Submission to the Senate Inquiry into Additional Water Supplies for South East Queensland - Traveston Crossing Dam

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Summary

1. Introductory sections set out the submitter's understanding of SEQ's urban water consumption and the submitter's understanding of rainfall patterns in SEQ.

2. Comments regarding the proposed Traveston Crossing Dam are made, including comments upon the claimed ability of the dam to yield 150,000 ML/yr for use in SEQ. Environmental, social and economic merits and detriments of the proposed dam are discussed.

3. Alternative options for SEQ water supply are discussed

 3.1 installation of rainwater tanks on all buildings in South East Queensland (SEQ),

 3.2 water recovery from sewage effluent ("indirect potable re-use").

It is estimated that implementation of these two measures would decrease SEQ's demand on its existing catchments by at least 41% without any further dam construction in SEQ. In particular, implementation of these options will forestall a need for the proposed Traveston Crossing Dam for the foreseeable future.

The proposals contained in this submission differ from those of DNRM (2004, 2005) and Turner et al. Neither DRNM (2004, 2005) nor Turner et al (2007) consider the mandatory installation of rainwater tanks, nor do they consider maximising the recovery of potable water from sewage effluent. The Western Corridor Recycled Water Scheme Stages 1 and 2, as presently planned, will recycle 78,000 ML/yr of water altogether.

1 Introduction

1.1 Use of reticulated water in SEQ.

The estimated residential population of SEQ in 2004 was approximately 2,780,000. The Cardno report estimates in the absence of restrictions, this population and its industries draw 480,000 megalitres of water per year (ML/yr) from SEQ's water storages. 60% of this is residential use, 10% is unaccounted for (firefighting, mains flushing, leakage), 15% commercial and 15% industrial and big users such as power stations.

240,000 ML/yr of waste water is treated in SEQ's Treatment Plants, and discharged offshore. At least 80% of this can be reclaimed using reverse osmosis, yielding 192,000 ML/yr of high purity water for re-use. (DNRM (2005), as quoted in "How to solve the water crisis without a new dam" August-

September 2006 issue of "Sunshine Coast Eco-News", http://econews.org.au/story3_8.php)

60% of 480,000 ML/yr (288,000 ML/yr) is used for domestic supply. Of this 288,000 ML/yr, 40% (~115,000 ML/yr) is either drunk, used for cooking or for personal hygiene. The other 60% (~173,000 ML/yr) is used for clothes laundering, toilet flushing and outdoor uses such as garden irrigation, swimming pool filling, car washing and so on; the only reason that this water is filtered, chlorinated and sanitised is that it is supplied via the same pipes as the water that is imbibed.

Table 1 summarises this understanding of uses to which reticulated water is put in SEQ. Water that is supplied to homes and is drunk, used for cooking or personal hygiene is classed as 'domestic imbibed'. Water that is put to other uses domestically is classed as 'domestic other'.

Table 1: uses for supplied water in SEQ

Application	Description	ML/yr	%
Domestic, imbibed	human consumption, bathing	115,000	24
Domestic, other	Lavatory flushing	58,000	12
Domestic, other	Clothes washing, garden uses	115,000	24
Commercial		72,000	15
Industrial		72,000	15
Non-accounted	Firefighting, mains flushing, leaks	48,000	10
Σ		480,000	100

'Domestic other' water (175,000 ML/yr) is not imbibed and therefore need not be treated to the same high standard. If an alternative source and supply network for this non-consumed water could be found, then demand on the existing reticulated network could be reduced by up to 175,000 ML/yr, (36% of total drawdown from SEQ's water storages.)

1.2 Changing rainfall patterns in SEQ

On 7 September 2006, Prof Ian Lowe was interviewed on ABC Radio National's "Life Matters" programme regarding SE Qld's water shortage. Prof Lowe stated that around one third of residential urban water consumption is for the purpose of flushing lavatories, and attributed the water shortage to lack of rainfall in SE Qld's water storage catchments, which he ascribed to 'climate change'

Rainfall data for the Wivenhoe Dam Catchment Area were punblished in the Courier Mail on 19 January 2007

- Long term average = 940 mm/yr.
- 2005 rainfall = 505 mm, 54% of long term average
- 2006 rainfall = 436 mm, 46 % of long term average.

The long term average is determined from historical data. However, increasing coastal urbanisation is likely to change rainfall patterns in SEQ, so that this 'long term average' rainfall will not be maintained over the next century. This change can be expected because moisture-bearing easterly breezes are now being uplifted by heat rising over the deforested urban areas of Gold and Sunshine Coasts, and Brisbane, instead of moisture-bearing breezes not being uplifted until they reach the ranges of the hinterland. The moisture content of those breezes now condenses above, and falls as rain upon those urban areas. By the time the breezes get to the water storage catchments, their moisture contents have been largely stripped out.

This is graphically shown on a map of SEQ, printed in the Sunday Mail of 6 August 2006, that compared rainfall in SE Qld since 2001 to average rainfall since records were kept, for all locations between Noosa and Coolangatta, and west to Toowoomba. The map shows that coastal urbanised areas have received 40-50% more rain than their long-term averages over the last five years, and hinterland water storage catchment areas have received 50-60% less rain than their long-term averages. It would seem that there has been as much rain in SEQ since 2001 as ever, it's just that the rain is falling on the cities, not in the adjacent water catchments.

The trend to increasing rainfall in coastal urbanised areas and decreasing in the hinterland water storage catchment areas is due to land use changes as described above. For planning purposes, these changes in rainfall distribution should be assumed to be permanent.

2 Comments regarding the Proposed Dam

2.1 Traveston Crossing Dam yield risks

The Cardno report states that a Water Resource Plan for the Mary River has defined the existence of a 'Strategic Reserve' yield from the Mary River of 150,000 ML/yr. The proposed Traveston Crossing dam is intended to make this reserve available for extraction. Under the present SEQ Regional Water Supply Strategy plans, 100% of this reserve is to be exploited in SEQ. Future changes to rainfall patterns in the Mary River catchment have not been considered in the SEQ Regional Water Supply Strategy.

It is understood that Stage 2 published maximum dam volume divided by total dam surface area shows that mean Stage 2 Traveston Crossing depth will not exceed 8m. Assuming approximately 1.5m evaporation per annum in that area, and declining rainfall in SEQ's hinterland, the dam is unlikely to ever be 100% full, or be able to supply the defined Strategic Yield of 150,000 ML/yr.

Evaporative water losses will be huge, especially when expressed in terms of water loss per day per million dollars of capital expenditure.

2.2 Equity issues regarding the proposal to construct a dam at Traveston Crossing

This dam would not be for the benefit of all Queensland people; it would be for the benefit of residents of SEQ only and deleterious to the Mary River valley to the extent that its capacity for self-support would be taken from it by sequestering of its life-supporting riverine water. Also to suffer would be anyone from outside the Mary River Valley who might have wanted to enjoy its amenities.

2.3 Environmental merits and detriments of the proposed Traveston Crossing Dam

Environmental merits of the Traveston Crossing Dam proposal: this submission contends that the Traveston Crossing Dam proposal has no environmental merit.

Environmental detriments of the Traveston Crossing Dam proposal: the proposed Traveston Crossing Dam will facilitate further removal of water from a river system that is already over-utilised.

The Mary River is already over-utilised, as the following paragraphs illustrate. Therefore, to make use of any of this so-called Strategic Reserve necessarily implies that a conscious decision has been made to wilfully allow the degradation of the environment of an area immediately adjacent to SEQ, of comparable size to SEQ.

That the Mary River is already over-utilised is shown by

1. the perceived need to install the Mary River Barrage in the Tiaro area, so that one-quarter of its entire length has been changed from a estuarine system to a largely stagnant salt inlet; for example, there were no mangroves at Maryborough when the town was settled, but they are now encroaching on Maryborough's port facilities due to drastic diminishment of fresh water flushing since European settlement.

2. consideration of water quality in the reaches immediately upstream of the Barrage. The absence of flushing results in elevated levels of agricultural run-off in those reaches, and accumulations of water weeds.

3. increasing salinity in the Great Sandy Straits and Hervey Bay.

Discussion of how and why each of these changes is environmentally detrimental is described by others. For example, discussion of detrimental effects upon the Great Sandy Straits and Hervey Bay can be found at www.OurGreatSandy.com.au.

The river is presently a continuous aquatic system from its headwaters to the Barrage (formerly from its headwaters to River Heads); the proposed dam will cut this system in two, creating a smaller aquatic system upstream of the dam, and a diminished, further degraded system downstream. Iconic species such as Mary River Turtle and Cod, and Queensland Lungfish will suffer further declines due to habitat loss and degradation of remaining habitat. The likelihood that alien species will enter and modify upstream ecology from the newly created lake cannot be discounted.

2.4 Social merits and detriments of the proposed Traveston Crossing Dam

Social merit of the Traveston Crossing Dam proposal: the Traveston Crossing Dam could serve as a recreational waterway when it is sufficiently full; as will be set out below, changing rainfall patterns in SEQ will render such occurrence increasingly unlikely.

Social detriments of the Traveston Crossing Dam proposal: farming in the vicinity of the dam will be severely curtailed, leading to social decline in the local community.

2.4 Economic merits and detriments of the proposed Traveston Crossing Dam

Economic merit of the Traveston Crossing Dam proposal: the increased availability of water to SEQ will alleviate water supply as a constraint upon economic growth in SEQ.

Economic detriments of the Traveston Crossing Dam proposal: farming in the vicinity of the dam will be severely curtailed, leading to economic decline in the local community. Environmental detriments extending along the entire length of the river system mentioned above have their economic analogues, so that primary productivity along the entire lower Mary River, as well as Hervey Bay's commercial fisheries, will be adversely affected. It is also likely that detrimental impacts will render Hervey Bay a less attractive resting location for migrating humpback whales, with a consequent reduction in the duration of the whalewatching season, and a decline in the number of whales to be seen at any given time; the quality of the Hervey Bay whalewatching experience will decline, as will its dependent tourism industry.

The Mary Valley will all but cease to be a source of fresh food for SE Qld, necessitating food import from further afield.

2.5 Summary of merits and detriments of the Traveston Crossing Dam proposal

There is no environmental benefit following from the proposed dam.

Extensive environmental detriment will be experienced throughout the area from Traveston Crossing to Hervey Bay, as discussed above.

The social merit of the proposal is that the Sunshine Coast hinterland might have an additional freshwater aquatic recreation area, provided the dam be reasonably full (there is evidence to suggest that this is less likely than a reading of State Government publications would suggest; see below).

The social detriment is the damage to farming communities in the vicinity, and to other communities throughout the length of the Mary River.

Any economic benefit will accrue in urban SEQ.

Extensive economic detriment will be experienced throughout the area from Traveston Crossing to Hervey Bay, as discussed above.

Support for these assertions may be found in the 2007 report commissioned by the Mary River Council of Mayors and written under the auspices of the Institute for Sustainable Futures, Sydney and Cardno, Brisbane, "*Review of Water Supply-Demand Options for South East Queensland",* by A. Turner, G. Hausler, N. Carrard, A. Kazaglis, S. White, A. Hughes and T. Johnson. In the Executive Summary of that report, to be be referred to as the "Cardno report" in this submission, they describe the proposed dam at Traveston Crossing as representing a “high total cost, high unit cost, high risk and high environmental and social impact option”.

3. Options for SEQ water supply

3.1 Installation of rainwater tanks on all buildings in South East Queensland (SEQ)

3.1.1 How much water can be harvested by installation of rainwater tanks in SEQ?

Mean and median annual rainfall at various weather stations in SEQ are shown in Table 2.

Table 2: Mean and Median Annual rainfall; annual rainfall is <decile in 90% of recorded years, and annual rainfall is < decile 1 in 10% of recorded years (source: Bureau of Meteorology website, Wivenhoe Catchment average Courier-Mail 19 January 2007)

mm/yr	mean	median	decile 9	decile 1
UQ Gatton	776.4	779.1	1025.3	473.2
Brisbane Airport	828.1			
Ipswich	877.2	844.5	1262.8	556.7
Wivenhoe Dam Catchment	940.0			
Tewantin Post Office	1007.6	1006.3	1317.4	676.9
Logan City Water Treatment	1058.1	1085.1	1625.3	667.2
Nudgee	1092.3	1128.4	1462.4	591.7
Redcliffe Council	1094.1	1097.7	1511.7	731.0
Maryborough	1155.6	1110.3	1573.0	728.5
Sandgate	1187.5	1143.5	1669.2	725.5
Redlands	1277.8	1264.3	1804.8	862.0
Hinze Dam	1321.5	1227.9	1902.0	847.5
Mt Tamborine Fern St	1553.1	1517.0	2180.3	951.9
Caloundra Signal Station	1575.3	1585.5	2017.1	1042.7
Coolangatta Airport	1590.9	1317.0	2039.3	888.0
averages	*1185.6*	*1187.8*	*1694.8*	*770.9*

It is recommended that rainwater tanks should be installed on all buildings in SEQ.

Harvested rainwater could substitute for reticulated water for flushing lavatories, outdoor uses and clothes washing. This would be done by supplying those services from the building’s installed rainwater tank; during unduly long rainless periods, the water level in the tank would be maintained at not less than, say, 5%, by level-controlled recharge from the building’s reticulated water supply.

In the absence of information of estimating the number of non-residential buildings in SEQ, the following discussion will concentrate on residential houses.

SEQ has a population of about 2,780,000, and unrestricted water demand of around 480,000 ML/yr (the Cardno report comments upon the elasticity of demand under restrictions, pointing that 480,000 ML/yr is a maximum estimate of demand at present population levels). The number of houses in SEQ is estimated to be 700,000 by assuming an average of 4 people per house. If each house has a roof area of 100 sq m (m^2), and rainfall across SEQ's urban areas is 1000 mm/yr, then each house could harvest 100 kL/yr. Over the entire SEQ region, this is 70,000 ML/yr, or 14% of total SEQ water demand, that could be harvested from roofs.

Note that this estimate does not include non-residential buildings; 14% is therefore an underestimate of the decrease in need for reticulated water that mandating rainwater tanks may bring about.

The Cardno report (Table 4.2, p. 38) assumes that 70 kL/household/yr could be obtained from urban SEQ's rooftops; that would be ~49,000 ML/yr overall, which is over 10% of total demand. The Cardno report assumes harvested rainfall to be 70% of the harvested rainfall in this submission; that is, in the work cited in the Cardno report, harvestable rainfall estimates are based upon decile 1 rainfall data, which have been historically exceeded in 90% of years for which rainfall data is exceeded. It is this submission's contention that the Cardno report's estimates of harvestable rainfall are excessively conservative.

3.1.2 Benefits proceeding from installation of rainwater tanks on all houses in SEQ.

1. Less water per capita will have to be supplied via the reticulated water supply system.
2. It is more likely that excess water from storm events will be harvested, thus reducing frequency and severity of stormwater loads. That is, frequency and severity of losses due to stormwater damage will decrease.
3. Stormwater volumes reporting to waterways will decrease, as will the damage and poll2.1.2ution associated with those volumes.
4. Remote, automated water extraction with its attendant detrimental effects upon the catchments from which the water is extracted (see above) would be replaced by increased local jobs for tradespeople, increased environmental awareness and self-reliance for the residents of SEQ.

   The Cardno report, in its discussion on Level of Service (p 18) refers to evidence that residents' attitudes may be amenable to this increased self-reliance, given the now widely acknowledged environmental problems facing Australia. The capacity of Australians to accept the reality and constraints of our own circumstances, and adapt accordingly, is among the Australian values championed by political leaders.

3.1.3 Funding mandated rainwater tanks

Fundamentally, home and building owners should pay for capital improvements to their properties.

Governments can facilitate this by not impeding rainwater tank installation; they can

1. Set GST rates to 0 for rainwater tanks (as for food)
2. Set sales taxes to 0 for rainwater tanks
3. Give rebates of, say, $2000 to all SEQ residents who install rainwater tanks and pipe their lavatory cisterns to them.
4. Increase water tariffs for all lavatory cisterns that are not supplied from rainwater tanks.

3.2 Water recovery from sewage effluent ("indirect potable re-use").

3.2.1 Discussion of this option

Assoiate Professor Greg Leslie, of UNSW Dept of Chemical Engineering, has worked on a number of such projects. Downloadable reports on these projects are available from his home page at UNSW's website, www.unsw.edu.au.

The technology exists to recover fresh water from treated effluent, and it is understood that the process is cost-competitive when compared to dam construction. The major obstacle to implementation of such projects is adverse community perception.

Pure water can be extracted from treated sewage effluent by sequential micro- and nano-filtration, then reverse osmosis RO. The pure water from the reverse osmosis stage, the 'permeate', is often further treated with oxygen or ozone, and UV radiation before use. (Recycling this permeate to dams allows for natural exposure to UV radiation and oxygenation). This technology is already used to augment fresh water supplies in a number of First World nations, such as Singapore, and the USA.

In SE Qld, 240,000 ML/yr of treated effluent is discharged to ocean outfall, although it is understood that there are projects presently underway to find onshore uses for this water. The Western Corridor reuse pipeline is already being implemented; it is understood that 78,000 ML/yr of treated effluent will ultimately be re-used under this project. Excluding this 78,000 ML/yr from the 240,000 ML/yr of treated effluent available for extraction of pure water, and assuming 80% recovery, 130,000 ML/yr of pure water can be recycled to SEQ's water storages to allow time for re-oxygenation prior to use.

Dam replenishment by fresh water extracted from treated sewage effluent using reverse osmosis would increase water supply to dams by 167,000 ML/pa, which is equivalent to decreasing demand by 27%. A seawater desalination plant presently being constructed on the Gold Coast could be readily adapted to using treated sewage effluent as its feedstock so that more fresh water would be obtained for less energy expenditure than if it uses seawater as feedstock.

3.2.2 Uses for, and constraints upon disposal of, concentrated sewage effluent

The remaining 32,000 ML/yr of concentrated effluent (the 'reject' flow from the reverse osmosis plants) would contain all the contaminants from the original 162,000 ML/yr of effluent not re-used via the Western Corridor pipeline. Dumping this nutrient-rich flow it into a waterway or offshore adds to blue-green algae problems, and contaminates seafood harvested from the area.

The concentrated effluent would also contain excreted metabolites from two thirds of the prescription and non-prescription drugs used in SE Qld. This would include antibiotics, chemotherapy drugs, and hormonal contraceptive drugs; these "endocrine disruptors" are biologically active, and adversely affect the ecology of whatever waterways they are dumped in. For example, fish and amphibians undergo mutation and sex-change, adversely affecting their reproductive success, and hence the long-term ecology of the waterway.

It should be noted that it is only with the development of powerfully bio-active drugs over the last 70 years that this hazard has become apparent, and it will only be exacerbated by the dumping of this reverse osmosis 'reject'. The old aphorism that "the solution to pollution is dilution" is not an appropriate response to the problem of endocrine disrupting chemicals being dumped in waterways. Instead, the reject stream should also be pumped inland, where it can be used for fibre production through agro-forestry or cotton farming.

Should it be used to irrigate agro-forestry in otherwise arid areas, then the resultant forest may further encourage rainfall and lessen the severity of drought. (50% of the rainfall in the Amazon is sourced from rain-bearing breezes coming in off the ocean; the other 50% of Amazon rainfall is of water that has evaporated out of the forest).

Should the concentrated effluent be used for cotton irrigation, it will offset the cotton industry's requirement for chemical fertilisers, and it will decrease cotton's demand for water from the water-poor Murray-Darling basin.

<u>3.2.3 Costs and Benefits of Indirect Potable Re-Use</u>

Indirect Potable Re-use involves similar processes, and hence similar plant and equipment, as seawater desalination. However, its operating costs, particularly energy consumption, are significantly lower than desalination. Whereas desalination produces substantial concentrations of brine (concentrated seawater) that must be disposed of with some difficulty and environmental risk a considerable distance offshore, the concentrated sewage effluent reject remaining after pure water recovery from sewage effluent is understood to potentially be applied as fertiliser to non-food crops.

The greatest benefit of indirect potable re-use is that it simultaneously negates the requirement for further environmental disruption arising from dam construction and decreases dependence upon the variable climate for water supply.

4 Summary: Comparison between the Traveston Crossing Dam proposal, and the proposals of this submission

Tables 3 and 4 illustrate the effects, respectively, of implementing the recommendations of this submission and of the Traveston Crossing Dam on SEQ’s water demand on its existing water storages.

Note that Table 3 probably underestimates the yield from mandatory rainwater tanks in SEQ Section 3.1.1), and that Table 4 probably over-estimates the obtainable yield from Traveston Crossing (Section 2.1).

Table 3: uses for supplied water in SEQ relative to Table 1 ‘base case’ incorporating submission recommendations

Application	Description	ML/yr	%
Draw on present water storages	Refer Table 1	480,000	100
Rainwater tanks		-70,000	-14
Indirect potable re-use	Recycled to water storages	-167,000	-27
Σ		255,000	59

Table 4: uses for supplied water in SEQ relative to Table 1 ‘base case’ incorporating Traveston Crossing Dam

Application	Description	ML/yr	%
Draw on present water storages	Refer Table 1	480,000	100
Traveston Crossing dam		-150,000	-31
Σ		330,000	69

Depending upon the extent of rainwater tank installation in SEQ, demand reduction upon reticulated could easily exceed the 14% shown in Table 3. Table 3 shows that investment in these recommendations would allow for per capita draw on dam catchments to effectively decrease by 41%. That is, these measures alone would allow sufficient water from SEQ’s water storages for SEQ’s projected population growth up to 2040. Any purported requirement for further dam construction in SEQ is thus negated. In particular, there is no need for the proposed Traveston Crossing Dam for the foreseeable future.

5 References

DNRM (2004) South East Queensland Regional Water Supply Strategy - Stage 1 Report, South East Queensland Regional Organisation of Councils and Department of Natural Resources and Mines, Brisbane.

DNRM (2005) South East Queensland Regional Water Supply Strategy: State 2 Interim Report, Department of Natural Resources and Water, Brisbane.

Turner, A., Hausler, G., Carrard, N., Kazaglis, A., White, S., Hughes, A. and Johnson, T. (2007) *Review of Water Supply-Demand Options for South East Queensland*, Institute for Sustainable Futures, Sydney and Cardno, Brisbane, February.