

## FLOOD ALLEVIATION SCHEMES & RIVER MANAGEMENT

### A submission to the Queensland Flood Inquiry

These notes are written from an observer's point of view. We were not flooded. The comments are submitted to support a personal belief for the need for flood alleviation schemes, flood alleviation measures and flood management on a catchment basis. The thoughts have been jotted down between work plus cut & pasted from old reports and notes. There may be some duplication; points listed are not fully sorted.

I am a civil engineer and have worked in water engineering since 1961. My work has included some flood studies, mostly in the UK with the Devon River Authority. The history of the Authority dates back to the Lynmouth disaster in 1952 <sup>(1)</sup>. Prior to that, river work was a county council 'one-man-band' job. After Exeter <sup>(2)</sup> was flooded twice in as many months in 1960, along with many smaller communities, the Authority was expanded. I became involve when a dozen of us were taken on to investigate floods, estimate flows, return periods, cost benefit analyses and design of flood alleviation schemes throughout the county. Over the years design methods have changed, the principles remain the same.

This year we had an interest in the weather - getting family home for Christmas and back to Sydney, Brisbane and Cairns by road a couple of days before New Year. All went well with the aid of a few back roads. It was clear from Bureau of Meteorology data well before Christmas together with the end of the long dry period that this year was likely to be a record year with widespread flooding.

This years flooding in southern Queensland could perhaps be broadly summarised as:

- Weather forecast & flood level predictions - BoM did and does a superb job.
- Free real time on-line river levels - once you know where to find them - a huge asset.
- Road reports - not the best. DIY road assessment based on the above - good.
- Flood mapping - most local authorities have good flood maps; there is a reluctance by a few to divulge this information <sup>(3)</sup>.
- Organisation, emergency services, response and cleanup - excellent.
- Spirit to recover - wonderful.
- Planning - referred to below.
- Flood alleviation schemes & measures - "What's that? She'll be right".... until next time.

Some comments are blunt and probably controversial, nature pulls no punches. None of this implies any criticism. South Africa's truth commission is a good model to follow. The aim is to minimise impact next time.

A couple of general terms are used for these notes:

- River manager - the body or authority responsible for all river management including flood damage minimisation.
- Supply manager - the body or authority who manages water from a river including for town water supplies and irrigation.

A few basic facts are perhaps a good place to start.

## 1 LAND FORM & CLIMATE

Land form and climate are not constant - a few examples:

- The sea level has risen 130m in the last 18 000 years <sup>(4)</sup> - an average of 7mm/year; something which is forgotten in the climate debate.
- Around Bundaberg, we are close to latitude 24°S, just south of the Tropic of Capricorn. All the major deserts of the world occur near this latitude - the Sahara, Arabian, Great Indian, Atacama, Namib, Kalahari and the Great Sandy Desert here in Australia. Only the proximity of an eastern seaboard makes the area possible for settlement to the present extent. Deserts tend to extend to the shoreline on western seaboards. Occasionally tropical weather moves across desert latitudes; evidence is clear driving across these areas.
- There is no known pattern of rainfall in our area.
- Dry periods tend to be self perpetuating until one day the trend abruptly ends, frequently flipping violently the other way with heavy rain and flooding. Multiple flood peaks can occur within a few months. The last few years are a text book case.
- Sediment transport is a natural occurrence with rivers. Disturb the river regime by say a dam and the river is likely to erode bed &/or banks downstream picking up an equivalent sediment load.

## 2 CONFLICT

A river, creek or stream is a drainage path for water on it's way back to the ocean. The river makes and changes it's path at will, guided by topography and gravity.

For the river, a river is:

- the main channel for low flows and 'one in a few year' higher flows,
- sometimes flood channels,
- the flood plain,
- the banks for several meters up each side.

For man, land near a river is:

- a good place for a home, easy access to water, transport,
- nice flat land to farm and for development,
- good soils (due to flooding) - and
- people like to live near water conveniently forgetting they may be living in a river, using the river's definition.

Our generation has lived through a relatively quite period until recently. Man creates the problem, nature gets the blame. We can learn to live with high river flows.

## 3 POLITICS OF FLOODING

There is a pattern to natural disasters. One occurs, there may be an inquiry, a report, hopefully a few points are headed, the report gathers dust, we forget, new people take over and the cycle repeats a generation later. When deaths occur and financial losses are high, there is a greater chance of progress.

In recent years water has become more of a political football; not a help to river management.

## 4 FLOODING

The main groups are:

- Overland flow - usually limited; design of all development must check impact and take appropriate measures.
- Flash flood - dangerous, high risk - little time for warnings; alleviation measure and planning can reduce the risk.
- Flood plain - we now have good real time river levels and flood models; much can be done through alleviation schemes and planning.
- Tidal surge - some protection can be achieved through alleviation works & planning.
- Tsunami - cause earthquakes or undersea landslides - if close to an event, it's probably curtains time. For example Alaska 1964 - amplitude 67.1m at Shoup Bay; still 0.2m at Sydney <sup>(5)</sup>. Further afield, planning regulations and 'get out ' warnings will save lives.

## 5 RIVER MANAGEMENT

Flooding cannot be considered in isolation. Rivers are best managed on a catchment basis. The full water cycle must be managed by one authority, see last point:

- There can be conflict when dams are dual purpose (Wivenhoe and I assume Paradise and Fairburn are also dual purpose):
  - The water supply manager likes to keep the dam full; money in the bank, water for dry periods.
  - The river manager would like the dam near empty at the start of a wet period or at minimum, have the authority to open the valve at the bottom of the dam to release water before an expected peak.
- The river manager must have final say on:
  - Dam control, if early release causes minor local flooding, there is a need for compensation to farmers if this 'man-made' flood causes the greater damage.
  - All planning in a river (the river's definition).
  - All structures built in or alongside a river.
- It can be easier if one authority is river manager and supply manager.
- The full water cycle must be addressed by the river manager including how water is managed during dry periods. Water storage from wet periods is essential if we are to produce food during dry years and supply water to the population. There is also a need for inter-catchment co-ordination. Where water is scarce, environmental flow and human needs will conflict. Transfer of water between catchments can sometimes have the lowest overall environmental and financial cost. All development has an environmental cost.

## 6 FLOOD ALLEVIATION SCHEMES, OPTIONS & CONSIDERATIONS

Detailed studies, design and cost benefit analysis is required. A few alleviation options and considerations:

- Levees.
- Reinforced concrete or sheet steel piling walls.
- Concrete lined channels to allow high velocity flow through restricted areas.
- Flood relief channels (land can be grazed during dry periods).

- Retention dams (land can be grazed during dry periods).
- Flood barriers - London has one; how will Brisbane fare with the next tidal surge?
- Warning of flash flooding is a problem due to limited time. Large area computer models may not pick very localised events. Mobile phone calls and message warnings may work well with city folk. Based on our own use, the pick up rate by country folk will be low. Fixed line messages are of little use if working outside; the days of a phone ringing 20 times or more are fast diminishing; now it's 6 rings and you're out. During WWII in the UK, sirens saved many lives, they can be heard over a wide area. Additional simple measures such as sirens linked to river gauges in high risk flash flooding areas can save lives, even if only a few minutes warning is given.
- In areas subject to inundation with minimal velocity, houses that float are an option used in The Netherlands, houses with concrete hulls.
- Small island in flood plains can save cattle; constructed in conjunction with farm dams; the benefit may outweigh the cost.
- Flood marks, gauges and location codes - would aid preparation if all property in flood prone areas were marked with a previous flood level, level to Australian Height Datum & a location code. It may not be universally popular. With the aid of computer flood models, it would enable more accurate warning for owners and perhaps allow local authorities with emergency services assistance to organise removal services for some people. Many properties in flood prone areas are old, their owners have limited resources. They need help. At least one city council is gathering accurate flood data. Flood markings could easily be added.
- All structures in and alongside rivers must be designed to minimise turbulence & backup. The upstream side of bridge piers need to be semicircular. On the downstream side the same or brought to a point. For example, the Bundaberg 'Newsmail' flood edition had a good picture of the old Bundaberg bridge with high river level last month. There is little turbulence around the tubular bridge piers. Compare this to some of the rectangular concrete structures visible in the 'Channel 9 chopper footage' over Brisbane. Rectangular blocks in a river are a menace. They increase turbulence, risk greater damage by scour to the structure and nearby structures, back up the river, collect more debris and are a greater hazard to any emergency or other craft in the river. The footage also shows areas where the main river channel has been nibbled away by development. These two aspects may only backup the river by a few hundred millimetres, that can be the difference between water over or under the floorboards for upstream home owners.
- Buyback - for where no other options are possible.
- Flood alleviation schemes tend to be designed for around 1 in 100 year flow. In some areas it is the economic limit. Larger floods will occur. Consideration of larger floods is essential during design to check vulnerability of the proposed works. For example, levees designed with say a 1m or 0.5m freeboard will be use to bank top at some stage. A slightly lower length of levee, protected against scour by Gabion mattresses<sup>(6)</sup>, concrete or sheet steel piling allows controlled rather than uncontrolled over topping. 'China' pumps<sup>(7)</sup> pumping out at a point downstream end of a protected area may limit flooding in such cases.
- If one builds a skyscraper in New York, the plans must include a demolition plan showing that the structure can be demolished safely without impact on neighbouring property. Likewise flooding should be considered with all river development including safely securing or removing floating structures during floods.

- Impact on other structures - at state borders flood works approved by different authorities can impact on each other - hence the need for single catchment control.
- All new critical infrastructure such as power, water, hospitals and schools to be above flood level or have flood defences. New sewerage works & pumping stations are already required to be above flood level; back to planning again.
- Planning - if we are serious about reducing the impact of floods, the river manager must have power of veto or add conditions on all development in and alongside a river including land clearing.

Flood alleviation (mitigation) schemes and measures don't received much discussion in Queensland. Only a few communities have them. As flooded communities calculate the cost, those with flood defences could make known the estimated savings to show the value of such works. It will help support the need for flood alleviation studies with cost benefit analyses for elsewhere.

These thoughts are offered for consideration in relation to planning for future floods.

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References:

- 1 Lynmouth UK, August 1952, 34 people died, 420 homeless, >100 buildings destroyed or damaged along with 28 bridges, 38 cars washed out to sea.
- 2 Exeter, county town, Devon, UK, >1000 properties flooded; Tiverton 500; Oct. & Dec. 1960.
- 3 Wide Bay 2020 Project, DLGP, Queensland 1996-1998
- 4 Alexander, N. et al. *Australia: State of the Environment 1996*, State of the Environment Advisory Council, CSIRO Publishing, Collingwood, 1996, 2-17.
- 5 USGS
- 6 Gabion boxes & mattresses - wire mesh boxes & mattresses filled with stone.
- 7 'China' pump - low cost, low head, high volume pumps.

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