GILBERT SUTHERLAND

11 March 2011

Queensland Floods Commission of Inquiry
PO Box 1738
Brisbane QLD 4001

Re: Submission to Queensland Floods Commission of Inquiry

Dear Judge,

Background
This submission has been made in response to the invitation to interested parties by the Queensland Floods Commission of Inquiry (Commission) to make submissions that relate to the Terms of Reference of the QFCI.

In accordance with its terms of reference, the Commission will inquire and report on a range of topics including:

- preparation and planning by federal, state and local governments, emergency services and the community;
- private insurers and their responsibilities;
- all aspects of the response to the 2010/2011 flood events, particularly measures taken to inform the community and protect life, private and public property;
- measures to manage the supply of essential services;
- adequacy of forecasts and early warning systems;
- implementation of systems operation plans for dams; and
- land planning.

The general issues raised in this submission relate to the flood preparedness in Queensland for the next wet season (September 2011 – March 2012).

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The particular issues raised in this submission relate to the operation of the Wivenhoe Dam and flooding downstream of the dam, with reference to the rainfall events of January 2011 and the historic hydrology relevant to the Brisbane River system. This has relevance to the last three topics listed above.

Introduction

It is critical, in the assessment of the rainfall, runoff, storages and discharges in a particular region, that they are assessed in an integrated way. This compels us to understand the interaction between the elements and the time and event related variances in the interactions. The interactions are often significantly influenced by human intervention, such as in infrastructure and land development and in decisions made concerning the actions, locality and movement of people. In the assessment of these elements in respect water supply reliability and the mitigation of flood damage, that the additional issue of risk must be clearly understood. Risk is, in turn, determined for many different scenarios and timeframes by the four elements listed above.

The extent to which these considerations are assimilated into management plans for land development, infrastructure development, asset operation and maintenance, and community awareness programs is dependent entirely on statutory regulations, the obligations of institutions and the needs of communities in a particular region.

It is the purpose of this submission therefore, to outline issues that we believe are critical for the Commission in respect of their consideration of the events of the wet season in Queensland in 2010/2011 and how the experiences from these events can help define new practices to improve long-term water security and reduce loss of life and damage to property.

Rainfall and runoff

Extreme, high rainfall events are typically the result of numerous, concurrent conditions, which exacerbate what would otherwise be considered a normal event (with reference to historic records and mean annual/monthly/weekly/daily characteristics).

The weather events that severely affected South East Queensland in January 2011, developed initially over South Australia in a trough which moved north-east culminating in significant rainfall over the Sunshine Coast sub-region, particularly from 5 January 2011 to 6 January 2011. A second trough moving east over Victoria slowed the dissipation of the first trough in South East Queensland and resulted in a new trough developing on 7 January 2001, stretching from Noosa in the north-east to Warwick in the south-east. This trough drew warm, moist, coastal air on-shore causing significant orographic rainfall on the ranges east of the Sunshine Coast. The runoff from this rainfall flowed both east and west of the divide, and much of that that flowed west, was in the catchments of the Somerset and Wivenhoe Dams. This weather system dissipated to some degree over the 8 January 2011, but began to reform on 9 January, again on a north-east to south-west axis, and was extensively developed by mid-morning on 10 January 2011. The catastrophic cloud burst over the ranges at Toowoomba from 12-noon to 15:00 on 10 January 2011 was a localized event made possible by the regional weather pattern, but triggered by unique, localized conditions.

The trough remained static and strengthened through 11 January 2011, increasing precipitation significantly in the south-west and the catchments of the Bremmer River and its tributaries. By 00:00 on 12 January 2011, the trough had all-but dissipated.

The purpose of this explanation is to illustrate the time-variance of rainfall, the significant localized differences possible and the relationship between rainfall and runoff.

It is important to note the distribution of rainfall recorded in rain gauges noted in the BOM records for the period from 1 January 2011 to 12 January 2011:

- The highest rainfall totals occurred in the ranges west of the Sunshine Coast, eg. Peachester (863.9mm), Maleny (795.6mm) and Cooroy (696mm);
- The Esk Post Office gauge (obviously upstream of Somerset Dam) recorded 435.2mm;
- The Toowoomba Airport gauge registered 401.2mm, most of which was recorded after 7 January 2011. (It is not known to G&S what was recorded for the day on 10 January 2011);
- The Somerset and Wivenhoe Dam gauges recorded 371.2 and 370.4mm respectively;
- The gauges in the south-west typically recorded between 200m and 300mm, eg. Moogerah Dam (306.6mm), Amberley (259mm), Boonah Alert (254mm), Beaudesert Alert (232mm) and Warwick Alert (170mm). Due to the development of the weather systems, most of the rain in the south-west occurred from 9 -12 January 2011.

This rainfall distribution and the periods of precipitation illustrate the following:

- The extreme inflows into the Somerset and Wivenhoe Dams on 10 and 11 January 2011 were the result of rainfall in the week prior to 10 January 2011 in the catchments;
- The peak inflows to the Somerset and Wivenhoe Dams on 10-11 January coincided with the catastrophic precipitation in the Toowoomba ranges on 10 January 2011, which resulted in the rapidly developed, extreme flood peak down the Lockyer Creek from 10 to 11 January 2011. The decision to fully open all five sluice gates at Wivenhoe Dam at 18:00 on 11 January, meant the Brisbane River downstream of Wivenhoe Dam was conveying two peak events concurrently, although it has been stated that Seqwater attempted to reduce the Wivenhoe releases for a short period to limit the effect of the combined peak flow;
- The severe rainfall in the south-west regions that occurred from 10 to 11 January 2011 resulted in subsequent peak flows in the Bremmer River and its tributaries, which again, were concurrent with the peak releases from Wivenhoe Dam and the Lockyer Creek flows by then absorbed into the Brisbane River flows. The fact that the Bremmer River backwater levels caused severe flooding was therefore as much due to the period of precipitation in a very large catchment as due to the flow rate in

the Brisbane River (itself the result of the uncontrolled Lockyer Creek floods and the releases from the Wivenhoe Dam).

It is thus critical that both rainfall and streamflow gauges are established to provide real-time warnings of severe conditions. While costly to establish, streamflow gauging stations will indicate the extent of cumulative runoff upstream of storages, nullifying the uncertainties of runoff characteristics in a catchment (ie. issues such as ground saturation levels, effects of grasslands and afforestation, spatial distribution of rainfall in the catchment, etc.). Very little reference has been published thus far of the extent to which real-time streamflow data was used to manage the releases from Wivenhoe Dam, more emphasis being placed on the real-time level, which obviously leaves very little time for preemptive action.

Storages and discharges

In-stream impoundments (storages) serve to store water for staged use, subsequent to the inflow, and to attenuate flows (most obviously flood peaks) which would otherwise threaten lives, property and the environment downstream.

The hydrology used in water supply security modelling of large storages (eg. Wivenhoe Dam) is typically monthly data, whilst the flood retention and flood release (or overflow) characteristics are modelled on a daily, hourly or instantaneous basis. These are two vastly different determinations and the hydrology used for each needs to reflect these differences. In terms of the operating rules for storages, there are rules for water supply security objectives and different rules for flood mitigation objectives.

The weather events of January 2011 clearly transformed the operation of the Wivenhoe Dam from a water supply security basis to that of flood mitigation, and ultimately, dam integrity preservation (to prevent the fuse plugs at Wivenhoe dam from breaching). One must also caution in determining rules for operation based on a particular event – originally, the rainfall and runoff reference for Wivenhoe Dam was the 1974 event, which in many respects was entirely different from the events of January 2011. The water supply security capacity of storages are assessed on the basis of 'reliability of supply', introducing the issue of risk - the more the storage, the greater the assurance of supply. The characteristics of reliability (or risk) for a particular storage are developed on a whole-of-catchment basis, using stochastic hydrology generated form the historic rainfall and runoff records. Using a particular event for the development of storage operating rules means the probability of that event needs to be determined, and will define the performance reliability benchmark for that particular storage (dam) and system.

The lowering of the maximum allowable operating level at Wivenhoe to the "75%" level (a so-called short-term strategy) has a major impact on the long-term water supply security performance, and the basis of when and why the maximum operating storage reverts to the 100% level needs to be carefully analysed. It is possible that the level may not recover above the 75% level before the onset of the next drought sequence, thus affecting long-term supply reliability.

We have also attached to this submission an earlier letter from this firm concerning the treatment of the data in the initial days after the flood.

Gilbert & Sutherland would be happy to assist the Commission by either appearing and expanding on these points, or providing expert assistance to the Commission upon request. These services would be offered gratis, in this instance.

We trust this is acceptable. Please do not hesitate to contact this office if you require any further details or elaboration.

Kind Regards,

[redacted]

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Attachment 1 – Letter to the Australian Newspaper

GILBERT SUTHERLAND

17 January 2011

The Australian
GPO Box 4245
Sydney NSW 2001

Attention: The Editor

Dear Sir,

Re: 'Calamity "inevitable" after decision on low dam releases' (by Hedley Thomas, The Australian, 17 January 2011, p1)

As a practicing Water Resource Engineer with direct experience in the hydrology and operation of the Water Grid and the Somerset/Wivenhoe Dams, it is important to provide a measured response to the commentary that the devastating floods downstream of the Wivenhoe Dam were somehow exacerbated (or even caused) by the inappropriate operation of the flood management system.

Given the devastation and heartache being felt by so many, it is highly irresponsible to then imply, without any credible justification, that their suffering was either avoidable or due to the incompetence of others.

Since the flood peak, there has been neither the time nor the opportunity to properly review and validate the mountain of data recorded during what was, almost certainly, the most extreme rainfall and runoff event experienced in the past 100 years. At least some of the mechanical and electronic instruments have failed to keep pace or were damaged, thus yielding data unreliable and flawed. Any assessment using unvalidated data should not be given any credence and is, in itself, dangerous.

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Apart from any unprofessional use of unvalidated data to present outcomes for such important and life-impacting natural events, there is basic lack of understanding of the design and operation of Wivenhoe Dam.

Along with countless other water resource engineers, I was repeatedly questioned and challenged during the drought as to why we (as a region) did not make use of the flood mitigation component of Wivenhoe for storing water for water supply purposes. Those asking often repeated the same simple reasoning – here is all this unused storage 'going to waste'. What possible problem could there be of using some of that flood storage for water supply?

The nation has just witnessed the very reason why Wivenhoe was specifically designed and is very carefully operated as a flood mitigation storage, even when very recent experience in an extreme drought shows that any rainfall-dependent water supply is a vulnerable and valuable resource.

In drought and flood, we have to carefully balance water supply with flood mitigation. We cannot (and must never) erode the flood storage component of Wivenhoe for water supply and vice versa. These decisions must be based on careful analysis and well-founded science, not on fag-packet arithmetic.

The operational rules of all dams should be reviewed when extreme events occur. Anyone who is even remotely aware of the diligence and professionalism displayed by those in the Government Flood Room will want them heavily involved in the review – not the armchair critics who only appear when it suits them.

Yours sincerely,

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Director/Principal Water Resource Engineer
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Personal information removed