PROJECT MANAGER – TRAVESTON CROSSING DAM PROJECT
SEQ INFRASTRUCTURE (WATER)
THE COORDINATOR-GENERAL
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Submission on the draft Terms of Reference for the EIS - Traveston Crossing Dam proposal.

Please consider this submission on the draft Terms of Reference for the EIS regarding the Traveston Crossing Dam proposal. I have some professional background and expertise relevant to the issues I am commenting on and have been a resident and landholder in the vicinity of the proposed dam wall since 1994. I request to be considered a stakeholder in the ongoing consultation process concerning the project and in the Resource Operations Plan that would licence its operations under the Water Act 2000 should the project be approved. I also request that this submission on the ToR be considered as a submission to the EIS itself.

My professional background is in environmental and agricultural science, working as a systems modeller for a number of years. My longest term of employment in this field was 12 years with the Western Australian Department of Agriculture in the Plant Industries Modelling Unit. In that time I developed mathematical models and worked in a number of different areas such as crop and soil water balance, carbon and nitrogen cycling in ecosystems, solute transport in soils, plant population dynamics, economic risk and decision analysis. Previous to this I had worked briefly on the population modelling of aquatic weeds, specifically *Salvinia molesta*. At various times since I have worked in the private sector conducting analyses relating to agricultural production systems. I am a member of the International Association for Environmental Hydrology and hold a licence issued by NSW DNR for the IQQM software used in Queensland's water resource planning under the Water Act 2000.

Since moving to the Mary Valley I have been actively involved in landcare, biodiversity conservation and catchment management issues, and have worked as a part-time teacher in local schools to develop science education programmes in the geology, landforms, and biodiversity of the Mary Valley. From this background I wish to make a broad-based submission, covering many aspects of the draft document, many of which may also be covered in other submissions.

I also wish to offer the results of some preliminary analyses relating to the hydrological appraisal of the project which are unlikely to be covered in other submissions. I would welcome the opportunity to discuss these in detail with appropriate officers of the state and federal governments and other project stakeholders. These are included as appendices to this submission and are referred to in the relevant sections of this submission.

Although not forming part of my written submission, I would like to contribute a collection of short video clips (approximately 2 mins each) as background information which sum up some of the main issues relating to the hydrological impacts of the proposal on matters and locations relevant to the Federal EPBC assessment These critical locations in the river are not protected by the environmental flow schedules in the Mary Basin Water Resource Plan referred to in the Terms of Reference and would need specific attention outside the existing provisions in the WRP to satisfy the requirements of the assessment under the EPBC act. These video presentations can be viewed online at http://www.youtube.com/profile_videos?user=SteveTrav.

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Overall comments on the scope and structure of the EIS

Stage 1/ Stage 2 split assessment
It is misleading to only assess the impacts of stage 1 of the project because the operation of the dam at the stage 2 supply level is a direct and foreseeable consequence of the construction of the wall to practically its full final height in stage 1. The crest heights of stage 1 and stage 2 are almost identical (QWIPL 2006(a)), and the spillway height is unchanged between stage 1 and stage 2. Property purchases are already being negotiated to the full extent of the stage 2 area (QWIPL 2006(b)). Arguments that stage 2 yields may not be required until a much later date are in conflict with the terms of reference used to evaluate alternative water supply options in the Mary Valley, such as a combination of smaller dams or building a very large Borumba dam, all of which have been evaluated in terms of their ability to supply 150,000 ML/year. NRW 2006, Qld Gov. 2006. As recently as this month (13 Feb 2007) the Queensland Premier was reported in the Courier Mail outlining his clear intention to proceed with Stage 2 of the proposal.

In my opinion the original EPBC referral should be withdrawn and a referral of the full project should be re-submitted to the Federal Minister for the Environment.

Water treatment and distribution infrastructure costs and impacts not included
It is not appropriate to regard the additional water treatment and distribution infrastructure associated with the project as a separate project (section 2.3.5 of the ToR). This also seems to be inconsistent with section 2.2.5 of the ToR. Neither the additional water treatment/distribution infrastructure, nor the dam project can fulfil their purpose independently of each other. The location and route of the associated water infrastructure could have significant impacts on terrestrial EPBC species and ecosystems, and the relatively high treatment and transport costs of water from the storage would impact considerably on its economic performance in comparison with other water supply alternatives.

Project and alternatives not subject to comparable cost/benefit analysis methodology and scope
The terms of reference have a major structural flaw in not specifying a consistent and clearly defined cost/benefit analysis framework to be used in a single comparative analysis of the dam project against a range of water supply alternatives. Sections 1.3.2 and 1.4 of the ToR should be combined, a clear and consistent list of which costs and benefits fall within the scope of the analysis should be determined and an economic methodology specified for valuing the costs and benefits used in the analysis. For example, how are the considerable evaporative losses from the dam going to be costed? Some method for valuing the environmental services provided by freshwater flow into the Great Sandy Straits RAMSAR wetlands needs to be specified. In this crucial component of the EIS for such a major project it would be more desirable to use a multiple-criterion methodology, rather than a simple one-dimensional analysis.

No reference to National Action Plans relating to catchment management and climate change
The Mary Basin is a Priority Catchment under the National Action Plan for Salinity and Water Quality. As such, its management is expected to be subject to particular agreed standards of community consultation, and high standards of managing the risks of declining water quality. Its status as a priority catchment under this national plan specifically links its management to particular strategies outlined in the National Biodiversity and Climate Change Action Plan (NBCCAP) 2004-2007, and the National Agriculture and Climate Change Action Plan 2006-2009. None of these national agreements or the specific obligations on the State Government to incorporate climate change modelling into natural resource planning in the

catchment are outlined in the ToR. The performance and impacts of the proposal and its alternatives need to be evaluated within a climate change framework for the EIS to comply with these national policies. In addition to incorporating the effects of climatic trends on streamflow, this also specifically includes evaluating changes to greenhouse gas emissions (carbon and nitrogen compounds) resulting from land use changes. The huge volume of very deep fertile alluvial soil to be inundated, in itself represents a significant carbon and nitrogen sink that is going to change from aerobic to fluctuating anaerobic conditions, which may result in significant emissions of carbon and nitrogen compounds with many times the greenhouse impact of CO_2.

Time constraints on the EIS process not valid.
While there is no time limit specified in the ToR, the timeframe advertised by the State Government for the EIS does not even encompass one complete seasonal cycle. The reproductive biology of many of the long-lived listed species threatened by this proposal is poorly known, and a study period this brief could not be reasonably expected to give any reliable baseline data from which to assess the risks posed by the project to these species and essential habitats. It is also insufficient time to conduct the detailed studies required to quantify the effects of the proposal on the interaction between groundwater and surface water flow regimes in the Mary Valley required. (This was not covered by the Mary Basin WRP). Construction time alone ensures that there is no way in which this project can provide any public benefit in the current water supply situation. More urgent and appropriate drought measures will need to be taken and those measures will continue to work in future drought or non-drought conditions. The extreme financial cost of this project and the magnitude of its likely adverse impacts would surely suggest that a thorough EIS is more appropriate than a quick one.

No method specified for analysis of risks to species and habitats listed in the EPBC legislation
There is no quantitative methodology specified for assessing the risks that the project poses to populations of threatened species and their habitats. A standard internationally comparable methodology such as population viability analysis (PVA) should be applied to quantify the extinction risk that the proposal is likely to pose to the internationally significant threatened species affected by the project. In addition, the precautionary principle suggests that the onus should be on the proponent to demonstrate to a high degree of statistical certainty that the project will NOT adversely affect the population viability of the relevant species. The NBCCAP also clearly states that the impact of climate change needs to be taken into account as part of this assessment.

No comprehensive Health Impact Assessment specified
The project is likely to have significant long term cumulative public health impacts through creating a large area of shallow vegetated water around the fringes of the storage in close proximity to areas of rapidly increasing settlement and development. Mosquito-borne notifiable diseases such as Ross River Virus and Barmah Forest Virus are already present in the Mary Valley, and this vast increase in suitable habitat for the vectors poses a significant public health risk from these and other arboviruses that should be assessed.

Another area of public health risk is related to the likelihood of poor water quality in the impoundment and distribution system, and the downstream effects of low flow on water quality at the Maryborough Barrage. Algal toxins and manganese problems have already caused problems in the catchment (in Lake Borumba and in Amamoor town water supply)(Stockwell 2001) and would be greatly compounded by the likely eutrophic conditions and low oxygen levels in such a shallow, warm storage. In addition, further reduction of flushing flows at the Mary River barrage could contribute to an accumulation of manganese, arsenic, mercury and other toxic metals in the sediments behind the Mary River barrage. All these metals naturally occur in significant quantities in the barrage catchment and have been released by past mining activities. The consequences of a possible accumulation of these metals in the barrage water storage (possibly used for future town water supplies) resulting from the reduction of flushing flows by the dam proposal warrants investigation.

The wider public health risks of the project, encompassing issues like those above should be assessed by an accepted Health Impact Assessment methodology (Department of Health 2001) as a specific and separate component of the EIS.

Project area not clearly defined
The ToR do not clearly define the geographic scope of the project area and its impacts. The project area illustrated on figure 1 of the initial advice statement for the project does not provide sufficient geographic scope for the impacts of the project. The geographic scope of project's impacts should include the entire catchment of the Mary and its tributaries and the extent of coastal waters influenced

by changes in freshwater flows to the Great Sandy Straits. In particular, the boundaries of any proposed catchment declaration under the Water Act 2000 need to be fully described. Specific attention should be paid to the river banks as far as Bell's Bridge, because of the risks posed by the predictable loss of riverbank stability downstream. The impacts of the water distribution infrastructure associated with the dam obviously extend as far as the water is distributed.

Relative importance of groundwater and surface water yields not clear.
Although proposed as a surface water storage, the ToR specifically refers to water extraction from 'target aquifers' (section 3.5.2, page 50) as part of the project. The relative importance of the surface water and groundwater components of the project is not clear in the ToR or in any supporting documentation released to the public to date. Groundwater extraction in the Mary Valley proper is specifically outside the scope of the Mary Basin Water Resource Plan. If significant new groundwater storage and extraction is made possible by design of the wall and the geological location of this project (ie using intercepted surface and ground water flows to recharge an underground storage of alluvium and fractured rock) or if the dam wall causes a significant change to the linkage between surface water and groundwater flows in the valley then this will require a complete reworking of the surface flow modelling and water allocation framework that underlies the Water Resource Plan for the catchment. If groundwater extraction is to be a significant component of the purpose of the project, then this needs to be clearly stated in the project description and the implications of this made clear to all stakeholders during the EIS process.

No way of measuring freshwater inflows into the Great Sandy Straits
Currently there is no ongoing measurement or monitoring of fresh water flows past the Mary River Barrage into the sea. This point in the river is the critical link between the river system impacted by the dam proposal and the internationally listed estuarine ecosystems impacted by the proposal. These flows are not specifically protected by the Mary Basin WRP. A thorough re-examination of the hydrology of the Mary River Barrage is required to enable the fresh water flows past the barrage to be accurately measured and monitored as part of the co - operating conditions of the proposed dam and the downstream barrage. Since construction, considerable siltation of the barrage storage, changes to the fishway and spill conditions, and changes to evaporative conditions in the storage because of surface weed infestations now suggest the surface area/storage volume/water level relationships of the storage and the spillway rating curves of the barrage need to be re-calibrated and verified to enable this modelling and flow monitoring to be conducted accurately. This work should be conducted as part of the EIS, because without it, the impacts of the proposal on the listed provisions in the EPBC act cannot be accurately assessed. This should be a high priority for assessing the impacts of the proposal on the river and the regional hydrological cycle. It is essential to know how much water is left to flow to the sea.

Principles behind assessing cumulative impacts
Many of the impacts of the project will add to existing environmental, social and economic pressures within the catchment, and add to the existing threats to the EPBC species which also occur outside the catchment. The ToR are not clear as to how the cumulative effects of the project's impacts will be assessed, but hint that only the incremental impacts of the project may be assessed. It is clearly not appropriate to only assess the marginal impacts of the project. The analogy with the straw that broke the camel's back applies. The impact of that straw is not half a gram of extra load on the camel, the impact is the avoidable death of the camel. The way in which cumulative impacts are to be assessed needs to be clearly stated and consistently applied throughout the EIS.

Comments on part B – specific requirements of the contents of the EIS

1.1 As a corporation, the proponent is a new entity and such does not have an environmental record to present. It is more appropriate to examine the environmental record of the principle staff and directors of the corporation and the contractors employed in executing the project. An examination of the environmental, economic and social impacts of recent water infrastructure projects managed by the directors, senior staff and major contractors of the corporation is relevant to this section of the EIS. The environmental record in areas of stream management of senior staff conducting the EIS for this project should also be outlined.

A suitable case study would be a thorough appraisal of the performance of Paradise Dam. Have the mitigation strategies in the EIS for that project been successfully implemented? Have the economic benefits outlined in the EIS been realized? Has the project complied with the environmental flow outcomes and water security provisions of the Burnett Water Resource Plan? Have the measures outlined in the EMPs for the project been properly implemented? Are the stakeholders identified in that project happy with the outcomes? Has there been successful mitigation of adverse impacts on EPBC listed species in the Burnett catchment?

This comparison is directly relevant to the proponent of this project – the two projects share the same CEO, the same consulting firm conducting the EIS, the same corporation doing the hydrological planning and operating the storage as is contracted to do the hydrological planning for the current project.

1.2 If groundwater storage and extraction is expected to form a significant part of the yield of the project, (as allowed in section 3.5.3) this should be clearly stated in the project description. See comments in section 1 of this submission.

1.3.1 In addition to the policies mentioned in the 8th dot point, specific compliance with the National Action Plan for Salinity and Water Quality, the National Biodiversity and Climate Change Action Plan and the National Agriculture and Climate Change Action Plan should be specified. See comments in section 1 of this submission.

1.3.2 & 1.4 See comments in section one of this submission.

1.5.2 3rd dot point would be more appropriately expressed as
'determine to what extent environmental …..'

1.6 should include an undertaking by the proponent to provide specific technical data regarding the project on request, and describe an independent method of appeal if reasonable and relevant requests for technical information are refused, or false or misleading information is issued in response to such requests.

2.2.1 should include further dot points
- Design and method of operation of spillway gates
- Engineering measures to prevent spillway blockage from floating vegetation and flood debris
- Engineering measures taken to control seepage around and under the barrier.

2.2.2 should include
- inundation area for a range of water levels *up to the crest height*
- cross sectional stream profiles and stream flow versus depth rating curves for critical points in the river downstream of the wall as far as Bell's Bridge.

2.2.4 should include
- full details of any off-site quarrying activities associated with the project.

2.2.5 dot points should include
- measures taken to control loss of storage capacity through sedimentation
- measures and infrastructure required for de-stratification of the water body
- measures taken to prevent fouling of outlet works and blockage of spillway

The last paragraph is inconsistent with statements made later in section **2.3.5**.

3 As described in section 1 of this submission, there needs to be a credible formal methodology specified to quantify the risks to the EPBC listed species and communities, and the burden of proof placed on the proponent to demonstrate that the action will NOT increase the extinction risk to these species and communities.

3.1 Flooding

The major extreme event that needs to be considered is flooding, and historical intense flood patterns are largely responsible for creating the distinctive soils and landscape of the central Mary Valley in the vicinity of the impounded area. The proposed impounded area is in the depositional zone of the valley where the stream bed gradient changes from the steeper slopes of the major tributaries to the very shallow gradient of the valley floor. (NRM 2005) Not only do flood water heights upstream of the wall need to be calculated based on the ability of the spillway to regulate the intense but normally short lived flood flows in this location, but the full hydrodynamic impacts at the interface between the upstream inflows and the ponded backwaters of the storage need to be thoroughly investigated within the scenario of likely extreme runoff events.

The effect of the spillway in decreasing the peak intensity of downstream flood flows but increasing the duration of high flow and high water level events (QWIPL2006) is likely to have large impacts on river bank stability for a great distance downstream (where the river banks consist of deep unconsolidated alluvium held together by fragile riparian vegetation). This has already been observed in the catchment as a result of the construction of Baroon Pocket dam which resulted in the destruction of riverbanks and sediment infill of the stream bed along the entire downstream catchment of Obi Obi creek (more than 30km)(Braby 2007) The implications of this effect for infrastructure downstream of Traveston Crossing requires thorough investigation.

In addition, there is a risk of the spillway becoming obstructed in one of these major floods due to the large amount of surface vegetation likely to be on the storage, and the large amount of floating debris likely to be deposited into the storage by a violent flood event. The consequences of such an obstruction for people living in areas upstream of the dam wall but lower than the crest height need to be thoroughly assessed in the EIS. The EIS should include the identification and analysis of any similar dams in other parts of Australia or internationally where residents of entire townships (eg. Kandanga, Imbil and Kenilworth) are permitted to live within the catchment of a dam at elevations lower than the crest height of the dam wall.

3.1 Landslip

Apart from the floodplain itself, another defining feature of the wider landscape in the vicinity of the dam wall is landslip and heavily faulted and fractured rock. Any possible interaction of the dam project with increased landslip risks in the wider Mary Valley needs to be thoroughly investigated because of the recorded history of serious landslip events in the valley in the vicinity of the project. The hills to the west of the dam have experienced many past serious landslip events, contributing in one case to the abandonment of the soldier settlement township of Calico Creek. Rehabilitation of these landslip areas was a significant component of Gympie and District of Landcare funded projects in the late 1990's. The ridge on the eastern abutment of the dam is heavily fractured and faulted, as is clearly shown on the geological maps of the area. The western abutment of the dam wall also adjoins a mapped fault buffer zone, and the dam itself lies above an ancient subduction zone intersected by major faults as outlined in the report on the Gympie Special sheet produced as part of the Geological Survey of Queensland and more recent digital mapping. There was recorded seismic activity in the vicinity of Burumba Dam and Moy Pocket in the early 1990's (several events up to Richter 3.6) (Geoscience Australia 2006) which coincided with at least one major landslip event on the western side of the valley on the Dagun escarpment. The compounding risks of high rainfall events, steep slopes at the valley sides, structural weaknesses and possible underlying seismic movement due to natural causes or construction activities need to be considered in tandem when assessing the landslip risk to the project and the surrounding hillslopes.

3.2.1
Description.
Should include salinity hazard mapping from the NAPSWQ.
Should include mapping of bank conditions from the Mary River and Tributaries Rehabilitation Plan 2001.

Impacts and mitigation

- Impacts on GCAL should include land use restrictions likely to apply to all GCAL in the catchment upstream of the dam, including specifically assessing the impacts that would occur if the catchment was listed as a declared catchment under the Water Act 2000.
- The boundaries of any declared catchment area need to be clearly defined and the planning and land use policies to be applied need to be clearly stated and described in the EIS. The impacts of these policies should be fully costed and included in the cost of the project.
- Should specifically investigate the risk of changing groundwater levels, drainage regimes and possible soil salinity on GCAL in the vicinity of the project and at all downstream locations at risk of these effects.
- Should specifically look at impacts on downstream users relating to the removal of streamflow resources from the catchment (The out-of catchment transfers from the yield of the storage, plus the evaporation and seepage losses incurred by the storage)
- Should examine costs and risks to riverbank land and infrastructure (river banks, fences, pumps, bridges etc) at least as far as Bell's Bridge resulting from changes to the river flow regime in areas of deep alluvial soils.

3.2.2
Description
Should include cross-sectional stream and river bank profiles near downstream infrastructure as far as Bell's Bridge, and in the vicinity of proposed new infrastructure in and at the margins of the impounded area. An estimate should be made of river height vs. river flow rate curves at each of these locations.

Impacts and mitigation
Should specifically investigate risks of downstream bank collapse.

3.2.3
Description
Should identify possible rock types likely to disturbed by the project that may produce acid rock drainage, or release toxic compounds (eg arsenic) on oxidation. This has been identified as an issue at the closest quarry to the project, (the Meadvale Quarry operated by Queensland Rail at Tandur). It is also an identified issue with the potential quarry materials at Belli.

Should identify toxic metal deposits in the greater Mary catchment that may accumulate in the sediment load in water storages, both at the proposed dam site and at the Mary River Barrage. For example, mercury, bismuth, cobolt, copper, arsenic and manganese have all been commercially exploited in the catchment.

Impacts and mitigation
The drainage from sites likely to produce ARD need to be investigated in terms of their effect on EPBC species and water quality guidelines. For example, Meadvale Quarry drains into the Six Mile Creek catchment and the Belli quarry site may drain into Belli Creek, both significant habitats for EPBC listed species.

The sediments accumulated behind the Mary River Barrage should be tested for levels of metals which potentially pose a health risk.

3.3
As mentioned in section one of this submission, there needs to be a consistent quantitative framework used to analyse the extinction risks to listed species *in their natural habitat.* The burden of proof should be on the proponent to demonstrate that the project will not increase these risks and the precautionary principle applied to this assessment.

The NBCCAP clearly states that in priority catchments under the NAPSWQ, habitat linkages should be maintained to allow populations to move in response to climate change. The specific effects of this proposal on habitat linkages and barriers to species movement both in the riparian zone and in the aquatic habitats of the river and estuary need to be clearly assessed under these agreements.

The additional extinction risk posed to threatened species needs to be assessed in the context of the cumulative impacts of this project and other known risks to these species. For example, impacts on the genetic diversity of lungfish need to be assessed in concert with any reduction in diversity and population viability already brought about by the extensive infrastructure development in the Burnett system.

3.3.1
The EIS needs to specifically identify crucial locations in the catchment where the proposal will have the greatest effect on matters governed by the EPBC act. These sensitive locations need to be the focus of detailed study and assessment and the focal points for any EMPs and licence conditions placed on the project by the ROP and other licensing procedures.
These locations should at least include

- the stretch of river from the dam wall to the mouth of Amamoor Creek,
- the Mary River Barrage,
- any areas of remnant valley floor 'scrub' vegetation or riparian rainforest (eg. Hyne Estate Rd),
- areas of limited habitat or vegetation critical to any of the listed species, particular those referred to in threatened species recovery plans (Eg. For Coxen's Fig Parrot, Richmond Birdwing Butterfly)

3.3.2 Potential impacts
This section needs to incorporate local climate modification caused by the storage. It is likely that the heat buffer formed by the large body of water would change the frost regime on the valley floor, and thus change the weed spectrum in the area. For example, para grass could conceivably become a problem at the margins of the storage. This weed is not currently a major problem on the valley floor but readily invades water bodies in tributaries at higher elevations. It has become established on the banks of the Mary River Barrage storage.

This section also needs to look closely at the impact of fluctuating water levels over large areas of land on weed dispersal and colonization. The fluctuating water levels in the storage will provide a mechanism for water borne dispersal of weeds over a large area of fertile deep soils. The periodic inundation will repeatedly interrupt ecological succession on the flood plain. These conditions are likely to result in rapid ecological selection for opportunistic colonizer weed species over much of the periodically flooded land in the impounded area and buffers. This would have severe economic impacts on landholders and leaseholders in this area.

As mentioned previously, river bank collapse for a considerable distance downstream is a predictable consequence of the changes in river flow patterns resulting from this project. The effects of this on riparian vegetation need to be assessed. Experience in the catchment suggests that it will not be possible to mitigate this impact.

3.3.4
The last paragraph of this section on p42 looks as if it belongs in 3.3.5

The absolutely predictable outbreak of exotic aquatic weeds in this storage would be a major threat to the economic viability of the entire project. The storage *will* become heavily infested with some combination of water hyacinth, salvinia, cabomba and dense water weed. The margins are likely to be colonised by bullrush and para grass. All these species currently cause problems in the catchment in the vicinity of the impoundment. In addition, reductions in the flushing flows and the low-flow regime in the river downstream of the dam, combined with a constant source of upstream re-infestation will ensure that the project will greatly increase the problems caused by these weeds for the entire length of the main stream of the river downstream of the dam.

The economic impacts of this will be enormous, setting aside the huge ecological impact on other species in the river. Economic impacts will include

- cost of ongoing (never ending) physical harvesting and control. (An indicative budget could be estimated by multiplying the annual cost of weed control in Lake McDonald by the relative surface area of the Traveston Crossing proposal)
- greately increased evaporative losses from the storage. For example, evapotranspiration rates from a hyacinth mat can reach 2.7 times the evaporation from a free water surface.
- physical displacement of water storage capacity by the large biomasses generated.

- greatly fluctuating oxygen levels in the storage contributing to water quality risks and treatment costs. In this storage, manganese oxides and algal toxins are likely to be a major problem.
- Increased structural and maintenance costs caused by continual physical obstruction of works.
- Risks of structural damage to downstream infrustructure when the weed mat is flushed downstream by floods.

3.3.5
Should include the impacts of the gross habitat changes that will result from the predictable outbreaks of introduced aquatic weeds both in the storage, and in all areas of the river downstream.

3.4
The landscape character and visual amenity of the Mary Valley from Traveston Crossing to Kenilworth would be utterly transformed by the project. Converting the rural landscape of a valley floor of mainly class 1 agricultural land into an area of weed infested swamp and mudflats is about the largest impact on landscape character and visual amenity that could be imagined apart from turning it into an open cut mine. This cannot be mitigated.

3.5
There are three appendices attached which are referred to in the comments on this section.

3.5.1
See attached report (appendix A) *Notes on the likely impacts of the proposed Traveston Crossing dam on the environmental hydrology of the Mary River*. **(Burgess & Edward 2006)**

The main comments to apply to this section are

- By itself, the Water Resource Plan (Mary Basin) 2006 will not provide adequate protection of environmental flows at locations in the river that are crucial for species and matters that need to be protected by the EPBC act. Compliance with the environmental flow schedules listed in the legislation for nodes 2 and 3 (the only nodes in the river downstream of the proposed dam) is not required by the wording of the legislation. Although the legislation specifies compliance with a flow schedule for the river mouth, flows at the river mouth are not measured, making nonsense of any concept of compliance with the stated flow schedules for that node. Compliance with the WRP is clearly not sufficient to protect environmental flows downstream of the dam site.

- The crucial IQQM nodes in the IQQM model that is used for water resource planning in the catchment that need to be closely monitored to assess the hydrological impacts of the proposal are Dagun Pocket (node 190) and the Mary River Barrage (node 039). These are the points where specified EFO's should be set to protect the environmental flow regime in the river as is the intent of the Water Act 2000. These are the points where changes to the flow regime will have the most impact on matters covered by the EPBC act. EFOs for these locations need to be specified as part of the licensing provisions and EMPS for the project.

- Currently there is no procedure for measuring flows past the Mary River Barrage into the Great Sandy Straits, but the barrage itself would provide an appropriate measuring instrument. It has a vertical slot fishway that passes water through a 200mm wide slot (ideal for measuring very low flows, a very narrow lower spillway at EL2.9 m (ideal for measuring low to medium flows) and the main concrete spillway at el 3.0m (adequate for measuring high flows). Because freshwater flow past this point is the main impact the storages on the main trunk of the Mary will have on the Great Sandy Straits and the RAMSAR wetlands, it is unacceptable to not measure and monitor this flow as part of operation rules of the storages on the river.

- The flood modelling published to date has only shown predicted heights at the spillway for a number of selected events. As discussed in the previous section on floods, there may be complicated flood flow effects at the upstream margins of the storage. What is needed, as a bare minimum, to assess flood impact of the dam taking these effects into account are maps showing
  1% AEP flood boundaries, without the dam
  1%AEP flood boundary, with the dam stage 1
  1%AEP flood boundary, with the dam stage 2
  1%AEP flood boundary, with an obstructed spillway (stage one or stage 2)

  The same maps should then be produced for the PMF (1:500000 year event) and the maximum recorded flood event (1893) (double flood)

- In the IQQM modelling of catchment used to formulate the draft WRP, there was a requirement to maintain a flow of 80ML/day at the Gympie TWS node (WRP Hydrological Report - 2005). This had the effect of ensuring a sufficient water level in the stream at this point, and maintaining this would also have also assisted in maintaining water quality downstream from the Gympie sewerage outfall at Widgee Crossing. This requirement was built into the modelling used to determining the draft environmental flow schedule for Fisherman's pocket. However, because the WRP was hastily changed to allow for the operation of the dam after the public consultation period on the draft had finished (Consultation report dated August/December 2006), it is not clear that this requirement would still be protected. Ensuring a sufficient flow to allow the operation of the Gympie TWS and to maintain sufficient flow at Widgee Crossing to dilute and flush the sewerage outfall needs to be a specific requirement of the EIS.

- Evaporation and seepage estimates assumed in the hydrological modelling of the storage and it's impacts need to incorporate information about the unique characteristics of the storage which have not been incorporated into simulation models of the project to date. Specifically, the evaporation model used in the past was based on monthly average Epan data modified by a lake surface factor calibrated for Nambour evaporation regimes, simulating evaporation from a deep, clear water body. This storage will not be a deep, clear storage. The albedo of the wet soil which will make up a significant proportion of the evaporative surface area, the shallow, warm nature of the storage and the impacts of fringing and surface vegetation on increasing evapotranspiration from the storage will require a much more sophisticated evaporation model to accurately assess the true evaporation losses from the storage.

- To date, seepage estimates have been based on nominal figures like 'a foot a year' or 'a mm per day' rather than any detailed analysis of the likely actual seepage losses from this particular storage. This is absolutely inexcusable when the *a priori* evidence based on the geology of the site is that seepage losses are likely to be considerably more than this, easily in the realm of 1m per year or more.

- There is a clear obligation under the national climate change action plans for biodiversity and agriculture to investigate the performance and impacts of the project in a climate change scenario. A suitable, and feasible analysis would be to use the last 10 years of climate data to model the storage and it's hydrological impacts on the river, similar to the approach suggested in the Marsden and Jacobs report on urban water supply planning, (Marsden & Jacobs 2006). On the Mary, this period conveniently includes a major high intensity flood event (1999) and a period of drought. The results from this should be used to assess the yields, benefits and costs of the project in comparison with other water supply options, and assess the impacts on downstream flows. **The results of a preliminary analysis of this nature of the storage behaviour and local flow impacts of the proposal are included in Appendix B of this submission.**

3.5.2

A major concern is the effect that the deep subterranean wall and grout curtain proposed for the project will have on groundwater flow regimes through the alluvium and shattered rock in the valley floor. This effectively produces a groundwater dam across the entire width of the valley at that point. The possible implications of this for the area downstream of the dam may be severe. Disturbing the linkage between surface water and groundwater flow in this region in this way may well completely invalidate all the surface flow modelling used to formulate the water resource plan relating to downstream flows and have significant downstream effects in the river. Additional surface water releases from the storage may be required to compensate for the loss of downstream sub surface flow.

The dot points referring to target aquifers and required volumes of water from these aquifers need clarification. (As discussed in section 1 of this submission). Is groundwater extraction a significant part of the intent of the project?

3.5.3

No mention is made in the ToR of the Mary River's priority status under the NAPSWQ. Water quality, both in the storage and downstream will be adversely affected by the nature of the storage and it's predicted impact on low flow regimes and minor flushing events. In times of low flow, water quality in the river already lies outside the Queensland Water Quality Guidelines (2006) for the catchment. **There is a preliminary analysis of some water quality impacts in Appendix C of this submission.**

3.6

The water in the storage would be expected to act a local thermal buffer, and therefore have an effect on local climate conditions. These could possibly include reductions in frost frequency and may increase local occurrence of low cloud and fog. Fog already has safety impacts on the Bruce Highway and Gympie Aerodrome close to the dam site. The likelihood of and risks associated with local climatic impacts should be investigated.

The types and levels of anticipated greenhouse gas emissions from the storage itself should be calculated and the impacts assessed This is an impact referred to under the National Climate Change and Agriculture Action Plan resulting from the land use change from class 1 agricultural land to swamp and mudflats. In addition, the greenhouse gas emissions resulting from the pumping and treatment of the water from the storage need to be included in the assessment of the impacts of the proposal.

3.7

Locations, hours of operation, likely traffic volumes and access routes to and from the major off-site landfill sites (mega dumps) required for the disposal of construction and demolition waste generated by the project need to be clearly specified in the EIS. All impacts of this major component of the project need to be comprehensively assessed and the full impacts explained clearly to the public.

3.8

Hours of operation, duration and intensity of noise produced should be assessed and described clearly to the public. In particular, the noise impacts of operations of a continuous nature (such as operation of concrete batching plant, gravel crushers, compactors, excavation machinery) need to be clearly outlined. The Mary Valley is a quiet place, sound is noticeable for long distances, and month after month of continuous noise of this type would seriously impact on the quality of life to which residents are accustomed.

3.9

As part of the EIS, the feasibility and likely construction plans for all new transport corridors needs to be checked with a thorough on-the-ground assessment in co-operation with long-term local residents and Cooloola Shire officers to ensure the viability of proposals. Map-based studies and costings are insufficient. Particular attention should be paid to any interactions of new road proposals with drainage lines to avoid inadvertent flooding and erosion impacts on surrounding land.

3.10

It is essential that the Local History Unit of the Cooloola Library be closely involved in the assessment of local cultural heritage values and assessment. They have been engaged in extensive and meticulously documented historical scholarship regarding the Mary Valley for a long time.

Because there is a history of conflicting native title claims over the Mary Valley, it is important that indigenous consultation is inclusive and involves the widest practical representation of Aboriginal interests including but not restricted to the current Native Title claimants over the Mary Valley. For example, Butchella people from the region of the river mouth and the Great Sandy Straits should be consulted concerning the impact of the proposal at the estuary end of the river.

3.11

Part of the social impact assessment should include an accurate measurement and reporting of

- Total costs of all government-funded counselling and support services (including the entire diversion of government expenditure to the community futures task force and associated projects, lifeline services, Kandanga One Stop Shop, Langmont Advantage) that have been incurred in relation to the project.
- A serious measurement of the total amount of volunteer hours taken from and personal expenses incurred by the community at large in providing community support services and participating in the community consultation and negotiation processes involved with the project.
- An estimate of the costs of private medical, personal counselling, legal and financial services purchased by the community as a consequence of the project.

3.12

A network analysis of the proposed new transport, power and communication networks should be conducted to design robust networks that will still continue to function in the event of failure of any particular link in an emergency. For example, in the event of a flood event to 80m EL at the spillway in stage one, how many properties in the wider area would be isolated from emergency services? Is there a change in the proposed road network that could reduce this impact?

In particular the Dam Safety risk assessment applied to the structure should not only look at downstream impacts in the event of wall failure or overtopping, but should explicitly examine the risks of a spillway blockage during a major flood event on upstream residents. It seems highly irregular to allow townships to remain inhabited upstream of a dam at heights lower than the crest height of the wall.

As mentioned in part one of this submission, the long term public health risks likely to be associated with this project warrant a separate Health Impact Assessment section in the EIS.

3.13
See comment in section one of this submission

4
Any monitoring benchmarks proposed in EMPS need to relate to physical measurements and observations that can be conducted by any independent body. It is not appropriate, for example, to have river flow criteria that can only be assessed in terms of a particular computer simulation analysis that can only be conducted by the proponent/operator or their agents. Considerable thought should go into formulating useful criteria that can be independently assessed and verified.

An example might be – "maintain inter-pool connectivity in the reach from Traveston Crossing to the junction with Amamoor Creek at all times", rather than "modelled flows at node 190 should meet the targets outlined in schedule 3"

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Notes on the likely impacts of the proposed Traveston Crossing dam on the environmental hydrology of the Mary River.

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Save the Mary River Co-ordinating Group.
November 2006

Background

In spite of many frequent and formal requests to date (26/11/06), the Queensland State Government has consistently refused to release any comprehensive scientific data regarding the predicted hydrological effects of the current Traveston Crossing Dam proposal on flow regimes and flood impacts on the Mary River. This information is critical in determining the likely impact of the proposal on matters covered by the EPBC Act and the EIS process under Queensland legislation.

After 5 months of protracted negotiations, the Queensland Government released the IQQM flow modelling that was used in the preparation of the Environmental Flow Assessment Framework and Scenario Implications report prepared for the draft Water Resource Plan for the Mary Basin (Brizga 2005). Although not based specifically on a model of the current dam proposal, it is the only published data available to investigate the likely impacts of a large dam on the Mary River upstream of Gympie.

An analysis of the IQQM modelling data made available shows that the simulations used for the preparation of the State Government Technical Advisory Panel report were based on a single large dam between Dagun Pocket and Moy Pocket that removed an average of approximately 130,000 ML/year of total flow from the Mary River (accounting for yield, evaporation, seepage and any other losses) above the full utilization of current water entitlements. The dam modelled in that study also had a system of downstream releases that passed all flows up to 250ML/day, and passed all flushing flows between 15,000 and 25,000 ML/day.

More recent information from the Queensland State Government shows a clear intent to harvest up to 150,000 ML/year in addition to existing entitlements, not accounting for the extra losses to the river flows caused by evaporation and seepage from the proposed dam(s). These losses would conservatively be in excess of 70,000 ML/year. To obtain the yields stated in the report 'Water for South East Qld - a long-term solution', the State Government used a dam model that only released up to 100ML day in the low flow regimes, and only passed one flushing flow between 10,000 and 20,000ML/day per water year.

The conclusion is that the likely environmental flow impacts of the State Government's more recent plans for the Traveston Crossing dam will be even greater than those on which the Technical Advisory Panel's assessments for the WRP were based. This means that the TAP's assessments in the studies undertaken for draft water resource plan are likely to underestimate the environmental impact of the current dam proposal, and therefore could be validly interpreted in the current context as an indicator of the minimum level of impact that the current proposal is likely to have.

This conclusion also concurs with the significant re-write of the environmental flow schedules that occurred between the draft and final versions of the WRP legislation. This re-write allowed much greater adverse impacts on the river within the scope of the environmental flow schedules in the WRP following the political announcement of the Traveston Crossing Dam proposal. The reasons for this rewrite should be contained in the consultation report required under the WRP process. To this date, the consultation report on the legislation, (which should have been released by August) has not been released to the public.

Summary of likely flow impacts at selected points in the Mary River system, based on IQQM modelling of dam options.

The places chosen for analysis are those downstream locations for which environmental flows are legislated for in the Water Resource (Mary Basin) Plan 2006, and the section of the river downstream of the proposed dam site (which is not protected in the WRP). The raw IQQM flow data released by the State Government from the scenarios investigated in the draft water resource plan were analysed using IQQM (Department of Land and Water Conservation , 2004) , RAP (CSIRO, 2006) and a series of Excel spreadsheets to calculate the suite of flow statistics relevant to the WRP legislation.

It should be noted that actual end-of-system flows at the river mouth are not measured and cannot be directly monitored or calibrated against real data: they are only produced as calculations via the IQQM model of the catchment. A crucial point is that although the predicted mean annual flow at the river mouth will be maintained at 87% of pre-development flow, this in no way implies that flows at the river mouth will be essentially unaffected. It only means that the dam will not influence the extraordinary large flood flows for which the Mary is infamous. The statistics show that effect of the dam on the low and no-flow regimes at the river mouth are likely to be significant, particular in regards to crucial environmental processes (such as the successful operation of fishways and water quality) from the Mary River Barrage to the estuary.

Table One shows a summary of some of the relevant flow characteristics. The critical points in the river seem to be in the reach just downstream of the dam at Dagun Pocket (an important lungfish and Mary River turtle breeding area), where the statistics indicate that the flow regime will be severely disturbed, and the river mouth, where the no-flow regime will be significantly altered from the natural state.

At Dagun Pocket, the impact is a reduction of median flows to 31.5% of the pre-development state, virtual no flows for more than 10% of the time, with periods of no flows for more than 6 months continuously. This corresponds with an APFD statistic (a measure of disturbance in river flow patterns) of 2.39, which is regarded as severely disturbed. The 1.5 year ARI daily flow volumes (indicative of minor flushing flood flows) are reduced to 57% of the pre-development state. It is interesting to note that major flood flow events (20 year ARI) are only reduced by 4%.

At the river mouth, the modelling suggests that the river will cease to flow to the sea for 9% of the total time under the single large dam scenario The APFD statistic for the river mouth is predicted to rise from 0.57 under current conditions to 0.95. Ecological processes at the river mouth are already heavily impacted by the operation of the Mary River Barrage, and this further disruption in freshwater flow patterns could have a severe cumulative effect on estuarine processes related to water quality and limited operation of fishways.

The statistics unequivocally demonstrate that statements to the effect that the environmental flows in the river will not be significantly affected by the dam simply because end-of-system flows are maintained at above 85% mean annual flow are grossly misleading. The full analysis of the State Government's own flow statistics indicate that the environmental values of the river are likely to be profoundly disturbed by the proposal, particularly by the impacts on the minor flushing flows in the river. It is far from certain that this problem could be overcome by fine-tuning the operating procedures of the dam without compromising the prudent yield of the storage.

Table 1. Summary of relevant environmental flow statistics calculated from "Hydrologic Impacts of Water Resource Management Scenarios" (also known as "Appendix A")

Dagun Pocket AMTD 204 km (Just downstream from proposed dam site)

	000b	**002b**	**N007**
IQQM scenario	Pre-development	Current development	Large Reserve
Mean Annual Flow (ML)	691,370	653,423	477,850
% of pre-development MAF		94.5	**69.1**
Median Annual Flow (ML)	430,714	386,530	135,802
% of pre-development MedianAF		89.7	**31.5**
Number of no-flow days	15	57	4031
% No-flow days	0.04	0.14	**10.08**
Continuous no-flow periods			
No flow periods less than 1 month	15	20	**75**
1 month to less than 3 months	0	0	**18**
3 months to less than 6 months	0	0	**16**
6 months to less than 12 months	0	0	**2**
More than 12 months	0	0	**0**
APFD (over full simulation period)	n/a	0.60	**2.39**
Low Flow Exceedence			
%Days >= 10cm	95.0	87.9	87.5
%Days >= 30cm	72.5	62.4	**49.0**
%Days <= 1ML	0.6	0.2	10.3
ARI stats (Annual series calculation)			
1.5yr ARI (flushing flows) (ML)	21,884	20,562	12,481
Percent of pre-development		94.0	**57.0**
5yr ARI (minor flood) (ML)	117,406	111,216	107,734
Percent pre-development		94.7	91.8
20yr ARI (major floods) (ML)	280,678	268,240	269,316
Percent pre-development		95.6	96.0

Fisherman's Pocket AMTD 170 km (just downstream from Gympie)

IQQM scenario	000b Pre-development	002b Current development	N007 Large Reserve
Mean Annual Flow (ML)	1,025,901	924,906	765,525
% of pre-development MAF		90.2	74.6
Median Annual Flow (ML)	700,516	584,821	356,589
% of pre-development MedianAF		83.5	50.9
Number of no-flow days	41	6696	1808
% No-flow days	0.10	16.74	4.52
Continuous no-flow periods			
No flow periods less than 1 month	28	149	158
1 month to less than 3 months	0	54	12
3 months to less than 6 months	0	15	2
6 months to less than 12 months	0	2	0
More than 12 months	0	0	0
APFD (over full simulation period)	n/a	0.85	1.88
Low Flow Exceedence			
%Days >= 10cm	85.1	68.1	58.4
%Days >= 30cm	55.4	41.7	34.9
%Days <= 1ML	0.3	16.8	4.8
ARI stats(Annual series calculation)			
1.5yr ARI (flushing flows) (ML)	34,817	32,374	24,721
Percent of pre-development		93.0	71.0
5yr ARI (minor flood) (ML)	156,834	147,874	136,918
Percent pre-development		94.3	87.3
20yr ARI (major floods) (ML)	339,260	320,280	331,660
Percent pre-development		94.4	97.8

Home Park AMTD 91 km (Lower Mary Valley)

IQQM scenario	000b Pre-development	002b Current development	N007 Large Reserve
Mean Annual Flow (ML)	1,800,148	1,675,628	1,520,754
% of pre-development MAF		93.1	84.5
Median Annual Flow (ML)	1,189,136	1,084,109	865,363
% of pre-development MedianAF		91.2	72.8
Number of no-flow days	14	5071	1550
% No-flow days	0.04	12.68	3.88
Continuous no-flow periods			
No flow periods less than 1 month	13	147	123
1 month to less than 3 months	0	41	9
3 months to less than 6 months	0	10	4
6 months to less than 12 months	0	2	0
More than 12 months	0	0	0
APFD (over full simulation period)	n/a	0.65	1.19
Low Flow Exceedence			
%Days >= 10cm	97.8	83.3	81.3
%Days >= 30cm	80.5	63.7	58.6
%Days <= 1ML	0.1	12.8	4.6
ARI stats (Annual series calculation)			
1.5yr ARI (flushing flows) (ML)	48,469	44,501	37,566
Percent of pre-development		91.8	77.5
5yr ARI (minor flood) (ML)	230,388	223,724	217,046
Percent pre-development		97.1	94.2
20yr ARI (major floods) (ML)	449,054	440,062	430,264
Percent pre-development		98.0	95.8

Estuary AMTD 0 (End of system)

IQQM scenario	**000b** Pre-development	**002b** Current development	**N007** Large Reserve
Mean Annual Flow (ML)	2,569,051	2,410,543	2,242,125
% of pre-development MAF		93.8	87.3
Median Annual Flow (ML)	1,645,546	1,504,401	1,299,315
% of pre-development MedianAF		91.4	79.0
Number of no-flow days	1	2775	3599
% No-flow days	0.00	6.94	9.00
Continuous no-flow periods			
No flow periods less than 1 month	1	201	244
1 month to less than 3 months	0	23	29
3 months to less than 6 months	0	0	0
6 months to less than 12 months	0	1	1
More than 12 months	0	0	0
APFD (over full simulation period)	n/a	0.57	0.95
Low Flow Exceedence			
%Days <= 1ML	0.0	7.1	9.1
ARI stats (Annual series calculation)			
1.5yr ARI (flushing flows) (ML)	63,772	61,691	56,983
Percent of pre-development		96.7	89.4
5yr ARI (minor flood) (ML)	285,640	277,974	280,840
Percent pre-development		97.3	98.3
20yr ARI (major floods) (ML)	501,322	516,276	481,400
Percent pre-development		103.0	96.0

Summary of likely environmental impacts identified by the Technical Advisory Panel, based on the predicted flow regimes from "Appendix A"

The table below summarizes:

- extracts quoted directly from Table 5.5 of the Environmental Flow Assessment Framework and Scenario Implications report prepared for the Mary Basin Water Resource Plan, relating to a large single storage on the Mary River.
- extracts from the TAP's assessments of the Traveston Dam proposal attached to the State Government report 'Water for South East Queensland – a long term solution' produced in July 2006.

Extracts from both reports are in the context of comparing the Traveston Crossing proposal with a proposal for a combination of smaller dams in the catchment, but are quoted here verbatim in reference to the effect of the Traveston proposal.

Table 2. Summary of likely environmental impacts related to flow regime changes identified by the Technical Advisory Panel.

Geomorphology

Barrier effects of the dam on sediment transport would be more significant for the middle and lower reaches of the Mary River. The alluvial nature of the river channel means that this option is likely to be associated with elevated risk of clearwater erosion impacts downstream of the dam. Elevated risk of accelerated bank erosion, due to sandy erodible riverbank materials. Soils within the impoundment and along its shoreline would need to be assessed to determine erosion risks within the dam pondage –experience with erosion in the Mary Barrage pondage suggests elevated risk of accelerated erosion in the upper section of the pondage, where the river banks are affected by standing ponded water and fluctuating water levels resulting from dam operation (the river banks would generally be submerged in the lower part of the pondage). Possible infill of pools downstream of dam due to reductions in high flows. Rivers with sandy load tend to show more rapid dramatic response to flow regime change than rivers with bedrock channels or gravel bedload.

Hydraulic habitat

Broad valley forms mean that the pondage area is likely to be wider than for option R1 with more extensive loss of terrestrial habitat and aquatic habitat on the main stream and tributaries than for the same volume of storage with option R1. Very long on-stream pools are a distinctive feature of the middle and lower freshwater reaches of the Mary River – the extent of this habitat type would be significantly reduced in this option. There would be reduced large woody material inputs to downstream reaches, which may be ecologically significant as there is already limited large woody material in the Mary River and degradation of bank vegetation in many areas has reduced local sources.

Water quality
Existing water quality in this part of the Mary River suggests a significant possibility of blue–green algal blooms. Stratification would also be an issue.

Aquatic vegetation
High risk of infestation of dam pondage by aquatic vegetation. Sandy substrates are favourable for hydrilla and vallisneria. There is risk of rampant growth of exotic aquatic weeds such as cabomba, egeria, and water hyacinth (sourced from the upstream catchment, including infested farm dams) Potential fringing macrophytes depending on dam operation & slopes (especially in upstream parts of the pondage).

Aquatic macroinvertebrates
The effect of option R2 will be concomitant with the size of the impoundment. Option R2 would replace a large stretch of lotic habitat with the lentic environment of a large dam pondage. Very long on-stream pools are a feature of the middle reaches of the Mary River and therefore a proportion of the macroinvertebrate assemblage may be able to use vegetated edges of the dam pondage like the edges of pools – however, the extent of quality of vegetated edge habitats would depend on dam operation. Highly variable water level regimes in dams often result in edge zones that are bare or colonised by tolerant exotics such as para grass. Any stands of emergent and aquatic vegetation within the impoundment would be colonised by macroinvertebrates. However, some obligate lotic species would be lost and a large extent of deep benthic habitat within the pondage will support very few macroinvertebrates. Depending on the management of the pondage, downstream effects are likely to occur due to changes in wetted area, sediment distributions and benthic substrates.

Fish
Potentially a greater number of fish species affected than option R1 due to position of dam lower in catchment – a single large dam on the Mary River upstream of Gympie would inhibit access to a greater area of aquatic habitat than several upstream dams. Magnitude of impact depends on length of impounded stream channel (including tributaries) – likely to be more for downstream site (for a given dam height) due to wider valleys and flatter gradients than for option R1. The dam impoundment is likely to favour only a subset of the total species pool naturally present in flowing waters (e.g. bony bream and fork-tailed catfish that are more likely to occur naturally in this part of the Mary River than at the upstream sites). Stocking of a dam in this part of the river system would open up more of the catchment to stocked species than option R1 (via free access upstream of the dam) though some downstream movement would also occur. A dam on this part of the Mary River is more likely to affect Mary River cod and lungfish than option R1, although currently degraded riparian and instream habitat conditions in this part of the river are likely to be negatively impacting on Mary cod and lungfish populations in comparison to less disturbed reaches further upstream.

Other vertebrates
More significant implications for Mary River turtle via habitat changes downstream (especially vegetation encroachment onto sand bars) and effects arising from the dam pondage (including loss of sand bars by inundation and possibly increased predation by large-bodied predatory fish that are favoured by impoundments including indigenous species such as fork-tailed catfish and stocked species). Dam development may lead to increased spread of cane toad.

General statement concerning the catchment
The Mary River catchment has significant ecological conservation values, as it is situated in a biogeographical transition zone between tropical and temperate environments, and supports a large number of plant and animal species of high conservation significance including species that are endemic[1] to the catchment (Mary River cod, Mary River turtle – both listed as endangered under EPBC; the significance of the Mary River turtle has also been recognised internationally by IUCN) or have restricted geographical ranges (e.g. lungfish [listed as vulnerable under EPBC] and a number of endangered frog species). The Mary River is the best remaining option for restoration and protection of the lungfish and Mary River cod[2]. It is the only river where the endemic Mary River turtle can be restored and protected. It is also the only large river in South-East Queensland without a major mainstream dam.

Impacts in the impoundment
The construction of new dams in both options would lead to significant geomorphological, ecological and water quality changes in the dam pondage areas resulting from conversion of river, floodplain and upslope habitats to dam impoundments (as noted in the introduction above). All of the dams under consideration would flood regional ecosystems of conservation significance.

Fish migration
Traveston Dam would pose a greater impediment to the movement of migratory fish species[3] as it is situated lower in the catchment and commands a greater proportion of the total catchment area than the Four Dams (Traveston Dam commands a catchment area of 2,110 km2, compared with a total of 1,064 km2 for the Four Dams)

EPBC species
Traveston Dam would not affect upper catchment ecosystems, except as a result of major reductions in connectivity with downstream areas (and hence, opportunities for biota to access upstream habitats), but would have greater impacts on the middle and lower Mary River than the Four Dams option[4]. Like the Four Dams option, the Traveston Dam option would affect species of conservation significance, including the Mary River cod, lungfish, Mary River turtle and endangered frogs.

Turbidity
There is a significant risk that water released/spilled from Traveston Dam would be turbid (due to the “averaging” effects of the dam pondage on turbidity resulting from the storage of turbid flood flows[5], as well as potential sources of fine suspended and colloidal material in the dam resulting from the dispersal of sodic soils and (wind or boat driven) wave-induced turbulence) – further investigations would be required to quantify this risk, particularly expert soils assessment in the pondage area.

Lungfish and Mary River Cod
Both options (Traveston Crossing and Four Dams) would lead to reductions in natural habitat and spawning grounds for Mary River cod and lungfish.

Mary River Turtle

Both options (Traveston Crossing and Four Dams) would have negative implications for the Mary River turtle based on existing knowledge of its distribution, habitat and breeding requirements, but the risks to this species could potentially be greater with Traveston Dam than the Four Dams. If the waters spilled/released from Traveston Dam become highly turbid, ecological changes associated with downstream effects of the dam (including loss of unvegetated sand bar habitat resulting from mud deposition and vegetation colonisation, as well as changes in aquatic habitat and food resources) could potentially contribute to the demise of natural populations of this species

Conclusion

The statement that the environmental health of the Mary River will not be significantly affected by a large dam at Traveston Crossing because end of system flows will be maintained in excess of 85% of pre-development flows is simply not supported by the comprehensive scientific investigations that have already taken place during the formulation of the Mary Basin Water Resource Plan. Even if 85% of pre-development mean annual flow volume is maintained at the river mouth, the likely environmental impacts of a markedly altered cease-to-flow regimes in the estuary, and severe changes to the flow regimes in the middle reaches of the river in critical habitats for lungfish, Mary River Turtle and other species will be severe and difficult or impossible to mitigate Because of the incredibly variable nature of flows in the Mary River, the ability to maintain 85% MAF at the river mouth is simply a consequence of the fact that the dam will have a negligible effect on mitigating the large flood events in the Mary River.

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Notes on trends in streamflow in the Mary River and modelling the operation of the proposed Traveston Crossing Dam 1997-2007

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February 2007

There is good evidence that streamflows in the Mary River have been declining over the last 40 years. This is in line with most of the current thought about cyclic climate variability and climate change in S.E. Qld. Figure 1 shows recorded streamflow in the Mary River at a point in the upper catchment that has not experienced any major upstream infrastructure development during the period of record. (It is possible that overland flows may have been reduced because of land use or groundcover changes). However, streamflow is the actual resource that is harvested by dams, and these data indicate that annual flows in the river at that location have reduced from an expected value of around 157 GL/annum to an expected value of 66 GL/annum since 1960.

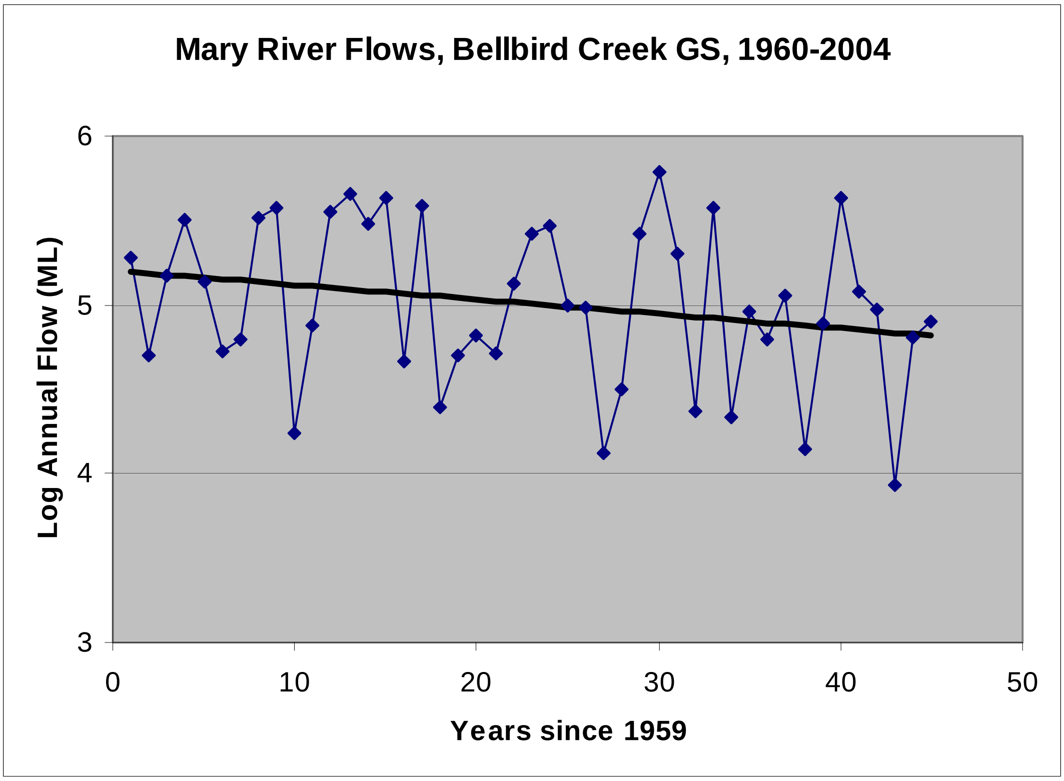

Figure 1. Trend in annual flow rate in the Mary River at the Bellbird Creek confluence.

The IQQM (DLWC 2004)modelling used to formulate the draft Water Resource Plan for the Mary Basin (DNR 2005) offers an opportunity to simulate the natural flows that would have existed in the river at the proposed damsite, in a non-developed 'natural' state over the simulation period of 1890 to 1999. These results are shown in figure 2. A striking feature is the large variability in flows. There does seem to be evidence of a cyclical pattern in the flows. An attempt to illustrate this is shown on the graph by also showing 11 year and 22 year moving averages. It seems that annual streamflows at the damsite would have been very high at the end of the 19th century, generally low during the first half of the twentieth century, high during the mid to late 20th century and the pattern suggests that low streamflows may generally be expected for the late 20th century/early 21st century.

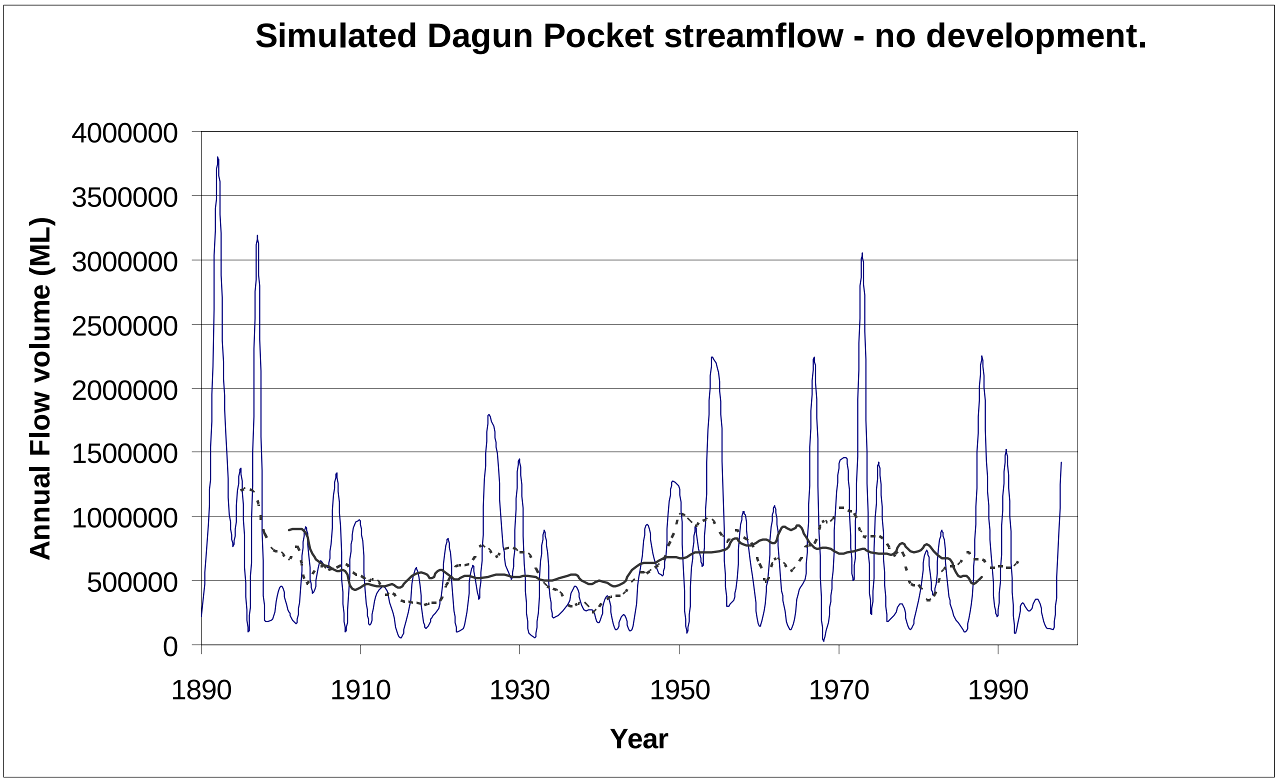

Figure 2. Simulated annual stream flow data for the 'no development' IQQM scenario at Dagun Pocket. 11 year and 22 year moving averages are shown. Derived from 'Appendix A' of the Environmental Flows and Scenario Implications Report for the Water Resource Plan (Mary Basin) 2005.

In their discussion paper on urban water planning commissioned by the Federal Government in 2006, Marsden and Pickering suggested that in light of the likely effects of climate change and variability on stream flows it is prudent to base water resource planning on the most recent available climate data. They observed the similar cyclical pattern in the modelled inflows to Wivenhoe dam over the same period. One question that has been asked of the State Government by Mary Valley residents since the dam proposal was announced, is 'If the dam was built 10 years ago, what would it be like now?". To date, all modelling of the performance of the project has been based only on the climate record from 1890 to 1999, including both very wet cycles, but only including one extended dry period, and explicitly excluding the current and most relevant dry spell.

To attempt to get a feel for the performance and impacts of the project under recent conditions, the Save the Mary River Coordinating Group has developed a daily time step model based as closely as possible on the modelling assumptions used in the published IQQM simulations of the dam proposal released to date. An approximate daily inflow hydrograph was generated for the dam site based on NRW and Sunwater streamflow records from the Dagun Pocket and nearby gauging stations. This enables us to evaluate various scenarios for operating the dam and examine the likely impacts of assumptions made about the operation of the dam. These analyses are only approroximate and need to be repeated with the full level of detailed information available to the proponent and the State Government. However, considerable consultation has occurred in order to ensure that the model is close enough to draw some valid conclusions and to get a feel for the relative magnitudes of assumptions and their impacts. In addition, some water quality analysis has been incorporated into the model, to investigate issues associated with the National Action Plan for Salinity and Water Quality.

An analysis of this crucial time period from 1999 to 2007 has not yet been conducted by the State Government, partly due to the large effort involved in setting the entire catchment model up for a new simulation period. The approach used here is meant to short cut this delay, and should be repeated as part of the EIS if the full simulation cannot be conducted and analysed in time. The inflow hydrograph generated from actual streamflow records should be at least as accurate as a hydrograph simulated from climate data. However, care is needed to interpret the results, because of complications with accounting for linkages with Borumba dam and downstream allocations. Three scenarios are presented and discussed here:

“S1 minimal loss”.
This scenario represents a dam of stage 1 capacity, shape, and target yield, operated under the same evaporation, seepage and downstream flow release rules as used in “Water for SE Qld- a long term solution”. These assumptions are very conservative, and in local eyes are likely to underestimate the actual seepage and evaporative losses in the storage. Evaporative losses are based on Nambour monthly Epan figures adjusted to simulate evaporation from a deep clear water surface. Seepage is estimated at ‘a foot per year’. To account for Borumba releases, it is assumed that all releases from Borumba that would have passed Dagun Pocket are captured by the storage and are available to be incorporated into the yield. This effectively gives the dam the best chance of success, because it does not need to supply any downstream allocations on top of the environmental flow release rules assumed. The environmental flow release rules are also very conservative – all flows up to 100 ML/day are passed through the storage, and one flushing flow of between 10,000 and 20,000 ML/day (if it occurs) is allowed to pass through once per water year.

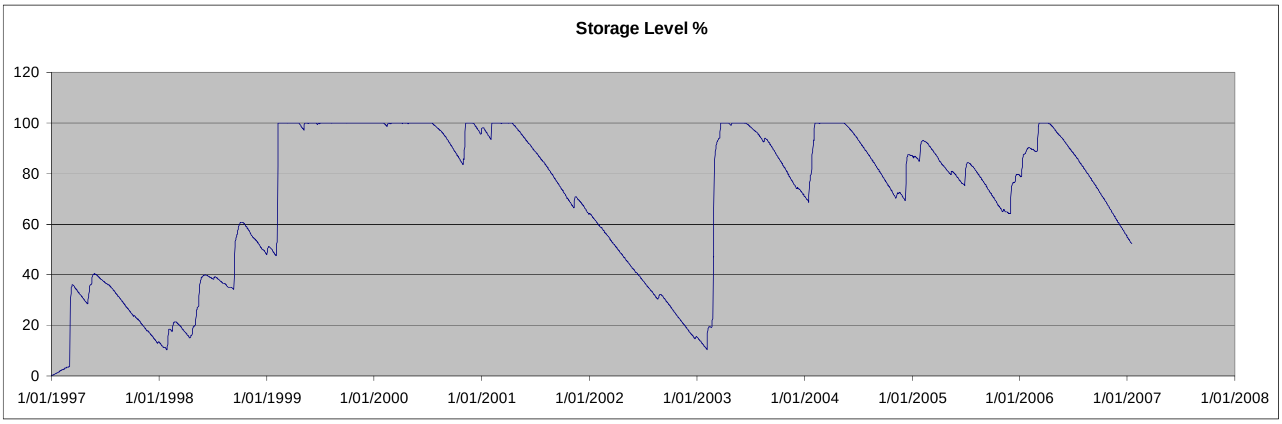

Figure 3. Storage behaviour curve for scenario S1-minimal loss.

Even with these generous assumptions, and not having to provide any water at all for downstream users, the dam operates at the margin of failure and has severe impacts on downstream flows, reducing median daily flows a further 35% below the existing (already drought affected) flow regime.

“S1 – WRP”
This scenario is based on the environmental flow release rules used to formulate the WRP, - all flows up to 250 ML/day are passed through the storage, and flushing flows between 15,000 and 25,000 ML/day are allowed to pass through. Evaporation losses are more in line with local expectations, based on being a warm shallow storage, with surface weed cover and fringing vegetation and mudflats – assumed to be 1.5 times the evaporation from a clear deep water surface. (Still conservative). Seepage losses are also more in line with local expectations at “a metre per year”. All Borumba releases destined for downstream users are still accounted for as part of the yield of the storage

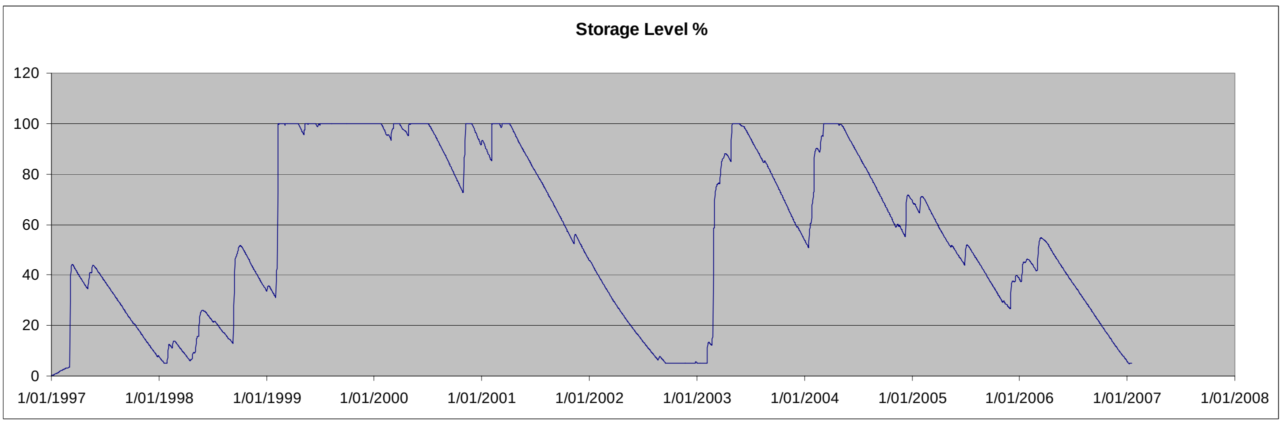

Figure 4. Storage behaviour curve for scenario S1-WRP.

With more realistic assumptions, but still not leaving any water for downstream users on top of the environmental flow releases, it is fairly clear that the dam would have experienced a convincing yield failure in late 2002 and in early 2007.

"S2 - WRP"

This scenario is also based on the environmental flow release rules used to formulate the WRP, and the same evaporation and seepage rules used in S1-WRP. All Borumba releases destined for downstream users are still accounted for as part of the yield of the storage. This looks at how the larger Stage 2 storage (530GL) would fare with trying to supply a yield of 110GL/year. (Note that this is not the 150GL allowed for in the WRP)

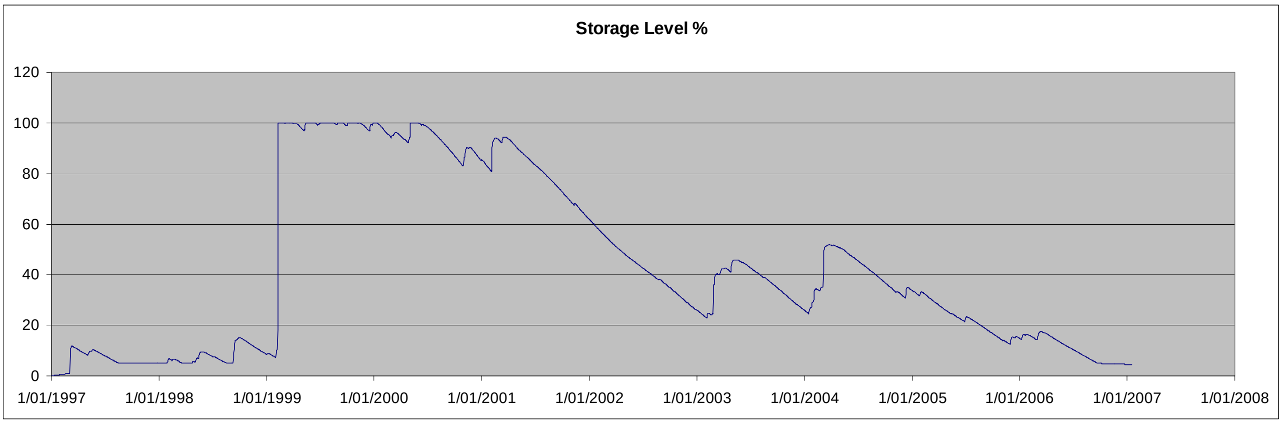

Figure 5. Storage behaviour curve for scenario S2-WRP.

It appears that even the larger stage 2 dam, with a moderate target yield of 110GL would have also experienced a convincing yield failure by the end of 2006.

Comparison.

Table 6 shows a comparison of some of the losses from the storage and the effects on flows immediately downstream. These serve to give a ball-park feel for relative efficiency of the storage and its impact on water resources in the catchment.

Scenario	S1 minimal loss	S1 WRP	S2 WRP
Mean annual yield (GL)	68.7	66.2	98.8
Mean operating depth (m)	4.47	4.0	5.3
Evaporative losses (GL)	20.6	26.6	54.2
Seepage losses (GL)	6.9	19.1	38.5
Reduction in mean annual flow volume at Dagun Pocket %	30	33	55
Reduction in median daily flow volume at Dagun Pocket %	35	7	5

Table 6. A comparison between the scenarios investigated for the modelling period 1997-2007

It is interesting to note that the environmental flow release rules assumed in the WRP resulted in much less impact on the median daily flow than the release rules used in later documents. It is important to stress that the last two rows refer to the additional impact over and above the current flow regime in the river, not relative to the 'no development' scenario as used in the WRP environmental flow schedules.

Conclusion

This preliminary analysis reinforces the commonsense conclusion that accurate assessment of likely evaporation and seepage losses is critical to evaluating the economic and environmental viability of the project. Under recent climatic conditions, it is unlikely that the project will be able to provide the anticipated yields, allow sufficient water for downstream users, and allow for maintenance of a satisfactory environmental flow regime. It is essential that this analysis be properly repeated and openly reported, and the estimates assumed for evaporation, seepage and environmental flow release subject to a meticulous independent peer review during the EIS.

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Notes on the likely impacts of the Traveston Crossing Dam proposal on salinity and water quality in the Mary River.

S. Burgess
Save the Mary River Coordinating Group
February 2007

There is some evidence that the base flow in the Mary River downstream from the proposed Traveston Crossing dam site is saline, which could indicate a saline groundwater table. If this is so, the effect of ponding a large area of water and blocking the natural groundwater flows with the dam wall in this area would have unpredictable consequences, possibly causing this saline groundwater to appear near the surface in nearby areas of the valley. The effect of this on the surrounding countryside, if this occurs, will be devastating. The area of the valley in the vicinity of the dam has already been mapped as a high salinity risk as part of the National Action Plan on Salinity and Water Quality. This map can be viewed at www.nrw.qld.gov.au/salinity/pdf/burnettmary_map.pdf.

In times of low flow, salinity (EC) levels in the river downstream of the dam already exceed the Queensland Water Quality Guidelines for the Mary River (2006). Figure 1 shows EC levels recorded by the MRCCC while travelling down the river during the annual catchment crawl in October 2006, indicating where this occurs. (from Wedlock 2006)

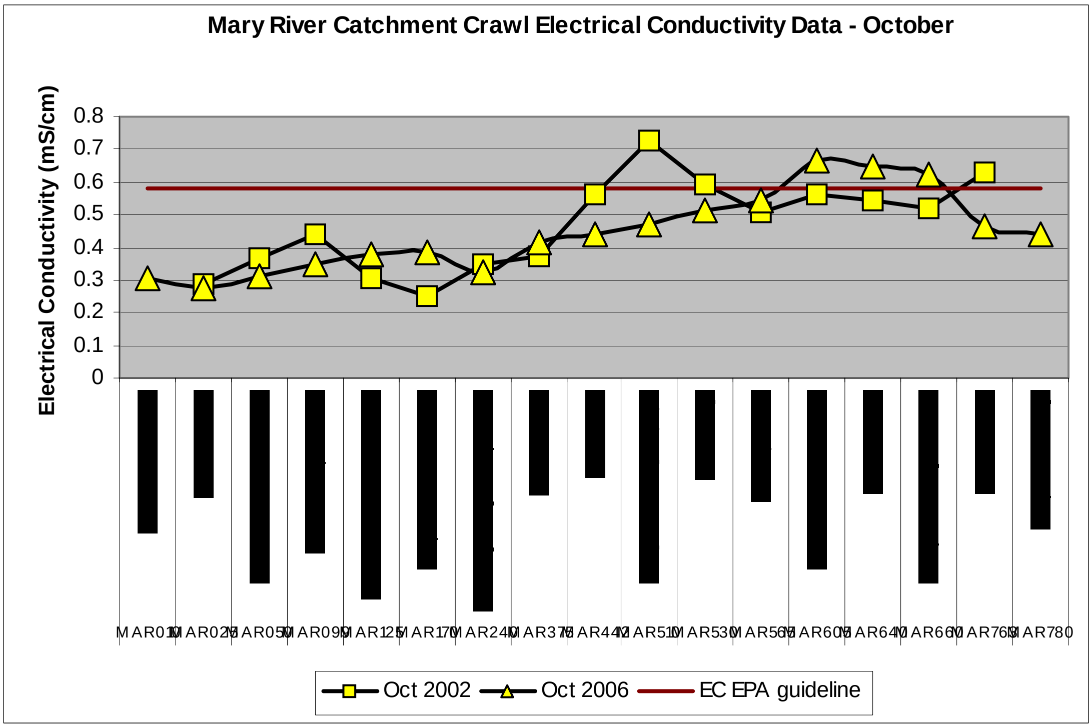

Figure 1: Electrical conductivity levels recorded during the 2006 & 2002 Catchment Crawls

At a given point in the river, there is a strong negative correlation between EC levels and flow, as shown in figure 2 for the stream gauging station at Fisherman's Pocket. It is particularly clear if you investigate a particular flow sequence (to remove compounding long term time trends), as illustrated in figure 3.

The 80 percentile figure for Southern Coastal Streams from Appendix G of the Queensland Water Quality Guidelines is 572 µS/cm. Figure 2 also shows that when flows are low, EC levels already reliably exceed this figure.

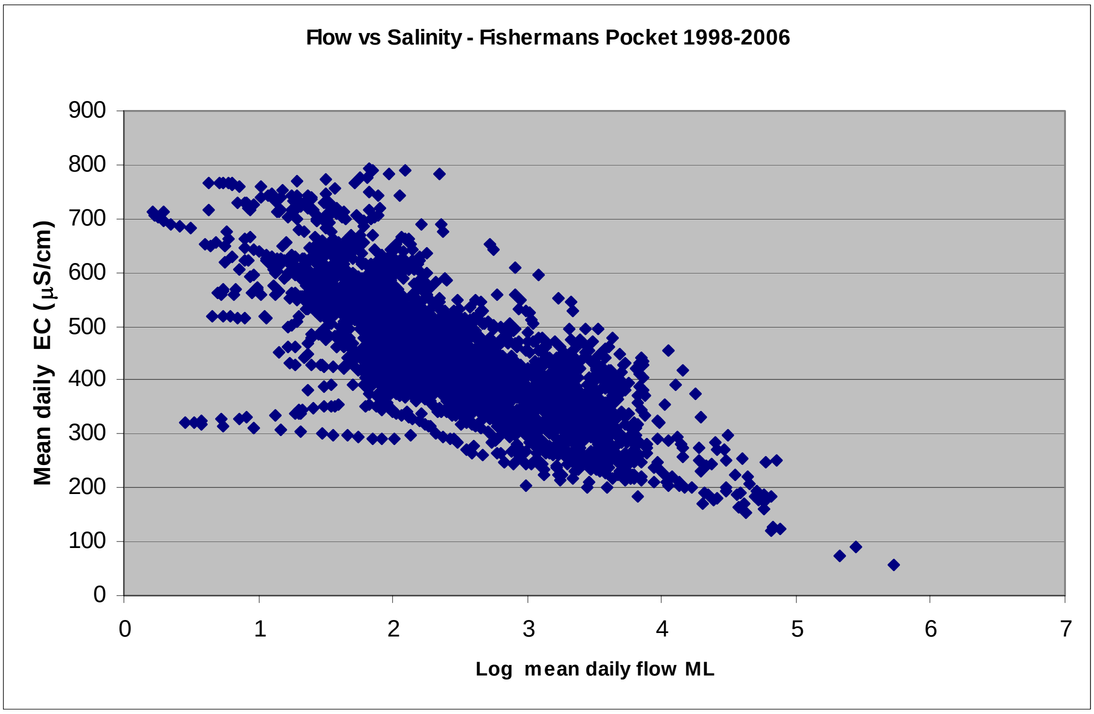

Figure 2. The overall correlation between reduced flow and increasing salinity at Fisherman's Pocket. Note the large number of EC readings above 572μS/cm.

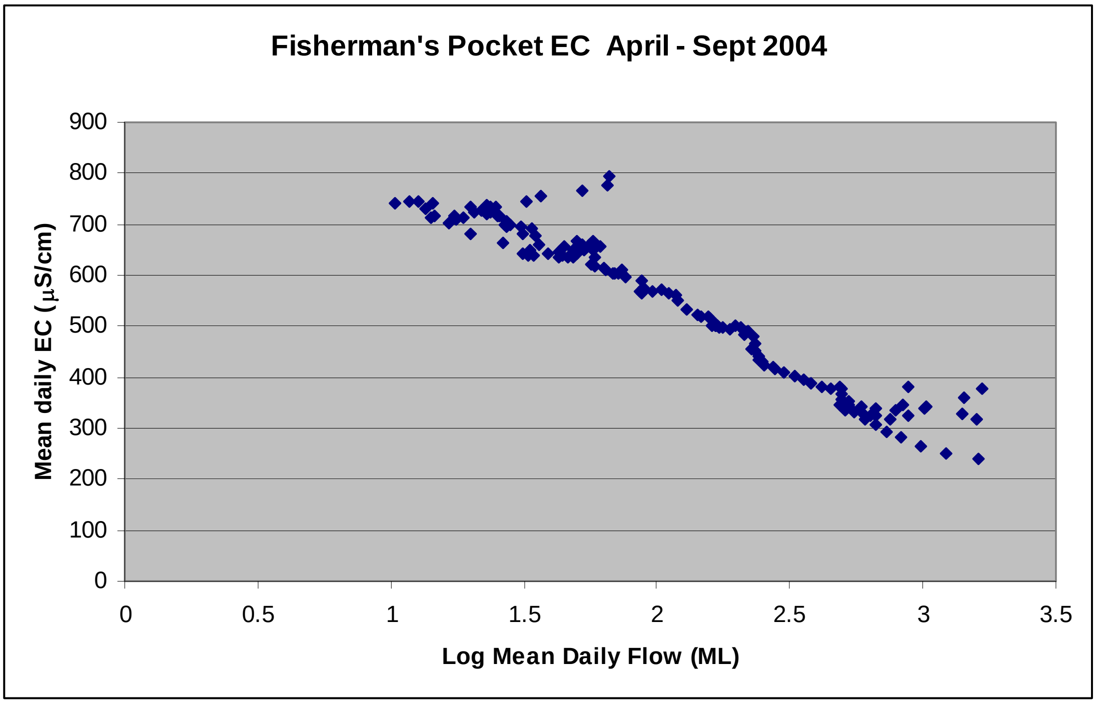

Figure 3. Correlation between reduced flow and increasing salinity during a typical seasonal decreasing flow sequence.

EC levels may also be showing a generally increasing long term trend with time, as shown in figure 4.

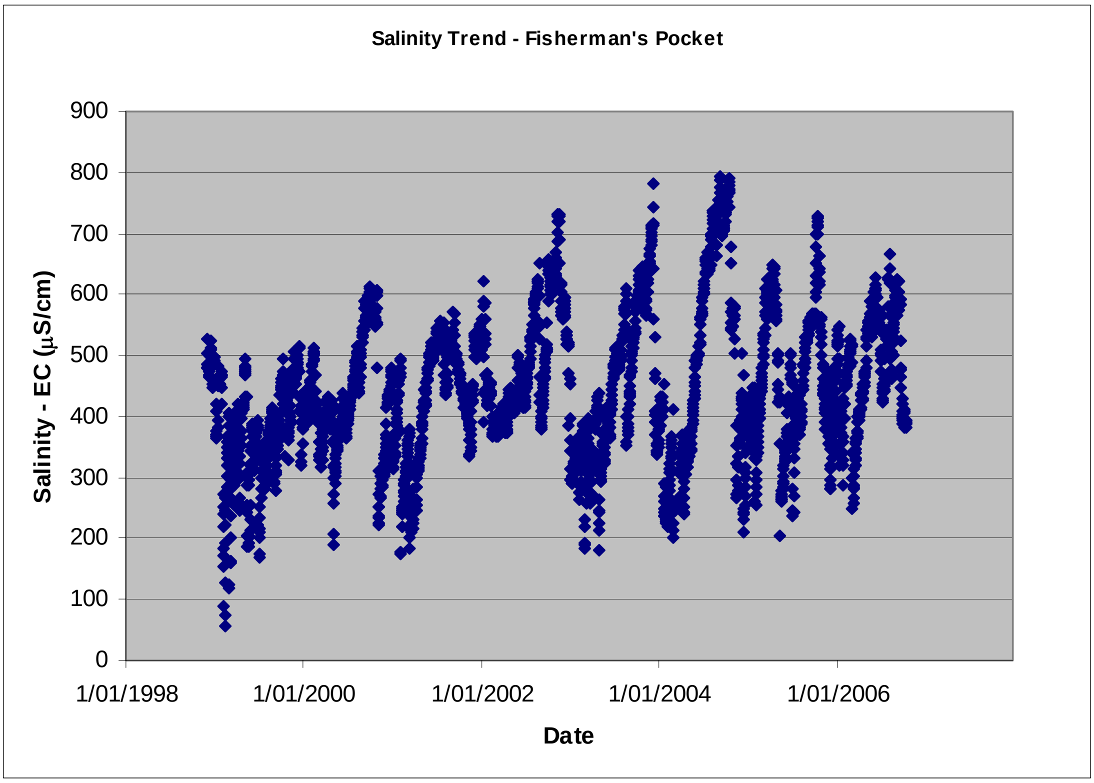

Figure 4. Time trend in salinity levels at Fisherman's Pocket.

The impact of the dam proposal of reducing river flows downstream of the dam site, particularly with respect to the low and medium flow regime, can do nothing but exacerbate and accelerate these trends and effects. For these reasons alone, It is not likely that the operators of the dam will be able to comply with the provisions of the Queensland water quality guidelines or the intent of the National Action Plan for Salinity and Water Quality and also provide the expected yields from the storage.

In addition to the effects on water quality resulting from reduced downstream flow, the dam itself would play a direct role in concentrating contaminants. A rudimentary water quality model was incorporated into the daily time step model described in Burgess 2007 used to investigate the storage and yield behaviour of the dam. This calculates the effect of evaporation and seepage from the storage on concentrating substances that come into the storage in the dam inflow. Figure 5 shows the effect of a stage one-sized storage (S1 minimal loss scenario) on concentrating pollutants in the storage over the 1997 to 2007 simulation period. Concentrations in the storage are increased to nearly 50% above the concentration in the inflow at times within this short 10 year period. This has major implications for water quality in the storage and in the downstream flows from the dam.

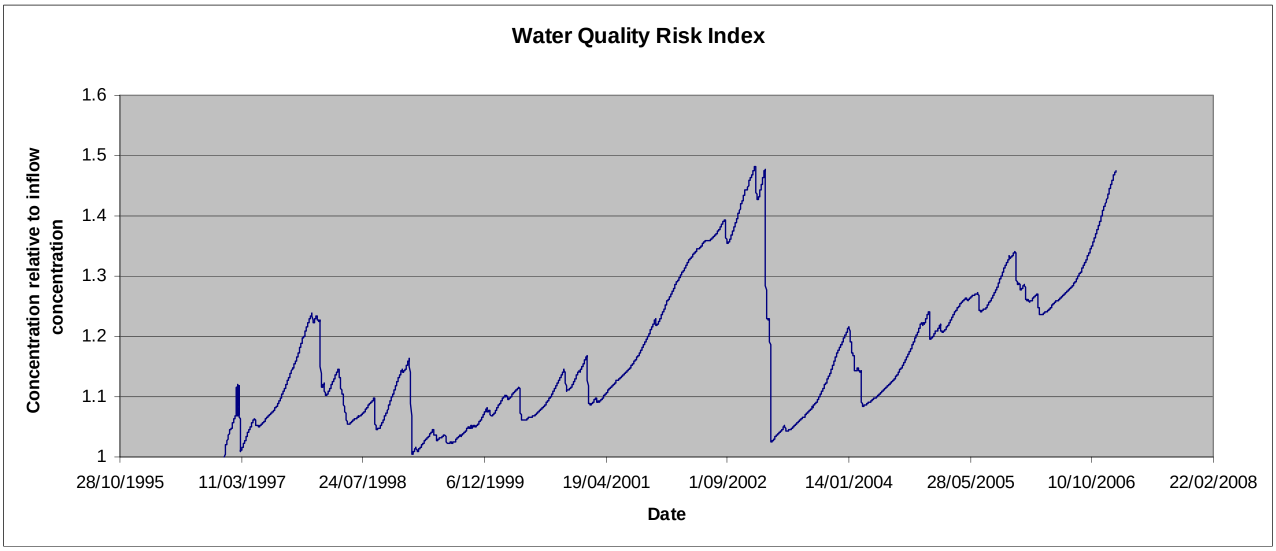

Figure 5. Modelled increase in outflow concentration from the storage, Traveston Crossing Stage 1.

To sum up, in times of low flow the Mary River already fails to comply with water quality guidelines, and compelling evidence suggests that the construction of the proposed dam can do nothing but greatly increase the risk of major salinity impacts on the surrounding countryside, and greatly reduce water quality in the river and the storage itself. This is directly opposed to the objectives of the National Action Plan for Salinity and Water Quality and in a properly conducted cost/benefit analysis would contribute overwhelming to the risks and costs of the project. It is highly unlikely that the proposal could produce the expected yields and also comply with the water quality requirements of the catchment.

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