02/Feb/2017

**Tasmanian Flood Enquiry**

**Submission from Wayne Soutter**

I apologise for the lateness of this submission. I was overseas when submissions were called for. Upon my return I read an ABC web article which referred to the enquiry and provided a link to the submissions. I thank you for permitting me to provide this submission.

Being late, has in this instance, given me the advantage of having been able to read the submissions of others.

*My background:*

My name is Wayne Soutter.  I am a retired hydrographer/hydrologist.

Prior to retirement in mid 2012, I was Hydro Tasmania’s *Hydrographic Data Coordinator.*

I was the *New Zealand National Field Hydrologist* working for the Quality Assurance section in the Hydrology Centre in Christchurch, New Zealand from 1984 to March 1986. Prior to 1984 I was the manager of a regional hydrological field party.

I was employed as a hydrographer/hydrologist for more than 40 years.

Since retirement I have acted as a casual hydrological IT consultant to Hydro Tasmania’s Dam Safety section.

I am familiar with all the hydro-meteorological installations  (including raingauges, river sites, lake sites and spillways) run by Hydro Tasmania. I am very familiar with the Meander, Mersey and Forth catchments.

I co-authored (with Grose and Parkyn) an internal Hydro Tasmania report “Forth River Flood Warning System Review” in 2001.

I have written this submission because, after reading the initial submissions to your enquiry, I feel that there are issues outstanding; Issues that none of the other submissions touched upon.

**1. The meteorological event.**

This was a weather event where the prevailing atmospheric conditions funnelled moisture laden air on to a particular geographic location for days.

Greater rainfall totals and intensities occur when the air is warm (warm air can carry greater moisture loads) and rainfall totals and intensities may be further increased by orographic effects such as the rain bearing cloud having to “climb” over mountain ranges or plateaux.

This event was unusual. It was more than just a “normal East Coast Low”.

1. It originated in waters off Queensland and travelled down the East Coast of Australia leaving widespread flooding in its wake.
2. The system could be seen, and anticipated, for days before the associated rain made landfall in Tasmania.
3. It was a very elongated system (North to South). It was picking up warm moist air from tropical latitudes and funnelling it down to Tasmania.
4. The warm air temperatures and the warm seawater off the East Coast of Australia (see submission *BoM\_1\_John\_Bally.pdf* for discussion on air and seawater temperatures) allowed the system to take up, and hold, much more water than one would expect for a winter storm. [Note that warmer air temperatures and warmer sea temperatures are a consequence of anthropogenic climate change. We can expect to see more such storms in the future].
5. The orographic effect came into play as the warm moisture laden air had to climb to clear the Northern tiers - thus dropping the rain, at its most intense, along the top edge of the tiers (e.g. in the headwater catchments of the Meander, Mersey and Forth rivers).
6. I have made much of the warmth of the atmosphere. *Proof* - The Sunday night 5/6 June, the night of the intense rain was, according to BoM, the warmest June night ever recorded in Hobart. [A “close to home” illustration of climate change in action - more severe weather events occurring. As predicted by climate scientists].

In summary, the event was unprecedented. Warm sea temperatures and air temperatures contributed to non- winterlike conditions. These conditions allowed the formation of a weather system that literally doused Northern Tasmania with extreme rainfall over a long period.

As the BoM states in submission *BoM\_1\_John\_Bally.pdf* . “*An estimate of the amount of moisture in the atmosphere, given by precipitable water, was close to the highest on record for June at several measurement locations along the east coast of Australia. A new June record was reported at Hobart Airport on the evening on Monday 6 June*”.

**2. Hydro Tasmania’s (HT’s) role.**

HT involvement;

1. HT are the power generators and it is their infrastructure, (lakes, dams , spillways, generators etc.) that are located in the headwaters of most of the major river catchments that were affected by the floods. HT are seen by many Tasmanians to “control” the spills and river flows.
2. HT own and fund the vast majority of the hydro-meteorological data sites (rain, river flow, dam spill etc.) within those upper catchments. BoM has a very limited presence.
3. The HT sites are telemetered. The data arrives at HT headquarters in Hobart and is archived at regular intervals. (see submission *Hydro\_5\_Forecasting\_Alerts\_Warnings\_.pdf*).
4. HT, by automatic processes, transmit the hydro-meteorological data, that is of interest to the BoM, directly to the BoM office in Hobart at 30 minute intervals.
5. HT run a cloud seeding program. HT cloud seeded in NE Tasmania on the morning of Sunday 5 June.

I will comment on each of tHT’s roles under separate numerical headings.

**3. *HT are the power generators and it is their infrastructure, (lakes, dams , spillways, generators etc.) that are located in the headwaters of most of the major river catchments that were affected by the floods. HT are seen by many Tasmanians to “control” the spills and river flows.***

Under normal conditions, HT control the dam outflows by adjusting the power generation and thereby altering the rate of outflow from the power station.

What most people do not understand is that all the generation lakes in Northern Tasmania have un-gated spillways. Once the lake starts to spill, HT have basically no control of the outflow. This point is made in Section 2 of submission *Hydro\_4\_Water\_Storage.pdf*. I quote from the HT submission: “*The storages upstream of the areas affected by the June 2016 floods in the Mersey, Forth, Ouse and Trevallyn rivers have fixed crest (ungated) structures, which do not have operable spillways.. This means that it is not possible to hold back or release flood waters by opening gates in the dam*”.

You will remember that, at this time, the Basslink cable was out of commission and that HT could not sell excess power (water) to the mainland. This meant that HT’s storage position was rising (i.e. that the lake levels for most lakes had been slowly rising over the months and weeks before the event).

Some of the submissions seem to believe that HT were “deliberately” holding back the water in the lakes in order to optimise the dollar value when Basslink was reconnected. They seem to think it was part of some Machiavellian scheme to enhance HT’s coffers and that the floods were exacerbated by this sharp practice. Nothing can be further from the truth. Quite simply, HT could not sell the excess power (water) because Basslink was down. The lakes filled naturally. Why would HT want to waste water? Water in storage is money in the bank!

How could HT get rid of this water without generating? We have already established the spillways are un-gated. There is no control. - [A qualification here in that some dams have extra valves that do allow relatively minor releases from un-gated spillways (e.g. Lake Trevallyn) but I am personally not aware of any such valves on the headwater dams involved in this particular flood event].

The notion of wrongdoing by HT in the way they managed the dams before and during the flood event, has come about because the general public thinks that all dams have gated spillways and that releases from all dams are controllable. This is untrue. All the dams involved in this event are un-gated and the spills are not able to be controlled. The notion of wrongdoing by HT may appeal to conspiracy theorists but it is a furphy and it should be laid to rest.

**4.  *HT own and fund the vast majority of the hydro-meteorological data sites (rain, river flow, dam spill etc.) within those upper catchments. BoM has a very limited presence.***

HT have an extensive network of raingauges sites, river level/river flow sites and lake level/spillway flow sites across the headwaters of the major rivers that originate in the tiers. The extent of the network and the geographic location of these sites is viewable on the interactive map on HT’s web site.

BoM have a very limited presence in these headwater areas.

The HT data is telemetered back at regular intervals. Some of the data is near real time. Other data can be delayed by up to 30 minutes (as discussed in submission *Hydro\_5\_Forecasting\_Alerts\_Warnings\_.pdf*).

As the data arrives at HT it is archived to an HT purpose-built hydro-meteorological database called TimeStudio. [I was, before retirement, the TimeStudio Data Manager and I am a TimeStudio superUser].

Automatic TimeStudio processes check the data, run models and, where necessary, notify HT staff, via SMS with attached pdf plots of rainfall, river flow lake level and spill etc.

HT staff take whatever action is necessary to protect the public, protect assets and/or deploy dam safety engineers or flood gauging parties etc. but it is NOT HT’s role to notify the general public. Flood warnings are the reponsibility of BoM. (See section 1 of submission *Hydro\_5\_-\_Forecasting\_Alerts\_Warnings\_.pdf).*

**5. *HT, by automatic processes, transmit that hydro-meteorological data to the BoM in Hobart at 30 minute intervals.***

HT’s TimeStudio database automatically transmits that data to the BoM at 30 minute intervals. There are time lags (discussed in HT submission *Hydro\_5\_-\_Forecasting\_Alerts\_Warnings\_.pdf*). Timelags of this order (perhaps an hour maximum) are not really an issue if using rain as the flood indicator. The rain will show the preliminary trends some hours before the response in the lakes and downstream river channels. Computer based rainfall runoff models predict downstream flows.

I am not familiar with what happens to the data after it is received by BoM. Delays caused by potential data ingestion lags and model run times are a matter for BoM and should be taken up with them.

**6.  *HT run a cloud seeding program. HT cloud seeded in NE Tasmania in the morning of Sunday 5 June.***

Cloud seeding has been performed by HT for many years. It was well established when I arrived in 1986. It continues to this day.

The cloud seeding track for that day is presented in (submission *Hydro\_3\_Cloud\_Seeding.pdf)*

The cloud seeding path was at the eastern end of the tiers. The clouds were seeded beween approximately 11:00hrs and 12:30hrs. The wind was from the NE at 40 knots.

Of note is that the rainfall event had started approximately 11 hours previous to the cloud seeding event.

A rainfall graph, [Soutter\_1\_Web\_Rivers\_OuseRvUpper.pdf] sent with this document, shows, in the bottom window, the cumulative rainfall for Lake Augusta {blue trace}. One can visually interpret the rainfall intensity.

* It started raining at about 21:00hrs on Saturday 4 June.
* Intensity increased dramatically at about 08:00hrs on Sunday 5 June and held at this rate until about 21:00 hrs Sunday 5 June.
* The intensity decreased after 21:00hrs Sunday 5 June.
* *Interpretation*: The cloud seeding event was between 11:00hrs and 12:30hrs on Sundau 5 June. From the rainfall plot, there was no observable difference in the rainfall intensity at Lake Augusta until 8 or 9 hours *after* the cloud seeding event. AND the change in intensity, when it did occur, was in the negative. The intensity actually decreased! If cloud seeding had “worked” the expectation is that the intensity would increase. - Thus no visual evidence of cloud seeding actually increasing the rainfall intensity.

HT have presented a report (submission *Hydro\_3\_Cloud\_Seeding.pdf).* which says that cloud seeding would have made no difference to rainfall totals over the event. My visual interpretation of the data from the Lake Augusta raingauge supports that conclusion.

**7. My actions during the event.**

I know it sounds silly, but rainfall and river flow were a large part of my life for over 40 years. I therefore take a very keen interest in extreme rainfall events and the ensuing floods.

I built (or rebuilt/upgraded) many of the HT hydro-meteorological recording sites in the north of the state. I am intimately associated with them. They used to be “my babies” and the data from them goes into the TimeStudio database that I used to manage. Even the TimeStudio plots that I observed and downloaded from the HT web site during this event were plots that I had initially built. I might be retired but I was much more than just a casual observer! { I downloaded 90 plots during the event].

I was aware from Friday 3 June that the BoM was issuing rainfall alerts for the coming days. I tracked the rain bearing system down the East Coast of the mainland using mobile phone apps such as Weatherzone.

I could tell from the extreme length of the system and the rainfall totals it was generating on the east coast of the mainland that Tasmania was in for a big event.

When I listened to the ABC on the morning of Monday 6 June I found that an elderly gentleman had, unfortunately, been swept away in the Ouse River at Ouse township.

I immediately checked my apps and the HT site on the web. I found an “Aladdin’s cave” of extreme data. I was so enthused and absorbed by the data that I did virtually nothing else for most of that day other than track the events unfolding before my eyes! [It was a wet rainy day anyway].

An Action Diary for Monday 6 June 2016 is presented on the next page.

Action Diary for Monday 6 June 2016

| TIME | **ACTION and RESULT** |
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|  |  |
| --- | --- |
| 07:55 | ACTION: First download of HT data from web. [Soutter\_2\_Web\_Rain\_UPPERMERSEY-3.pdf] sent with this document.  RESULT: Amazed! Fisher above Lake Mackenzie rainfall. Event started just before midnight on Saturday June 4. By midnight June 5 there had been about 400mm and at the time I was looking there was some 450mm for the event.  The most that I could recall at Lake Mackenzie (since 1986) was some 200mm in 24 hours. This was twice that. |

| 07:55 to 08:56 | ACTION: Downloading further data graphs from HT website. |
| --- | --- |

| 08:56 | ACTION: sms to ABC newsroom re alerting them to “amazing rainfalls”. Offered to show them how to access the HT web data.  RESPONSE: No response from ABC |
| --- | --- |

| 08:56 to 09:30 | ACTION: Downloading further data graphs from HT website. |
| --- | --- |

| 09:30 | ACTION: Rang HT’s *Hydrographic Data Coordinator.* [A position that I held prior to my retirement]. Discussed rainfalls, floods and spills etc. Talked particularly about the large spill from Lake Augusta that would end up at Ouse township.  RESULT: See next entry |
| --- | --- |

| 09:30 to 09:56 | ACTION: Mulled over the implications of the flood crest coming down the Ouse. Downloaded further data graphs from HT website.  RESULT: Decided to contact SMS re Ouse flood. |
| --- | --- |

**8. I interrupt the Action Diary to discuss the flood event in the Ouse.**

The Ouse was of some interest. A flood crest at Ouse township early in the morning of Monday 6 June had swept away an elderly gentleman and a larger flood was to come. i.e. The spill from Lake Augusta, when it arrived at Ouse township, was going to easily eclipse the flood crest that had occurred earlier that morning.

The Ouse is, hydrologically, a difficult river in that it has two quite separate sub catchments that can function independently.

The Shannon sub catchment extends northwards to the Lagoon of Islands and Miena. The Ouse/Lake Augusta sub catchment drains country many kilometres further to the west and extends much further north. It obviously includes the catchment of Lake Augusta and therefore reaches out (north and west) to the boundary of the adjacent Mersey catchment. The channel length of the Lake Augusta sub catchment is much greater than that of the Miena catchment. This leads to time differences in flood peaks.

As an example: If we had a blanket rainfall event where the same amount of rain fell simultaneously over both catchments then, at Ouse township, there would be an initial flood peak as the water from the Lagoon of Islands/Miena sub catchment arrived, followed some hours later, by another flood peak when the Lake Augusta sub catchment flows arrived. The second flood, arriving on the recession of the initial flood, will in all probability, be larger in magnitude than the initial flood. [The long narrow river channel does cause some attenuation (channel storage) of the flood peak]. If there is more rain in the Lake Augusta sub catchment then the second flood will definitely be of higher magnitude.

The remoteness of the Lake Augusta area and the time lag between the peaks from the two sub catchments can be dangerous. Residents of the lower Ouse Valley can experience local rainfall, get an initial flood peak from the Lagoon of Islands/Miena sub catchment and think that it is all over. Many would be unaware that a second and far larger flood peak could be coming down the upper Ouse from the Lake Augusta sub catchment.

I could monitor the flows down the upper Ouse from Lake Augusta sub catchment by using the data on HT’s website. It was made a little difficult because the recording site at Waddamana was completely wiped out before the peak, the site below the confluence of the two sub catchments (Ouse at Ashton) had an electrical fault and a 3rd (Ouse at 3b Weir -just upstream of Ouse township) suffered a gas leak and was taken off the HT web displays.

In this flood event, the rainfall in the headwaters of the Lake Augusta sub catchment was extreme. My estimate, from the recording sites still functioning in the upper catchment, was that the second peak at Ouse township, would occur in the late afternoon/early evening of Monday 6 June and be 2 or 3 times the magnitude of the peak that had passed earlier that day.

I was concerned; this was the “perfect storm”. An initial flood, a sigh of relief and then, like the sword of Damocles, an unexpected and much larger second flood. A recipe for disaster. AND there was no warning on the ABC radio of any flood on the Ouse.

In my Actions Diary it states;

| 09:30 to 09:56 | ACTION: Mulled over the implications of the flood crest coming down the Ouse. Downloaded further data graphs from HT website.  RESULT: Decided to contact SES re Ouse flood. |
| --- | --- |

Why did I decide to contact the SES directly? Because exactly this scenario had happened a few years before. Whilst I had been working for HT, I had recognised a major flood coming down the Ouse from the Lake Augusta sub catchment. There were no published flood warnings. I rang the BoM hydrologist and alerted him. The flood had been overlooked. BoM published a subsequent flood warning.

It appeared to have happened again. I decided to go direct to the SES.

**8. Action Diary recommences on next page.**

Action Diary for Monday 6 June 2016

| **TIME** | **ACTION and RESULT** |
| --- | --- |

| 09:56 | ACTION: Rang SES on their public number. Operator told me that somebody would ring me back |
| --- | --- |

| 10:01 | RESULT: Gentleman from the SES called me. He did take my explanation of this second major flood peak on the Ouse seriously. [Sorry I cannot remember his name]. I advised him to alert the SES at Ouse. He said that he could take no action until he had an official warning from BoM and he advised me that I should ring BoM. |
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| 10:06 to 10:07 | ACTION: Downloaded further data graphs from HT website. |
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| 10:07 to 10:10 | ACTION: Rang BoM twice on public number. Line overloaded. Advised that call would be dropped off. |
| --- | --- |

| 10:15 | ACTION: Rang SES person on direct number and advised that I could not contact BoM via public line but would try alternatives.  ACTION: Downloaded further data graphs from HT website. |
| --- | --- |

| 10:16 | ACTION: Rang HT’s *Hydrographic Data Coordinator* and explained the circumstances. I asked the HDC if he could contact the BoM on a direct number and warn them of the flood coming down the Lake Augusta sub-catchment. HDC said that he would get a Generation Operations Controller to do it.  ACTION: Downloaded another 14 data graphs from HT website between 10:15 and resolution at 14:42 |
| --- | --- |

| **TIME** | **ACTION and RESULT** |
| --- | --- |

| 12:52 | ACTION: Rang SES contact on direct number. I was told that a flood alert had been received and SES staff were being deployed at Ouse. |
| --- | --- |

| 13:27 | ACTION: SMS message to ABC radio. They had just broadcast the flood warnings. The Derwent catchment had been upgraded to “Major flood” BUT there was no mention on the radio bulletin that it was the Ouse that was the subject of the warning. It was not until one opened up the BoM’s press release that one realised that the “Major flood” was the Ouse flood.  I advised ABC of this and suggested that they open the press release and read out the flood warning on the Ouse.  RESULT: The ABC understood. At the next broadcast of warnings (around 14:40) they did read out the Major flood on the Ouse. This was the first on-radio advice Ouse Valley residents received. This was some five hours after I had first rung the SES. |
| --- | --- |

| 14:42 | ACTION: SMS message to ABC radio to congratulate them on reading out the whole of the flood warning message. Not just “Major Flood in the Derwent Catchment”. |
| --- | --- |

| 14:42 | End of diary. Resolution. I had succeeded in alerting Ouse Valley residents.  Note that the second flood peak caused the Ouse River bridge on the Lyell Highway to be closed and houses were evacuated in Ouse township. |
| --- | --- |

**9. The role of the BoM during the flood**

Many of the submissions to the flood enquiry pointed to the ‘’lateness” of the warnings they received. It is BoM’s agreed role that they are the sole provider of official flood warnings. Others such as HT provide data to the BoM but that is all they do. (See section 1 of submission *Hydro\_5\_-\_Forecasting\_Alerts\_Warnings\_.pdf).*  BoM call the warnings - thus it is pertinent to look closely at how BoM managed such an extreme event.

Points to ponder:

* Many who provided submissions to this enquiry perceived the warnings as *late.*
* BoM had to be prompted to declare the Ouse warning.
* On the ABC radio, BoM meteorologists were saying that the flooding was restricted to north of a line between Strahan and Coles Bay. They were still saying this even after the hydrologists had declared the flood on the Ouse. Ouse is below that line. The information being broadcast at that time was misleading.
* BoM is composed mainly of meteorologists but there is a hydrology section in Hobart. During flood events the hydrologists man what they term “the flood desk”. They receive data from BoM sources and other data providers such as HT. They ingest this data into their IT system and run hydrological models to predict river levels. The hydrologist on duty publishes the flood warnings when necessary. Note that this flood desk is not normally manned 24/7. It is manned when needed.
* BoM have provided a timeline of their flood warnings. [Section 4 of submission *BoM\_1\_John\_Bally.pdf*], but we simply do not have enough information about the background processes of the BoM hydrology section. Their role in this flood is not fully understood.

Questions that spring to mind.

Upper catchment data comes primarily from HT at 30 minute intervals. Is the BoM data ingestion process automatic? How frequently does it run? How long does it take to process the data?

Were there any problems with the ingestion process or the physical running of BoM’s hydrological models during the flood event.

Are the models capable of being run concurrently or can only one model be run at any given time?

How are the hydrologists alerted of particular events such as extreme rainfall totals? Are there automatic alerting processes such as those used within HT?

Why was the Ouse flood overlooked?

The extreme rainfall event started at about 2200hrs on Friday 4 June 2016. The intensities started to ease at about 0800hrs on Monday 6 June. The extreme intensity rate therefore ran for some 34 hours. Much longer than “normal”.

An analysis of a log of the timing of the flood warnings (submission *Hydro\_4\_Water\_Storage.pdf,*  page 9 ) suggests that there may have been times when the BoM Flood Desk was unmanned. Below is a table containing a selected time period from that log. Comments are the authors.

|  |  |
| --- | --- |
| Saturday 4 June @ 4:20pm | Forth river declared as minor flood.  COMMENT: Last warning for the day. No further action until 12:44 pm on the next day (Sunday). Looks like the flood desk may have been unmanned from perhaps 5pm on the Saturday night until noon on the Sunday. |
| Sunday 5 June @ 12:44pm | North Esk river upgraded to moderate flood. |
| Sunday 5 June @ 4:15pm | Flood watch broadened to “all Tasmanian river basins” |

| Saturday 4 June @ 4:20pm | Forth river declared as minor flood.  COMMENT: Last warning for the day. No further action until 12:44 pm on the next day (Sunday). Looks like the flood desk may have been unmanned from perhaps 5pm on the Saturday night until noon on the Sunday. |
| --- | --- |
| Sunday 5 June @ 4:16pm | Mersey river upgraded to major flood |
| Sunday 5 June @ 5:14pm | Forth river upgraded to moderate floor |
| Sunday 5 June @ 9:58pm | Meander river upgraded to major flood |
| Sunday 5 June @ 10:36pm | Derwent (including Ouse) declared as minor.  COMMENT: Last warning for the day. No further action until 06:25am on the next day. Looks like the flood desk may have been unmanned from perhaps 11pm on the Saturday night until around 6am on the Sunday. |
| Monday 6 June @ 6:25am | COMMENT: Sudden flurry of alerts. (Consistent with the flood desk re-opening about 6 am). 3 majors and 1 moderate within 2 hours.  6.25am North Esk upgraded to Major Flood  7.21am South Esk upgraded to Major Flood  08.05am Macquarie upgraded to Moderate Flood  08.37am Forth upgraded to Major Flood  On the timings above, it appears that the Forth river was the last river to be analysed/classified. Its flood warning (major) went out at 8:37am. |

Was the flood desk manned by hydrologists 24/7 over the event period? Is lack of hydrological staffing continuity or resources associated with the perceived lateness of the warnings? If it was not manned 24/7 by hydrologists (with models being run) can BoM provide a roster showing the times that the flood desk was not manned by hydrologists?

**10. BoM flood warnings: Catchment and River naming conventions**

The Ouse flood warning is not a standalone flood warning in its own right. BoM package it up and embed it in a Derwent Catchment warning ABC radio bulletins broadcast only the headline *Derwent Catchment* warning.

I presume that this would also be the same case for the Clyde River. Why is this so? I know that the Ouse and the Clyde are tributaries of the Derwent but so is the Jordan and the Jordan gets its own individually named warning.

The Ouse and the Clyde may *technically* be part of the *Derwent Catchment* but they deserve warnings under their own individual river names. Imagine a major flood on the Clyde that wiped out Bothwell and Hamilton and the only warning on the radio was “Major flood warning for the Derwent Catchment”. Even upping it to “Extreme flood warning for the Derwent Catchment” (not that such a category exists) would not alarm the people of Bothwell! This naming anomaly is dangerous. It affects the way that affected persons respond to the flood warnings (they don’t respond- they don’t know that they are affected!). The naming convention is a danger to both property and human life. It should be addressed.

**Conclusion.**

**I ask that the enquiry;**

**(a) Consider my submission.**

**(b) Formally request the BoM for a response to the questions that I have raised in Section 9 of this submission. They are generally questions relating to the manning and operation of the BoM flood desk.**

**(c) Formally request the BoM for a response to the issues that I have raised in Section 10 of this submission. Namely that the catchment and river naming conventions used within the BoM flood warning system do not fully alert the riparian dwellers, within some sub catchments, to the flood danger.**

END