorological conditions. The Werris Creek to Mungindi railway is an example of this problem.

Major flooding is an important groundwater recharge source (Timms 2011). Thinking of rivers as ecological systems that are integral with their floodplains, gives a better understanding of the whole catchment and adds meaning to a holistic, multidisciplined approach to floodplain management. Major flooding, as a recharge source, was also a finding of the Namoi CMA Gins Leap Gap Project (KLC Environmental 2010).

Major Floods

Consider the Australian writers classic, ‘The Red Chief, as told by the last of his tribe’, by Ion Idriess. This is an historical reference text for our area. Idriess records in the appendix of his book on page 245 an account of the 1750 flood, (Idriess 1979). I quote directly, ‘So far as could be ascertained, the Red Chief lived in the late seventeenth and early eighteenth centuries. Bungaree told of a great flood that apparently occurred about 1750, changing the course of the Namoi and Mooki Rivers. The Red Chief appears to have died about twenty years before this flood.’ Bungaree, who gave the account, was the last of his tribe.

The second biggest flood was the 1864 which destroyed the township of Gulligal (personal comm. McIlveen, P.) Boggabri then became the main town centre.

The following flood height recordings of Major floods at the Gunnedah Gauge (419001) are as follows: *Gauge Zero = 254.885 mAHD* Table 1 (DLWC, 1996). A major flood is classified by the SES for the Namoi River at Gunnedah as having a gauge height of 7.9 metres (m).

Table 1

Gauge Heights (419001) for Major Historical Floods in Gunnedah
(Gauge zero = 254.885 mAHD)

Year	Date	Height (m)	Year	Date	Height (m)
1864	-	9.85	1964	15/1	8.69
1900	25/7	8.96	1971	2/2	8.98
1908	18/3	9.65	1974	9/1	8.59
1910	16/1	9.40	1976	25/1	8.78
1920	30/6	7.93	1977	17/5	8.00
1921	3/7	8.23	1984	31/1	8.84
1942	12/7	7.93		29/7	8.00
1950	24/7	8.38	1998	22/7	8.84
	23/11	8.10		29/7	8.55
1955	26/2	9.60		9/8	7.98
	26/10	8.47		7 Sept	8.50
1956	11/2	8.84	2000	22/11	8.87
1962	14/1	8.05			

The above flood records demonstrate that we must remain aware of what has happened in the past. We should also not rule out more extreme events in the future. In our relatively narrow floodway, with constricting ridges both sides, in extreme floods there is nowhere else for the water to go but to increase in depth and velocity. Talk of a 1 in 20 return period in engineering structure design, and levels of the 1984 flood, are completely unacceptable when there is evidence of previous floods much higher. The safer strategy is to choose alternative access routes and keep off the floodplain.

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