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## CONTENTS

<b>6.</b>	<b>Project Rationale and Alternatives</b>	<b>6-1</b>
6.1	Need for Water	6-1
6.2	Compliance with Government Water Planning Policy	6-3
6.2.1	Water Act 2000	6-5
6.2.2	Draft South East Queensland Water Strategy	6-5
6.2.3	Need for Traveston Crossing Dam as part of the water grid	6-6
6.2.4	Future demand projections	6-7
6.3	Selection of Traveston Crossing Dam	6-7
6.3.1	Alternatives to surface water supplies	6-8
6.3.1.1	Desalination	6-8
6.3.1.2	Water Demand Management	6-24
6.3.1.3	Water Harvesting	6-24
6.3.1.4	Stormwater Harvesting	6-25
6.3.1.5	Recycling	6-26
6.3.1.6	Rainwater Tanks	6-27
6.3.1.7	Groundwater	6-27
6.3.2	Alternative Surface Water Supply Options	6-28
6.3.2.1	Cost of Northern NSW Dams	6-29
6.3.2.2	Cambroon Dam	6-30
6.3.2.3	Other Alternative Surface Water Supply Options	6-30
6.4	Costs and Benefits of the Project	6-31
6.4.1	Costs estimates for Traveston Crossing Dam	6-37
6.4.1.1	Land Costs	6-37
6.4.1.2	Northern Pipeline Interconnector	6-38
6.4.1.3	Relocation of Bruce Highway	6-38
6.4.1.4	Relocation of Local Roads	6-38
6.4.1.5	Cost of Water Restrictions	6-38
6.4.2	Sustainability of Traveston Crossing Dam	6-38
6.4.3	Sustainability Implementation	6-41
6.4.4	ISF/Cardno Report	6-46

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**FIGURES**

Figure 6-1 Timeline of Queensland Government Water Planning Policy	6-4
Figure 6-2 Supply Augmentation Projects to the year 2012	6-7
Figure 6-3 Energy Consumption per ML for Traveston Crossing Dam vs. Desalination (delivered to Brisbane)	6-9
Figure 6-4 Whole-of-Life Energy Consumption Comparison	6-10
Figure 6-5 Operational Emissions of TCD vs. Desalination	6-11
Figure 6-6 Whole-of-Life Operational Emissions of TCD vs. Desalination	6-12
Figure 6-7 Annual energy acquisition costs for a desalination plant or Traveston Crossing Dam (real 2008 dollars)	6-13
Figure 6-8 Whole-of-life costs for Traveston and desalination plants with cost of energy offsets (carbon credits) included in energy costs	6-16
Figure 6-9 Whole-of-life project costs for Traveston and desalination plants with cost of green energy included in energy costs	6-17
Figure 6-10 Difference in whole-of-life project costs for Traveston and desalination plants with cost of green energy included in energy costs	6-18
Figure 6-11 Levelised Cost Comparison of Traveston Crossing Dam to Desalination	6-19
Figure 6-12 Broader cost benefit analysis	6-36

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## TABLES

Table 6-1 SEQ Regional Population Projections (2006 - 2056)	6-2
Table 6-2 Water Restrictions	6-5
Table 6-3 GHG Emissions – Traveston Crossing Dam	6-10
Table 6-4 GHG Emissions – Desalination	6-11
Table 6-5 Capital cost comparison to other desalination plants in Australia	6-15
Table 6-6 Whole of life costs: Traveston Crossing Dam and Desalination	6-16
Table 6-7 Summary of whole-of-life project costs for Traveston Crossing Dam and a desalination plant with cost of carbon credits and green energy included in energy costs	6-19
Table 6-8 Supplementary Benefits of the Project	6-23
Table 6-9 Alternative Surface Water Options (not in priority order)	6-28
Table 6-10 Present value cost estimates for alternative supply portfolios, 2007-2056	6-33

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## 6. PROJECT RATIONALE AND ALTERNATIVES

Six core issues were raised in submissions relating to the rationale and alternatives for the construction of Traveston Crossing Dam. These included claims relating to:

- need for water;
- projects compliance with regional and State water supply planning, policy and legislation;
- demand projections;
- selection of Traveston Crossing Dam;
- historical decisions on project viability
- process of project justification.
- sustainability of Traveston Crossing Dam as an option;
- economic assessment supporting the Project.

### 6.1 Need for Water

The need for the water is discussed in detail in Section 2.3 of the EIS. The following discussion expands on the information presented in the EIS.

The rationale in regard to the need for water can be categorised into two areas:

- 1) response to population growth; and
- 2) response to drought conditions and drought proofing the region.

SEQ is currently experiencing the compound effects of the worst drought in more than 100 years, unprecedented population growth and uncertainty surrounding the nature of climate change and future climate variability. The Queensland Government has recognised the potentially devastating social and economic impacts associated with a water supply shortfall through numerous policy documents and regulations, and is committed to ensuring water supplies in SEQ are sufficient to meet future demand. SEQ has been under water restrictions since May 2005, with Level 6 water restrictions introduced in November 2007.

Since the 1980s, the SEQ population has experienced a sustained average population growth average of 55,300 persons per year. The SEQRP was prepared to provide a framework for sustainable growth in the region to the year 2026. The population projections that were the driver for the preparation and implementation of the SEQRP underpin the need for water security in the region, to ensure the sustainable growth of the SEQ community.

The current population projections (as presented in the Draft South East Queensland Water Strategy prepared by the QWC) are presented in **Table 6-1**.

**Table 6-1 SEQ Regional Population Projections (2006 - 2056)**

	Projected Population	
	Medium	High
2006 <sup>1</sup>	2,802,500	2,802,500
2011	3,072,300	3,133,800
2016	3,376,800	3,518,900
2021	3,677,000	3,921,200
2026	3,959,500	4,321,600
2051 <sup>2</sup>	5,079,700	6,233,500
2056 <sup>3</sup>	5,250,000	6,432,1000

<sup>1</sup>Sourced from the Planning Information and Forecasting Unit, Department of Local Government, Planning, Sport and Recreation, October 2007

<sup>2</sup>2051 figures taken from *Queensland Government Population Projections to 2051: Queensland and Statistical Divisions, 2<sup>nd</sup> Edition, 2006* (Published by the Office of Statistical Research, July 2006)

<sup>3</sup>2056 – extrapolated by QWC from 2051 data and figure provided by PIFU and from *Queensland Government Population Projections to 2051: Queensland and Statistical Divisions, 2<sup>nd</sup> Edition, 2006*

Assuming the medium growth projection series (which is considered the most reasonable prediction for planning purposes), SEQ will continue to grow at a rate of nearly 60,000 persons per year, and will reach an overall population of nearly 4 million by 2026. The Plan therefore provides a clear direction for the State Government to implement strategies to facilitate sustainable growth.

A critical element in achieving sustainable growth in the region is to provide timely and cost-effective infrastructure and services to the SEQ community. With SEQ's population predicted to increase by 33% over a 25 year period, the inherent need for water to ensure the region is protected against the economic and social impacts associated with lack of sufficient water supply is evident.

The Queensland Government has a clear, regulated strategy to address and manage population growth through the implementation of the SEQRP. It is also pertinent to note that the SEQRP involved its own separate stakeholder consultation process prior to it becoming Government regulation. The SEQRP identifies 12 regional policies which set out the desired regional outcomes, principles and policies to address growth management issues.

In particular, Policy 11 - Water Management, directly responds to water management issues in the region. A key principle is to 'provide assured supplies of water to meet the reasonable needs of growth and development in the region'. To achieve this principle, the document directly identifies policy initiatives to develop new and upgrade existing dams as part of an integrated water supply system. In order to support the implementation of the SEQRP, the South East Queensland Infrastructure Plan and Program (SEQIPP) has been developed. SEQIPP outlines the State Government's infrastructure priorities, describing the SEQ Water Grid and specifically identifying the construction of the Traveston Crossing Dam as a key component to the Strategy.

The SEQRP is the key planning document that identifies the Queensland Government's intentions in relation to the planning and development of SEQ. Rather than capping population growth, the Plan facilitates population growth management in SEQ. The Plan states:

*"Some submissions on the Draft Regional Plan suggested growth should not be planned for, but rather should be redirected to alternative locations in the State. While*

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*this could be encouraged, there is no available or generally acceptable policy arrangement to direct this outcome (SEQRP, Office of Urban Management)."*

Growth management and the promotion of sustainability are proposed to be achieved principally through the regional land use pattern which establishes categories of land use, and regional policies, one of which is "sustainability":

*"The overriding intent of the Regional Plan is to ensure the region grows and changes in a sustainable way. An appropriate balance of environmental, social and economic objectives needs to be used in assessing major planning and development proposals; and in better managing the use of resources, particularly land, water and energy."*

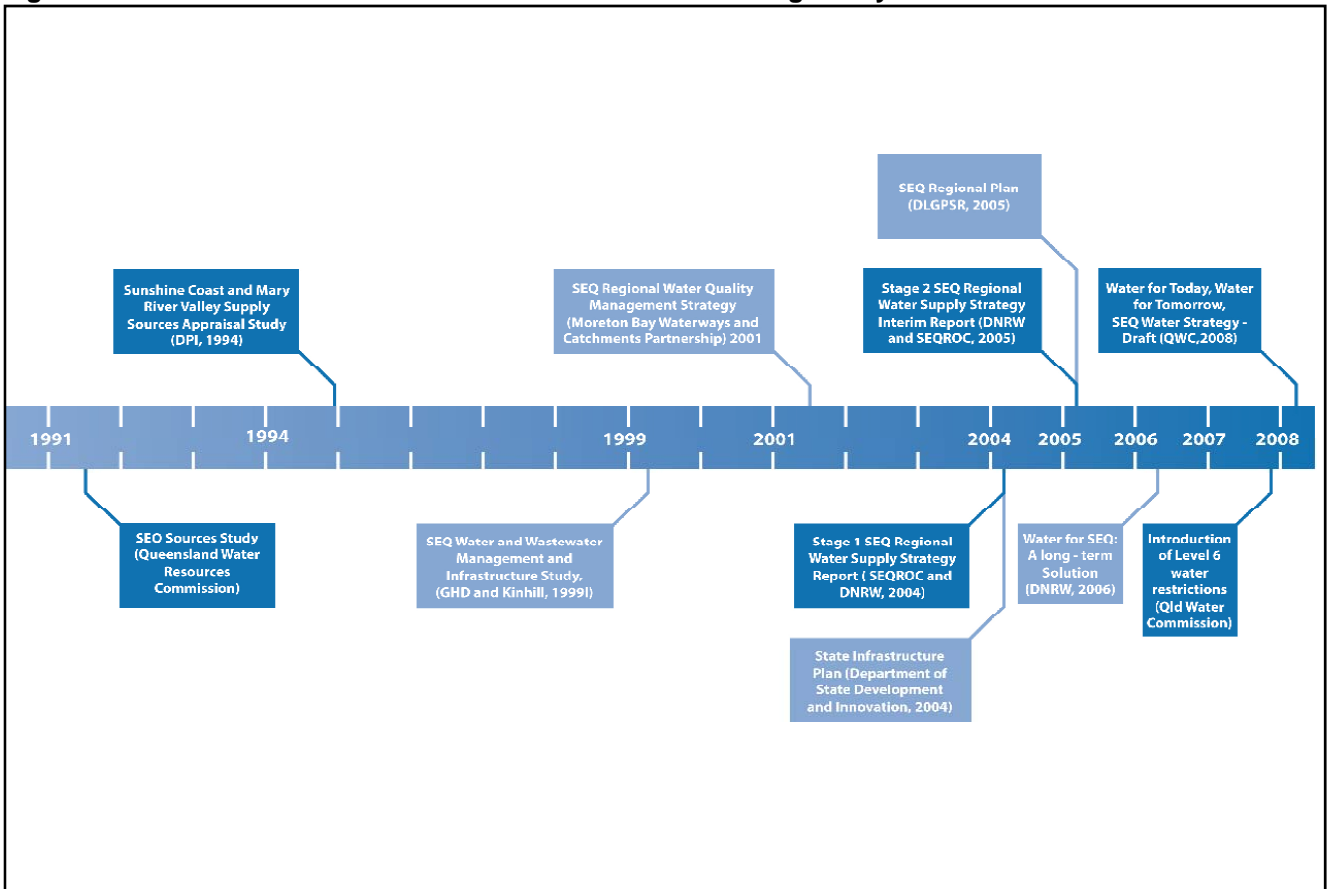
Accordingly, the State Government's planning framework for the SEQ region does not propose population caps as a means of developing or promoting sustainability. Development of Traveston Crossing Dam is foreshadowed in the SEQRP as a response to managing the increased demand to provide secure water supplies for SEQ. The balancing of environmental, social and economic objectives through the conduct of an EIS is the appropriate means of ensuring that the SEQ region grows in sustainable way consistent with the regional policies of SEQRP.

A submission claimed that the proposed dam could potentially be used as a nuclear power facility in the future. The State Government has regulated the implementation of the Water Supply Emergency Measures through the construction of the SEQ Water Grid to ensure the security of essential water supplies. The proposed Traveston Crossing Dam is a key element of the water grid that will provide 70,000 ML/a of potable water to the residents of SEQ. It is therefore not the Government's intention to use the facility as a nuclear facility.

## **6.2 Compliance with Government Water Planning Policy**

The Queensland Government's water supply strategy is the culmination of a lengthy planning process which has been in progress for more than a decade. The historical development of water planning policy in SEQ is detailed in Section 2.2 of the EIS. A timeline of the key investigations and policy documents is presented in **Figure 6-1** below. Furthermore, as part of Queensland Government policy process, the preparation of each of the documents listed in **Figure 6-1** involved key stakeholder consultation, specific to the document content at that point in time.

**Figure 6-1 Timeline of Queensland Government Water Planning Policy**



Each of the strategies and studies in **Figure 6-1** identified the inherent need for increased water supplies in SEQ. Most notably, many of them identified the Mary River, Traveston Crossing and the Coles Creek areas as prospective sources for additional water supply.

The inherent principle of these plans, strategies and policies is that of sustainability. The key themes of the principles applicable to the Traveston Crossing Dam project include:

- ensuring sustainable water supply for future generations;
- sustainable ecosystems ensuring protection of biodiversity;
- sustainable enterprises and employment opportunities; and
- sustainable communities.

Water resource planning in SEQ reached its pinnacle in late 2005-2006, when the region was experiencing the pressures associated with continued drought conditions coupled with unprecedented population growth. Increased restrictions were being put in place, which further highlighted the need for water supply options to be reviewed, prioritised and progressed urgently. **Table 6-2** shows the timing of water restrictions in SEQ.

**Table 6-2 Water Restrictions**

Water Restrictions	Date
Level 1	13 May 2005
Level 2	3 October 2005
Level 3	13 June 2006
Level 4	1 November 2006
Level 5	10 April 2007
Level 6	23 November 2007

It was in 2005 that the State Government implemented the water planning policy and strategies to be undertaken over a 15 year period, in order to protect the region from the potentially devastating social and economic impacts. The Queensland Government has committed to ensuring that water supplies in SEQ are sufficient by mandating the implementation of the SEQ Water Grid.

### 6.2.1 Water Act 2000

The State Government, through amendments to the *Water Act 2000*, has established the QWC, with the key objective to facilitate and implement regional water security programs.

To further ensure regional water security, amendments to the *Water Regulation 2002* regulates the implementation of Emergency Water Supply Measures, including identification of responsible parties and timeframes for the measures to occur. The construction of the Project is listed as one of the emergency measures, and QWI is directed to:

‘Take all necessary steps to prepare for, and construct, Traveston Crossing Dam Stage 1 by 31 December 2011’<sup>1</sup>

Therefore QWI is carrying out its legislative requirement through the preparation of the EIS and Supplementary Report.

### 6.2.2 Draft South East Queensland Water Strategy

The QWC’s Draft South East Queensland Water Strategy - released on 26 March 2008 – sets out the next significant stage in regional water planning designed to meet the region’s water supply needs for the next 50 years. The QWC is currently undergoing a consultation process on the Strategy. The Strategy is designed to deliver a new standard of water security to Queensland, with the aim of supplying sufficient water to support a comfortable, sustainable and prosperous lifestyle while meeting the needs of urban, industrial and rural growth and the environment.

The basis of the Strategy is to provide a plan for providing new water supplies to prevent the development of any gap between supply and demand in the face of certain population growth and probable climate change impacts. The Strategy recognises that a diversified and integrated approach including demand management, surface water augmentation, desalination, purified recycled water and a network of pipelines to connect the water supply sources is required to satisfy the future water supply needs of SEQ. Through these supply sources the Strategy will make the most of the rain received and protect the regional community from drought. The Strategy identifies that Traveston Crossing Dam is an absolutely necessary and integral part of the future supply requirements of SEQ. The Strategy forecasts demand of 230L/person/day, which is based on permanent low level restrictions and that water consumption will reduce per capita by around 24% compared to before the Millennium Drought.

<sup>1</sup> Schedule 10B, Item 12, Water Regulation 2002

### 6.2.3 Need for Traveston Crossing Dam as part of the water grid

Many submissions have outlined the ability of several measures to supply water to SEQ. It is recognised that there are a suite of measures that could potentially provide future water supplies. As outlined in Section 6.2.1, the State Government has regulated the implementation of the Water Supply Emergency Measures through the construction of the SEQ Water Grid to ensure the security of essential water supplies. This includes the implementation of an integrated and diversified portfolio of projects and strategies including:

- one of the largest potable recycled water (PRW) schemes in the world;
- one of the largest desalination facilities in Australia;
- Traveston Crossing Dam;
- the Logan River system, comprising the Wyaralong Dam, Bromelton Offstream Storage and Cedar Grove Weir; and
- 400 kilometres of interconnecting pipelines.

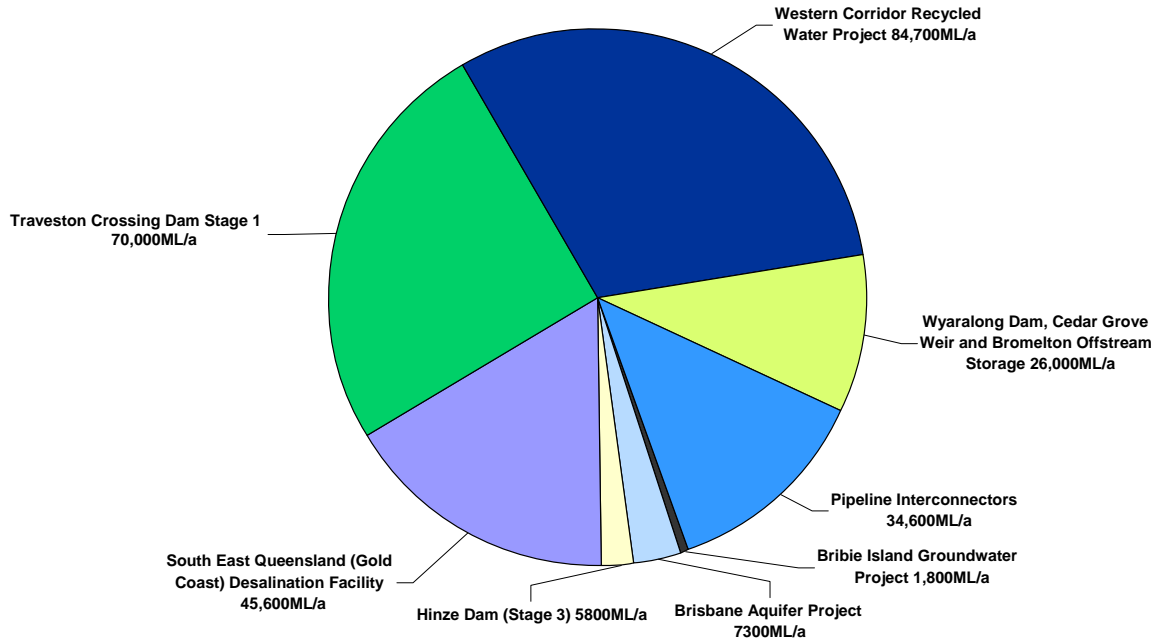
Through the implementation of these measures, SEQ will not rely on any one type of water source. This diversification of supply is seen as integral in ensuring that SEQ has sufficient reliable water supplies into the future. It is important to acknowledge that Traveston Crossing Dam is a critical element in the SEQ Water Supply Program, and the SEQ Water Grid.

**Figure 6-2** identifies the contribution of supply augmentation projects to the year 2012 (i.e. 2008 – 2012). These projects encompass a diverse range of supply options from both surface water and ‘manufactured’ water sources. This mix of projects will reduce the risk of supply failure, by broadening the geographic location of water sources and reducing the reliance on water from dams and weirs from 95% of the total regional supply (in 2006) to approximately 75% in 2012 (QWC, 2008). Through this combination of supply sources, the Strategy will make the most of the rainfall received in the region and protect the regional community from drought. The interconnection of water supply sources also results in the ability to run the water grid as a portfolio. This will provide the ability to pump water from areas with a surplus to another with low capacity, which will increase the LOS system yield.

Traveston Crossing Dam will provide 70,000 ML/a, which is a significant portion of the additional water supply of the projects planned for construction (refer **Figure 6-2**). In Section 2.4.4 of the EIS it is concluded that the Project supplies a significant portion of SEQs additional water supply requirements on a least cost basis. If the Project was omitted from the strategy, it is considered that other water supply alternatives could not provide 70,000ML/a to the region’s water supply on a same cost basis.

Figure 6-2 Supply Augmentation Projects to the year 2012

Drought Contingency Projects - Water Supply Capacity



Source: Queensland Water Commission Draft South-East Queensland Water Strategy

6.2.4 Future demand projections

Submissions have raised issues about the demand projections outlined in section 2.3.1 of the EIS. In particular, issues have been raised about whether the forecast demand of 230L/person/day is appropriate given that the population of SEQ has been achieving a target of 140L/person/day under Level 6 water restrictions. The use of 230L/person/day is consistent with the demand projections outlined in the QWC’s Draft South East Queensland Water Strategy. The forecasting of urban water demands in SEQ takes into account population growth projections derived from the Queensland Government Population Projections 2051, assessment of historical patterns of water use, and effectiveness of existing and potential water saving programs. In particular, demand forecasts were made assuming existing policies will continue, such as the Water Efficiency Labelling Scheme (WELS) and parts of the *Queensland Development Code* that mandate the installation of water efficient fixtures and fittings in new homes. Further, the demand projections are based on the premise that there are permanent low level restrictions and that water consumption will reduce per capita by around 24% compared to before the Millennium Drought when water consumption was around 300L/person/day.

6.3 Selection of Traveston Crossing Dam

The reasons the Traveston Crossing Dam was preferred ahead of other alternatives are well documented in Section 2.4.2.2 of the EIS. In particular, it is the only surface water option that can provide the size and reliability of yield required. The Mary River has SEQ’s largest mean annual flow and is also one of the most undeveloped rivers in terms of existing take or storage capacity. The Mary River flow is equal to approximately 76% of the flow of all the other rivers in SEQ combined.

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### 6.3.1 Alternatives to surface water supplies

Section 2.4.1 of the EIS considered alternatives to surface water supplies. Alternatives discussed included:

- demand management;
- recycling;
- rainwater tanks;
- groundwater; and
- desalination.

Triple bottom line (i.e. economic, environmental and social) performance was the main criteria adopted in determining which alternative supply options to compare with the Project. An extensive process of screening over 80 water supply options was undertaken by the Queensland Government. This screening process focused on hydrological performance, indicative cost, and social and environmental impacts. Demand and supply options shown to have high economic, social or environmental costs were removed from the list of potential options. Options with low hydrological performance were also removed. Following this initial screening process, the focus was on determining the best supply portfolio to meet forecast demand, with the assumption that all realistic demand side measures were included. This formed a key component of the preparatory work for the QWC's Draft South East Queensland Water Strategy.

Many of the submissions received suggested that the assessment of water supply alternatives was not adequate, inaccurate or was not conducted. Section 2.4 of the EIS outlines the alternatives that were assessed to provide a comparison to the Traveston Crossing Dam. The assessment clearly indicates that Traveston Crossing Dam provides an optimal water supply augmentation solution to provide the additional water necessary for both the existing and future populations of SEQ. The following assessment reiterates the suitability of alternate water supplies and whether they have the ability to meet water demand, in comparison to the proposed Traveston Crossing Dam.

#### 6.3.1.1 Desalination

Submissions have raised several issues in relation to desalination. These issues have been addressed separately below.

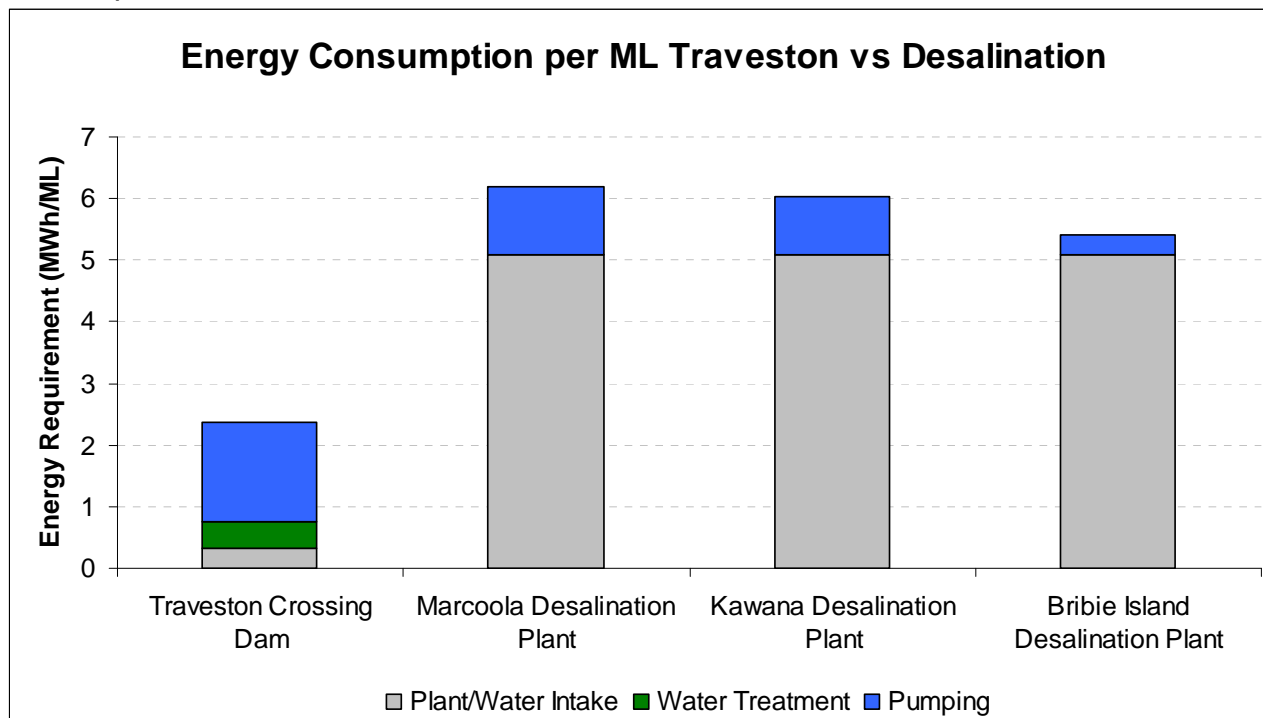
##### ***Energy Consumption and Greenhouse Emissions***

Submissions have raised issues around the energy consumption and greenhouse emissions associated with Traveston Crossing Dam in comparison to a desalination plant located on the coastal areas north of Brisbane.

An assessment of energy consumption and greenhouse gas (GHG) emissions associated with desalination concludes that desalination has significantly higher energy requirements and associated greenhouse gas emissions.

A comparison of the energy consumption associated with the Project compared to a desalination plant in different locations has been conducted. These locations were assessed because of their identification by the QWC as potential future sites for a desalination plant. The analysis was based on a report prepared by Kellogg Brown and Root in March 2008 for the QWC titled *Energy Consumption Discussion Paper*, which is publicly available. This report was prepared after the EIS, and has provided further clarification on the energy consumption associated with desalination, interconnection and the Traveston Crossing Dam. The analysis concluded that, irrespective of the location of a desalination plant, it would consume between 2 and 2.5 times the energy of Traveston Crossing Dam (**Figure 6-3**).

**Figure 6-3 Energy Consumption per ML for Traveston Crossing Dam vs. Desalination (delivered to Brisbane)**



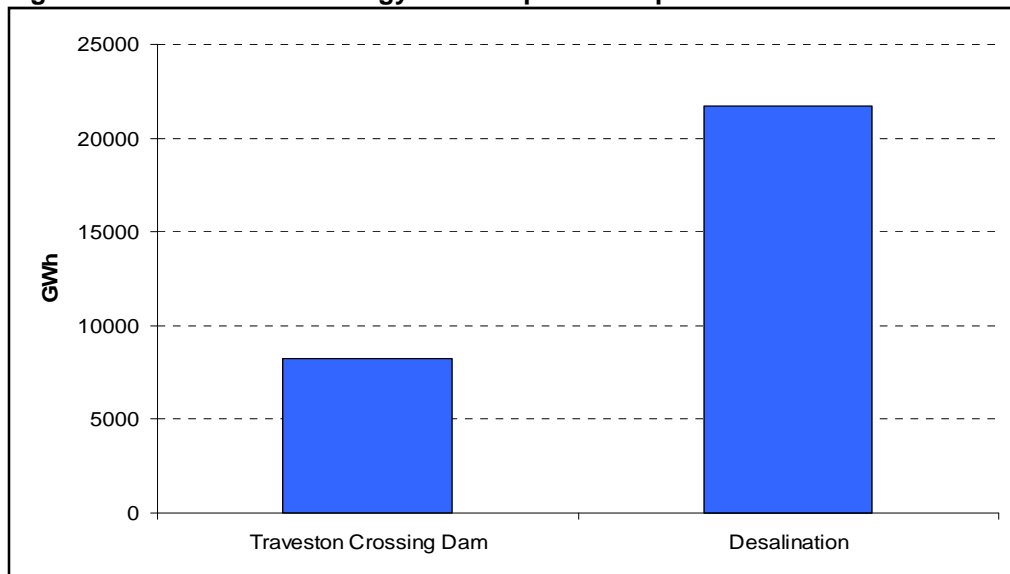
The energy consumption figures represent an update to those outlined in the EIS. Traveston Crossing Dam values include the total energy consumption for delivery of water to Brisbane, whereas the values estimated in the EIS included delivery of water into the SEQ Water Grid. Similarly, the updated desalination values also include delivery to Brisbane, whereas the values in the EIS showed delivery to the SEQ Water Grid.

The significant proportion of energy consumed by a desalination plant is associated with the plant itself, and not associated with pumping. Approximately 5.1 MWh/ML is associated with the desalination plant, which in itself is over twice as much as the energy consumed by Traveston Crossing Dam (with pumping and treatment included). This is compared to the Melbourne desalination plant, which is expected to consume 5.35MWh/ML, including transfer of water (Melbourne Water Seawater Desalination Feasibility Study June 2007).

With projected population growth on the Sunshine Coast expected to rise from the current level of 214,000 in June 2007 to 353,000 by 2026, it is also likely that a portion of the future water will supply the Sunshine Coast, reducing the transportation costs. Any such uptake would only further enhance the comparative energy consumption of Traveston Crossing Dam in comparison to desalination.

The whole-of-life energy comparison for Traveston Crossing Dam compared to a desalination plant located on the coastal areas north of Brisbane highlights the significant difference in energy consumption. This is illustrated in **Figure 6-4**. In turn, this whole-of-life energy consumption has a flow on impact to whole-of-life GHG emissions.

**Figure 6-4 Whole-of-Life Energy Consumption Comparison**



An analysis of the GHG emissions produced by the Traveston Crossing Dam compared to a desalination plant located on the coastal areas north of Brisbane (assuming both were powered with electricity from the National Electricity Market) was conducted by Marsden Jacob Associates (Appendix C22). This analysis concluded that a desalination plant would produce significantly more GHG emissions over the life of the Project. Consistent with the economic analyses undertaken for the EIS, GHG emissions were streamed over a 50 year period. The annual volumes of emissions were then discounted using a 4% real discount rate, to derive a present value volume. A discount factor has been applied because of the assumption that there will be a cost associated with an emissions trading scheme. This is because any given economic cost, declines the further into the future it is incurred, as deferring an expenditure provides an opportunity to invest the relevant amount of money prior to using it to purchase carbon credits (or for other mitigating action). The economic return attained from the investment effectively lowers the economic cost.

This volume was divided by the present value of output (i.e. 70,000 ML/a post construction) to derive a levelised volume of GHG emissions per ML of output over the 50 year evaluation period. The emissions factor applied in the methodology was derived from the Australian Greenhouse Office National Greenhouse Accounts Factors, January 2008.

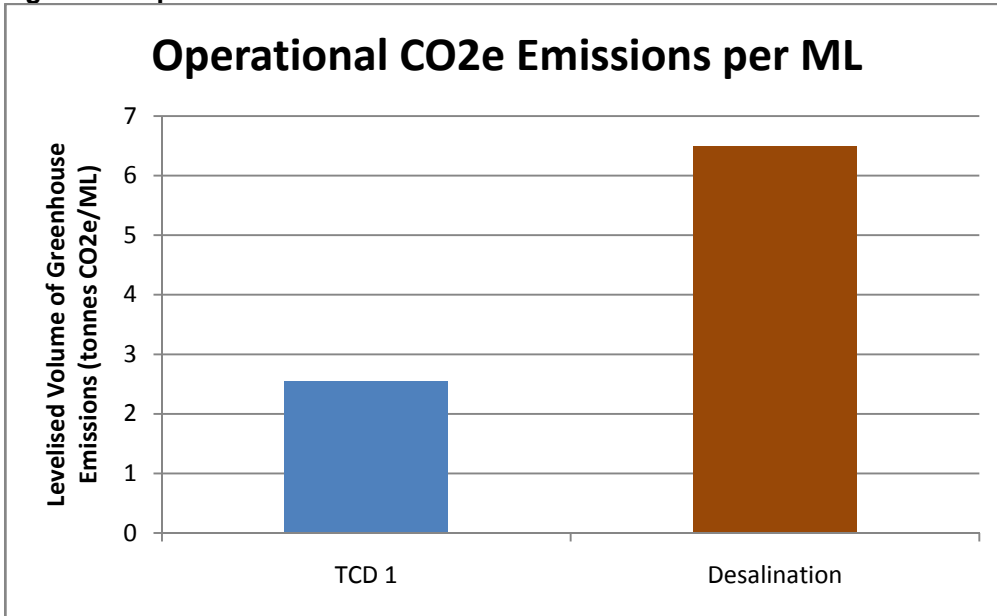
**Table 6-3 GHG Emissions – Traveston Crossing Dam**

Component	Tonnes CO <sub>2</sub> e	Levelised Volume /ML
	(tonnes/a)	(Tonnes CO <sub>2</sub> e/ML)
Dam Operations	1,000	0.02
Water Intake Pump Station	23,296	0.33
Water Treatment Plant (WTP)	31,304	0.45
Transmission	117,208	1.67
Total Operational Emissions	172,808	2.47

**Table 6-4 GHG Emissions – Desalination**

Component	Tonnes CO <sub>2</sub> e	Levelised Volume / ML
	(tonnes / a)	(Tonnes CO <sub>2</sub> e / ML)
Desalination Plant	371,280	5.34
Transmission	80,080	1.15
Total Operational Emissions	451,360	6.50

**Figure 6-5 Operational Emissions of TCD vs. Desalination**

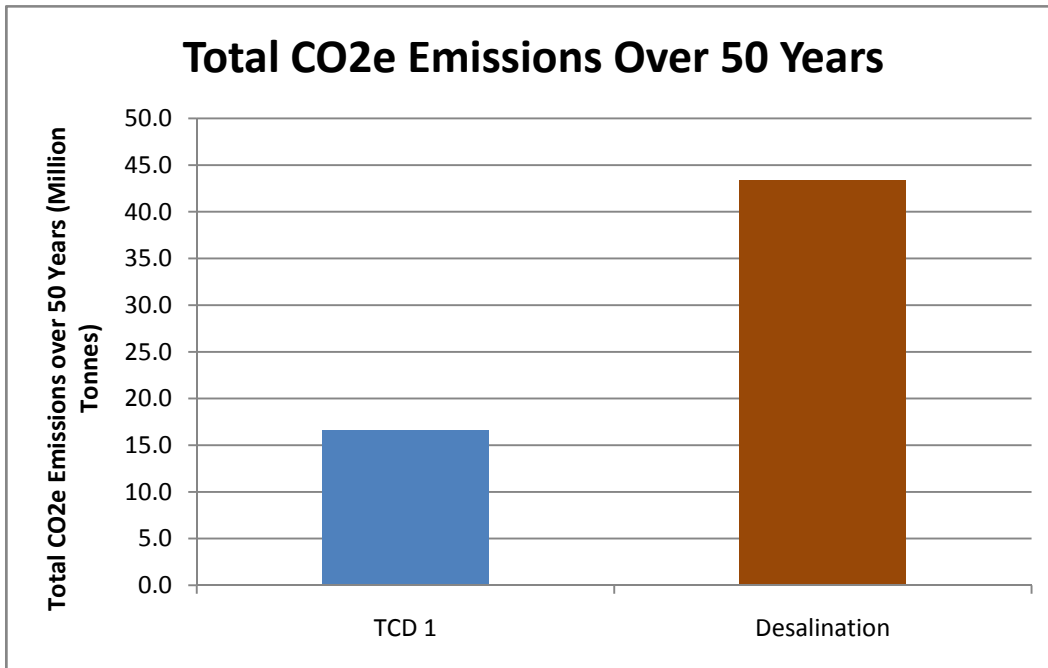


Source: Marsden Jacob Associates

For the Project, the majority of the emissions are attributable to pumping water to and from the Water Treatment Plant (0.33 tonnes of CO<sub>2-e</sub>/ML), treatment (0.45 tonnes/ML) and transmission through the Grid (1.67 tonnes of CO<sub>2-e</sub>/ML), with emissions associated with the dam operations accounting for less than 1% (0.02 tonnes of CO<sub>2-e</sub>/ML). The dam operations emissions are associated with the drawdown/fill sequences of the dam.

For the desalination option, over 82% of the volume of emissions (5.34 tonnes of CO<sub>2-e</sub>/ML) is associated with the actual production of desalinated water, with the remainder (1.15 tonnes of CO<sub>2-e</sub>/ML) comprising emissions associated with the transmission of the water.

**Figure 6-6 Whole-of-Life Operational Emissions of TCD vs. Desalination**



Source: Marsden Jacob Associates

In summary, the volume of emissions from the desalination plant is estimated to be around 2.5 times higher than the emissions associated with water delivered from Traveston Crossing Dam. Over the 50 year period of the analysis, total emissions from the desalination plant (43.3 million tonnes) are estimated to be around 26.7 million tonnes of CO<sub>2</sub>e higher than those from Traveston Crossing Dam (16.6 million tonnes) for an equivalent volume of water delivered into the SEQ Water Grid at a similar location.

An analysis of land availability for proposed timber plantations to offset the carbon emissions associated with the Traveston Crossing Dam has been undertaken. This analysis has identified that there are approximately 2200 ha that will be investigated for afforestation.

An assessment of the embedded emissions for Traveston Crossing Dam has been undertaken, with the results being outlined in Chapter 21 (Air Quality) of this report. The results concluded that the embedded emissions from the Project will be approximately 133,244 tonnes CO<sub>2</sub>-e. These embedded emissions amount to less than 1% of the whole-of-life emissions from the Project. A quantitative assessment of the embedded emissions for desalination has not been possible, however qualitative consideration has been given to the elements that would make up the embedded emissions for a desalination plant. The elements that would make up the embedded emissions for a desalination plant would include:

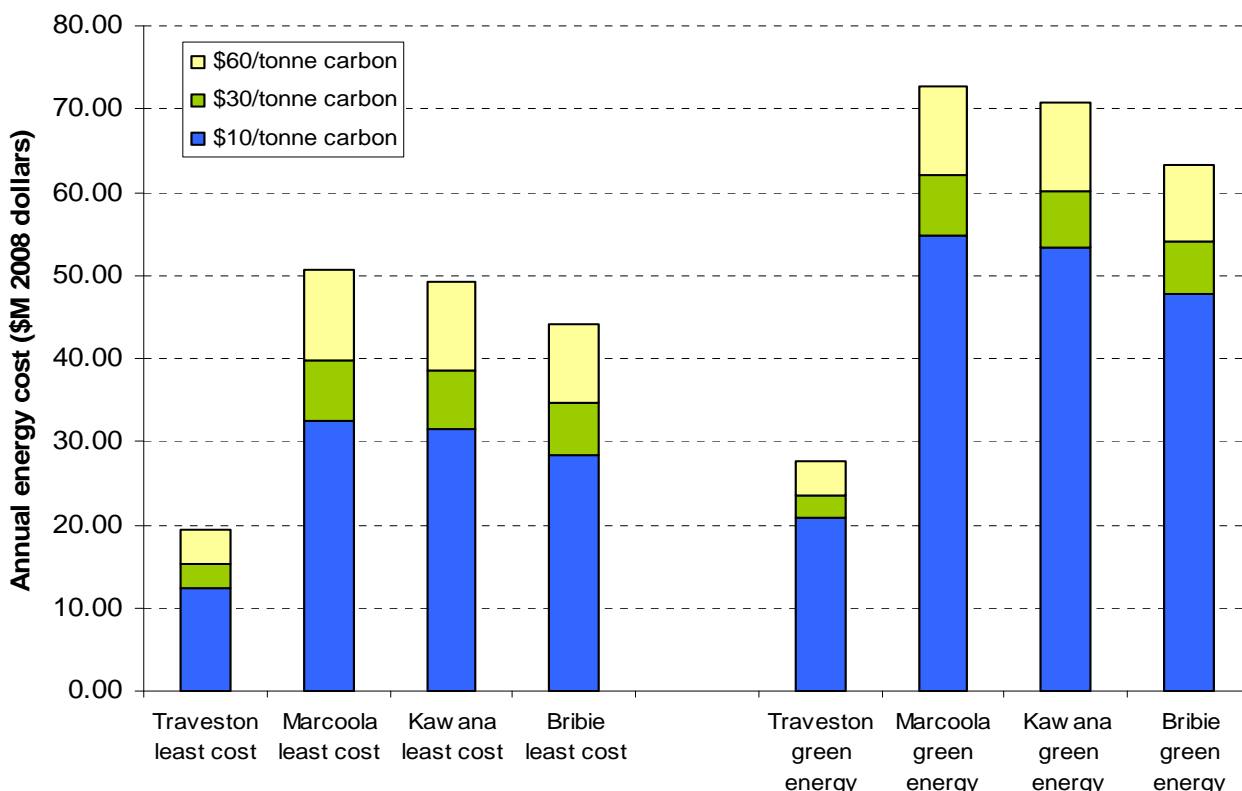
- site clearing;
- site excavation;
- diesel use for transport of materials and construction;
- cement production;
- aggregate sourced from quarries;
- steel production;
- tunnel boring for intake and outlet pipes;

- tunnel boring, pipe trenching and laying for interconnection to the grid; and
- electricity transmission line augmentation.

Given the extent of works to be undertaken to construct a desalination plant, it is considered that the embedded emissions would be similar to those for Traveston Crossing Dam.

Submissions have raised the issue of whether renewable energy could be used to negate the impact of the significant GHG emissions that would be associated with a desalination plant located on the coastal areas north of Brisbane. It is recognised that renewable energy could be used to power a desalination plant, in the same way that renewable energy could be used to power the energy requirements of the Traveston Crossing Dam. However, it should be noted that the use of renewable energy has a significant cost burden associated with it. An analysis of the cost associated with the use of renewable energy was conducted by consultants Energy Edge (Appendix C19). This analysis concluded that the use of renewable energy for a desalination plant would increase the annual operating costs by \$22.1 million. In comparison, the use of renewable energy for Traveston Crossing Dam would increase annual operating costs by \$8 million. The reason that the use of renewable energy has such a significant impact on the annual operating costs for a desalination plant in comparison to the Traveston Crossing Dam is that desalination uses significantly more power. The results of the analysis are graphically illustrated in **Figure 6-7**

**Figure 6-7 Annual energy acquisition costs for a desalination plant or Traveston Crossing Dam (real 2008 dollars)**



Source: Energy Edge

It is recognised that desalination plants are energy intensive, and that there is considerable scope for improvement in technology that could enhance their efficiency and energy intensive nature. It has been recognised by the Australian Government's Productivity Commission in March 2008 that

there is a risk associated with investing in desalination while the technology is still developing, and while there are alternate supply options that provide water at a lower cost. The report states:

*“Desalination can reduce the supply risk associated with reduced rainfall. However, early commitment to desalination can result in loss of flexibility to respond to new information, such as rainfall patterns and changes in technology, and result in substantially higher supply costs”<sup>2</sup>.*

The Productivity Commission further states:

*“A risk associated with planned desalination investment is that a large proportion of plant capacity will remain unused for some time. Higher rainfall would raise dam levels, make rainfall-dependent supplies more economical and – in the absence of institutional arrangements that commit to sourcing water from desalination regardless of the availability of rainfall-dependent supplies – reduce the demands on desalination. In the interim, investors in desalination (or consumers) would bear the capital and maintenance costs of desalination plant infrastructure. The additional costs would be akin to an insurance premium”<sup>3</sup>.*

In simple terms, investment in the Traveston Crossing Dam, has the current least cost, is substantially less energy intensive, and with substantially less GHG emissions provides more than 20 years to allow for improvements in desalination technology before any additional supply requirements are forecast to be necessary.

### **Capital Cost of Desalination**

Submissions have raised the issue of whether the costs used for desalination are appropriate. There are several points to raise in relation to the costs used to compare desalination to the Project.

While the cost model was initially based on the cost of the Tugun desalination plant, the data was updated to reflect differences in the timing of construction as well as environmental, location-specific factors and scale differences. Specifically, the cost data for the desalination plant included in Marsden Jacob’s portfolio model was provided by the QWC and took into account more recent estimates on the cost of building desalination plants, and the characteristics of the site on the coastal areas north of Brisbane, where a plant could potentially be located. The cost of constructing desalination facilities in SEQ is relatively high, due to the limited number of potential sites and the flat topography of the ocean floor. These characteristics mean that the intake and outlet pipelines for a desalination plant are longer than for other desalination plants in Australia. The cost of these pipelines adds a significant expense to the overall construction cost of a desalination plant in SEQ.

Additionally, there have been significant increases in construction costs over the last few years, and therefore to use the cost of the Kwinana desalination plant in Western Australia would be inappropriate. As an example of current cost estimates for a desalination plant in Australia, the feasibility study for the Melbourne desalination plant (which will supply 150,000ML/a) outlines that the capital cost of the plant is estimated to be \$3.1 billion and the operating cost will be \$130 million per annum. This equates to a capital cost of \$20,600 for each ML/a yield. A second desalination plant in Western Australia (which does not require the intake and outlet pipelines of the length required for a SEQ plant) has an estimated capital cost of \$640 million for a plant that will supply 45,000ML/a. This equates to a capital cost of \$14,222 for each ML/a yield. These

<sup>2</sup> Towards Urban Water Reform: A Discussion Paper, Australian Government Productivity Commission, p85, March 2008

<sup>3</sup> Towards Urban Water Reform: A Discussion Paper, Australian Government Productivity Commission, p98, March 2008

costs are relatively similar to the capital cost of \$18,400 for each ML/a yield outlined in the EIS as an estimate for a desalination plant in SEQ.

**Table 6-5 Capital cost comparison to other desalination plants in Australia**

Plant	Capacity	Capital Cost	Capital Cost for each ML/a
Second WA Desalination Plant	45,000ML/a	\$640 million	\$14,222 for each ML/a
Melbourne Desalination Plant	150,000ML/a	\$3.1 billion	\$20,666 for each ML/a
Desalination Plant north of Brisbane	73,000ML/a	\$1.34 billion	\$18,356 for each ML/a

Therefore, it is considered that the capital costs outlined in the EIS for a desalination plant in SEQ are appropriate as they take into account the specific site characteristics of the ocean floor and, as outlined above, are comparable to desalination plants currently being assessed for construction.

The portfolio modelling by Marsden Jacob Associates (MJA), under the base-case scenario, assumes that all supply options deliver a supply augmentation of 88,000 ML/a by 2011 (including 18,000 ML/a from Wyaralong Dam/Cedar Grove Weir). Following this, augmentations occur when demand growth reaches the limit of supply capacity.

An alternative, more staged approach was also assessed in Marsden Jacob’s 2007 Economic Report Section 4.5 of the 2007 Economic Report – Sensitivity Analysis), whereby the requirement to augment supplies by 88,000 ML/a is relaxed. In this case, there is more modular development of desalination plants, as from the initial date in the portfolio model, augmentation only occurs when demand reaches the supply limit. Thus, two 43,800 ML/a modules are followed by a third module of 87,600 ML/a. The Traveston Crossing Dam Portfolio still had a lower cost compared with the desalination portfolio, even when applying this more staged approach.

The base-case (energy from National Electricity Market with zero cost for carbon credits) was applied in the 2007 Economic Report, and this showed a cost differential (in favour of Traveston Crossing Dam) of \$210 million:

“Given that the TCD Portfolio and the desalination portfolio have the lowest economic cost, it is instructive to consider the cost of TCD Crossing Dam relative to the cost of a desalination plant with similar capacity (i.e., 200 ML/day or 73,000 ML/a).

In this case, the present value of Traveston Crossing Dam is just under \$1,850 million and the estimated present value cost for a 200 ML/day desalination plant is around \$2,060 million. Hence the difference in economic cost of these two options is approximately \$210 million.”

**Table 6-6 Whole of life costs: Traveston Crossing Dam and Desalination**

	Prudent Take (ML/a)	Capital Development Costs <sup>a</sup> (\$M)	Discounted Capital Development Costs <sup>b</sup> (\$M)	Discounted Fixed Operating Costs <sup>c</sup> (\$M)	Discounted Variable Operating Costs <sup>c</sup> (\$M)	Present Value "Whole of life" Costs (50 yrs, \$M)
TCD (Stage 1)	70,000	1,592	1,452	305	90	\$1,848
Desalination	73,000	1,341	1,285	605	169	\$2,058
Difference			168	300	79	210

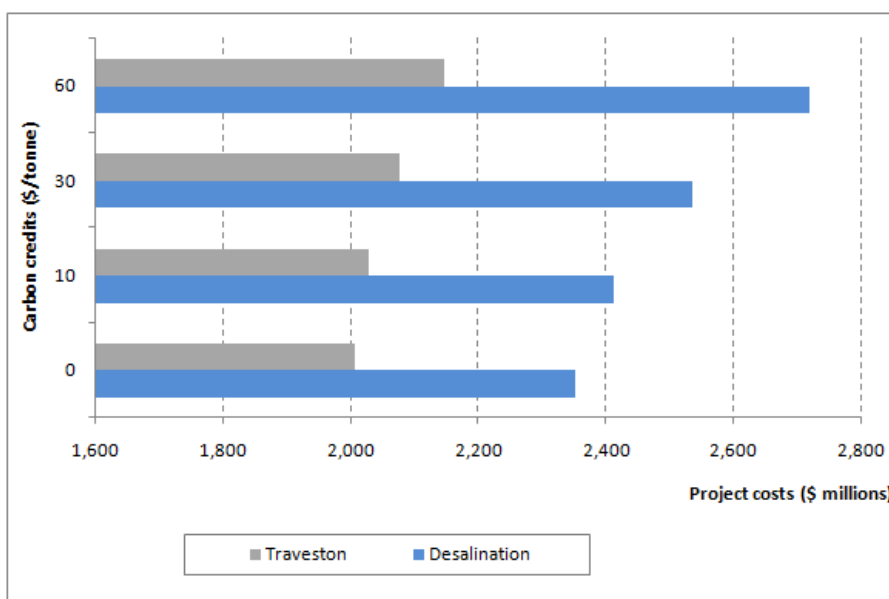
Note a): Capital Development Costs include ancillary infrastructure (such as pipelines, treatment works, relocation of roads and other infrastructure)

Note b): Represents capital expenditure which is assumed to start in 2009-2011 in both alternatives, these values have been discounted to \$2007 at 4%

Note c): Represents operating expenditure which is assumed to start in 2012 in both alternatives, these values have been discounted to \$2007 at 4%

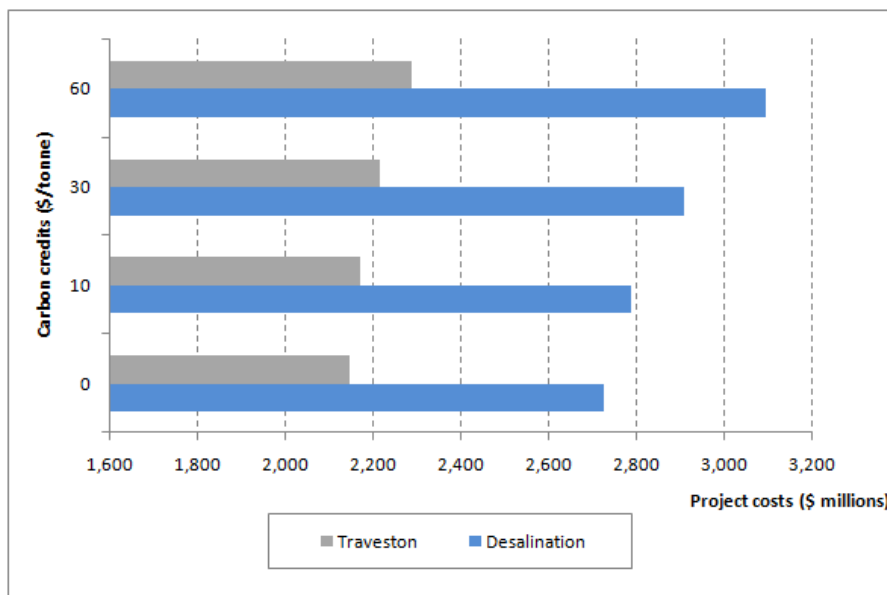
When the operating costs outlined in Figure 6.7 are taken into account, including the cost of transmission to Brisbane, these flow on to the whole-of-life variable costs for both Traveston Crossing Dam and a desalination plant located on the coastal areas north of Brisbane. The inclusion of the cost of carbon or the cost of renewable energy results in a more significant cost difference between Traveston Crossing Dam and desalination. The results are outlined in **Figure 6-8**, which incorporates the cost of carbon, and **Figure 6-9**, which incorporates the cost of green energy.

**Figure 6-8 Whole-of-life costs for Traveston and desalination plants with cost of energy offsets (carbon credits) included in energy costs**



Source: Marsden Jacob Associates

**Figure 6-9 Whole-of-life project costs for Traveston and desalination plants with cost of green energy included in energy costs**



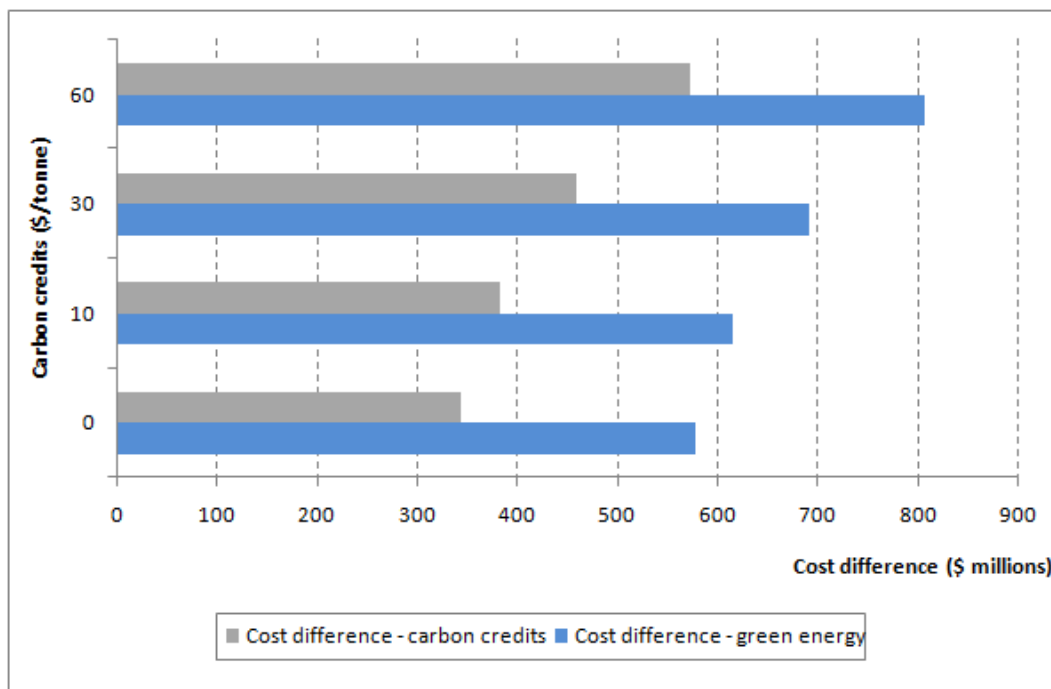
Source: Marsden Jacob Associates

Based on the whole-of-life cost estimates represented in Figures 6-8 to 6-9 (these estimates are based on the assumption that both Traveston Crossing Dam and desalination are operated at full capacity), it can be seen that this differential increases significantly if the cost of carbon credits is taken into account. Due to uncertainty about the value of carbon credits a range of different carbon credit costs have been used in our energy cost estimates – i.e., \$0/tonne, \$10/tonne, \$30/tonne and \$60/tonne. As shown in **Figure 6-8**, if the cost of carbon credits is taken into account, then the cost of a desalination plant with similar capacity to Traveston Crossing Dam is an estimated \$345 million to \$574 million greater than Traveston Crossing Dam.<sup>4</sup>

Green energy costs further increase the differential in cost between Traveston and desalination, with the cost of desalination being an estimated \$579 million to \$807 million (see **Figure 6-9**) greater than Traveston Crossing Dam if green energy is utilised (in favour of Traveston).

<sup>4</sup> The lower bound represents the cost difference if the cost of carbon credit cost is \$0/tonne, while the upper bound assumes a carbon credit cost of \$60/tonne.

**Figure 6-10 Difference in whole-of-life project costs for Traveston and desalination plants with cost of green energy included in energy costs**



Source: Marsden Jacob Associates

In summary, a desalination plant located on coastal areas north of Brisbane is significantly more expensive under all scenarios using different sources of energy and differing carbon costs. The cost differential between Traveston Crossing Dam and a desalination plant located on coastal areas north of Brisbane is \$210 million using energy delivered from the National Electricity Market with zero cost of carbon, up to \$574 million more expensive using energy delivered from the National Electricity Market with different carbon credit costs, and up to \$807 million using renewable energy.

This analysis illustrates that energy costs will have a significant bearing on the relative cost effectiveness of Traveston Crossing Dam and desalination. Moreover, due to uncertainty about the cost impost associated with carbon credits and green energy, this represents a very significant risk contingency factor for potential desalination plants.

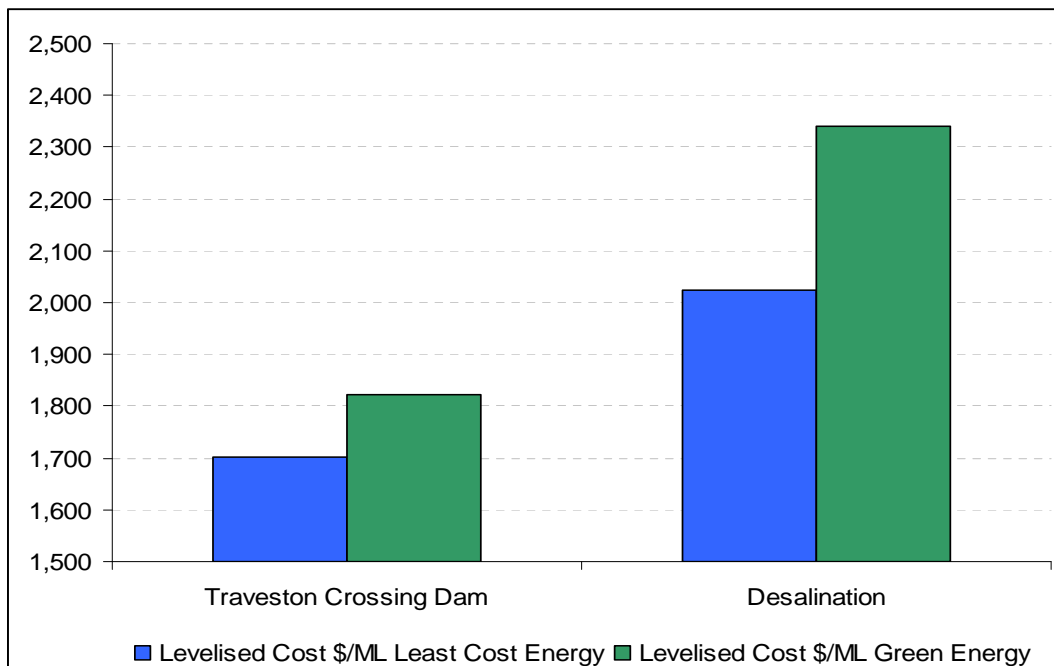
By way of example, Table 6-7 shows the breakdown of capex, fixed operating costs and variable costs for Traveston Crossing Dam and the alternative desalination plant option, for the 'least cost energy' and 'green energy' scenarios (assuming carbon credits trade for \$10/tonne), and the resultant levelised costs associated with both Traveston Crossing Dam and desalination under these scenarios.

**Table 6-7 Summary of whole-of-life project costs for Traveston Crossing Dam and a desalination plant with cost of carbon credits and green energy included in energy costs**

	Capital Development Costs (\$M)	Discounted Capital Development Costs \$M	Discounted Fixed operating costs (\$M.)	Discounted Variable operating costs (\$M.)	Total Costs	Levelised Cost \$/ML
<b>Least cost energy</b>						
Traveston Crossing Dam	1,592	1,453	305	270	<b>2,028</b>	1,701
Desalination	1,341	1,285	605	522	<b>2,411</b>	2,023
Difference		<b>-168</b>	<b>300</b>	<b>252</b>	<b>383</b>	<b>322</b>
<b>% Difference</b>						<b>18.93%</b>
<b>Green energy</b>						
Traveston Crossing Dam	1,592	1,453	305	414	<b>2,172</b>	1,822
Desalination	1,341	1,285	605	899	<b>2,788</b>	2,339
Difference		<b>-168</b>	<b>300</b>	<b>485</b>	<b>617</b>	<b>517</b>
<b>% Difference</b>						<b>28.28%</b>

Source: Marsden Jacob Associates (utilising energy cost data provided by EnergyEdge 2008).

**Figure 6-11 Levelised Cost Comparison of Traveston Crossing Dam to Desalination**



The results presented in **Table 6-7** show that despite desalination having a \$168 million lower capital development cost than the Project, the whole-of-life cost would be an estimated \$383 million greater than Traveston Crossing Dam using least cost energy with a \$10/tonne cost of carbon included, or \$617 million greater using green energy with a \$10/tonne cost of carbon included.

Hence, the key driver for the large cost difference between the whole-of-life costs for Traveston Crossing Dam and a desalination plant is the desalination plant's comparatively high fixed and variable operating costs which, in turn, can be largely attributed to the relatively high energy requirements for desalination plants.

Submissions have raised the issue of the additional cost per household for water supplied from desalination compared to Traveston Crossing Dam. The cost to households of water is a process that is currently under development by the QWC. However, given the significant cost difference between Traveston Crossing Dam and a desalination plant located on the coastal areas north of Brisbane, it is reasonable to conclude that water supplied to SEQ households from desalination would impose an additional cost burden on SEQ in comparison to water supplied from Traveston Crossing Dam. It should also be noted that the higher the value of the carbon cost assumed to be \$10/tonne, the greater the difference between the cost of desalination and Traveston Crossing Dam, which would increase the cost of water supply to SEQ.

### ***Supplementary Benefits of the Project***

In addition to the substantially lower impact of GHG emissions from the Project in comparison to desalination, there are also several significant supplementary benefits that arise out of the Project that do not occur with desalination.

Such benefits include:

- recreation and tourism;
- recreational fishing;
- improved road safety and travel times;
- downstream flood mitigation; and
- health benefits from increased physical activity.

### ***Recreation and Tourism***

The Traveston Crossing Dam area will become a major drawcard for residents and visitors in SEQ by providing a significant additional key outdoor area for recreation. There is currently a need for additional outdoor recreational areas in SEQ due the increasing population. The most recent Outdoor Recreation Demand Study conducted by the Queensland Outdoor Recreation Federation stated that:

*“the magnitude of outdoor recreation use.....cannot continue to be treated as a minor matter by either the public or the private sector. The predicted population increases in South East Queensland (of approximately 50,000 per year or an extra million people by the year 2021) means that experiences of crowding and conflict due to incompatible recreational use of an area, already reported by participants in the 2001 study, will become exacerbated.”*

Various surveys have shown that Australians place a very high value to visitation to waterways and Lakes. The Project has been designed to enable the development of various recreational infrastructure. It is very difficult to accurately forecast visitations to the Project area, Marsden Jacob Associates, 2008 conservatively estimate that this number could be between 200,000 to

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400,000 visitors per year. This has a substantial benefit to the local economy; an estimate of the economic surplus of such visitations is difficult to accurately predict for Traveston Crossing Dam. Studies conducted by CSIRO (Dyack et al.) for the Murray River and one reported recently for Lake McKenzie on Fraser Island (Fleming and Cook), estimate that each person will spend between \$240 and \$530 per visit.

### ***Recreational Fishing***

Recreational fishing is an important outdoor activity in Queensland. The Australian Bureau of Statistics' 1999-2000 survey on "Participation in Sport and Physical Activities" ranked recreational fishing fifth highest for its participation rate out of fifty activities reported, and the highest rates of participation were found in Queensland. The National Recreational and Indigenous Fishing Survey (Henry & Lyle, 2003) indicate that an estimated 475,000 people in SEQ participate in recreational fishing each year at a participation rate of 22.6%.

The Project will provide a suitable habitat for a range of targeted species with the provision of boat ramps and related facilities. It is likely that the economic benefits arising of out angler visitations are likely to be significant to the local economy. Rolfe and Prayaga, 2007, conducted an estimate of the values arising out of fishing at the Bjelke-Petersen, Boondooma and Fairbairn Dams in Queensland. Based on this estimate it is not unreasonable to estimate that the benefits arising from recreational fishing at Traveston Crossing Dam could be equal to those estimated at Boondooma and Fairbairn i.e. \$3.0-4.5 million per annum.

### ***Improved Road Safety and Travel Times***

There are two broad components of the road costs attributed to the Project:

- road realignment, including 'bring forward' costs for upgrading of the Bruce Highway; and
- increased maintenance cost (and/or bringing forward of major road maintenance) as a result of increased heavy vehicle traffic.

Land costs (\$45 million), and bring forward costs for the Bruce Highway (\$85 million) and increased maintenance (\$918,000) have been directly included in the estimated capital development costs. These costs were already taken into account in the economic analysis undertaken in the EIS.

An additional factor is that road improvements undertaken for the Project will deliver safety benefits (although travel times will increase marginally on some routes).

The RACQ recently prepared safety ratings for Queensland's country highways as part of the "Australian Road Assessment Program". A key finding was that the Cooroy to Gympie section of the Bruce Highway was ranked as the second worst state road and national highway. The primary reasons provided for this poor safety rating was that it was a narrow road, with a rough surface and limited overtaking opportunities. Further, it has pavement failures, drop-offs and pot holes. This section of the Bruce Highway is to be realigned as a result of the Project. In respect to the Cooroy to Gympie sector of the Bruce Highway the RACQ noted that:

- it is one of nine segments of highway (within country areas of Queensland) urgently requiring attention; and
- it was given a rating of 2 stars, and only 17% of the State's country highways were allocated a rating of 2 stars. (There were no highways with a star rating of 1, 83% had a rating of 3 stars or above).

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The significance of improving the safety rating of the Bruce Highway in the study region can be gleaned from research undertaken on the economic cost of road accidents, as the improvement in the highway will help reduce the number of accidents in the region.

A detailed study undertaken in 2000 by the Bureau of Transport Economics<sup>5</sup> using the human capital approach estimated that if the road improvement lead to even a small reduction in incidence of road accidents, or a reduction in severity of accident, then the economic benefits could be very large.

### ***Downstream Flood Mitigation***

The impact of the severe floods in Gympie in 1999 was very significant. In the EIS, it is noted that approximately 60 residences and 130 businesses were affected by the 1999 flood, with an estimated damage bill of \$25 million including roads and infrastructure. It is therefore the case that the Project has potential to deliver substantial benefits in terms of flood mitigation.

The Project has been designed with a buffer zone to manage a 1 in 100-year flood event, with spillway gates that will significantly reduce flood impacts at Gympie. The increment to capital development cost for the Project to achieve flood mitigation benefits has been estimated at around \$70 million (excluding additional buffer land costs). Marsden Jacob and Associates estimate that this increment in capital cost can be used as a proxy for the economic value of the anticipated flood mitigation benefits. Given the impact of the 1999 event, the whole of life benefits can reasonably be expected to exceed the capital cost of flood mitigation being incorporated into the design.

### ***Health Benefits from Increased Physical Activity***

Social benefits (social inclusion) and health benefits from physical activity are well documented. There is extensive recent research about the health benefits from use of parks, which is highly relevant in assessing the potential benefits from recreational activities at Traveston Crossing Dam.

Moreover, where provision of new recreational amenity leads to an increase in the level of physical activity, there are marked health benefits that have been quantified in a number of studies. This leads to a reduction in the community health cost. Consequently, there is expected to be a significant health benefit associated with increased propensity to engage in outdoor recreational activities.

It is difficult to quantify the change in community health costs (e.g., cost of health services and losses in productivity) attributable to specific projects or recreational activities. However, given the strong relationship between health costs and physical inactivity, it is reasonable to assert that where a project, or government program, promotes physical activity, the reduction in health costs are likely to be significant.

Health expenditure is a major fiscal impost on the Queensland Government and expenditure on health in 2004-05 exceeded \$16 billion<sup>6</sup>. Essentially, outdoor recreation is an investment in preventative health practices that provide significant economic benefits in the form of avoided health expenditures. Key findings from previous studies include:

- According to the World Health Organisation / World Bank Report, cardiovascular disease and poor mental health are expected to be the two biggest contributors to risk of disease by the year 2020. Increased levels of physical activity significantly reduce this risk.

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<sup>5</sup> Bureau of Transport Economics, 2000, *Road Crashes in Australia*, Report 102, May

<sup>6</sup> Australian Institute of Health and Welfare, 2006, *Health Expenditure Australia 2004-05*

- A study commissioned by Medibank Private calculated the gross and net direct health costs of physical inactivity of seven medical conditions: coronary heart disease, stroke, type 2 diabetes, breast cancer, colon cancer, depression and falls. The results indicated the direct cost that were attributable to physical inactivity being increased risk of mortality and incidence of these conditions. The research revealed that 17% of the total health cost of treating these seven different conditions can be attributed to physical inactivity and amongst Australian adults have an annual cost of \$1.5 billion in direct healthcare costs.
- The Medibank Private study also shows that the proportion of the Australian population which is not getting enough physical activity to maintain health was unchanged from 2000 to 2007 at 54.2% in 2000, roughly 9 million Australians. The Queensland population is similar to that of Australia at 55%.

### ***Supplementary Benefits – Desalination vs. Traveston Crossing Dam***

Desalination requires a piece of engineered infrastructure to be constructed on an area of land to house the desalination process. It is a purely industrial process that attracts no supplementary benefits. Traveston Crossing Dam, however, gives rise to many significant supplementary benefits due to its very nature of creating a reservoir within a protected area. **Table 6-8** summarises a comparison of some of the supplementary benefits available to the Project that are not available with desalination.

**Table 6-8 Supplementary Benefits of the Project**

<b>Supplementary Benefits</b>	<b>Traveston Crossing Dam</b>	<b>Desalination</b>
Recreation and Tourism	Yes	No
Recreational Fishing on the pond	Yes	No
Improved Road Safety and Travel Times	Yes	No
Downstream Flood Mitigation	Yes	No
Health Benefits from Increased Physical Activity	Yes	No

It is evident that the Project, as designed, has greater supplementary benefits than any desalination project alternative.

### **Brisbane River Desalination Barges**

Submissions have raised issues around the use of desalination barges in the Brisbane River as an alternative to Traveston Crossing Dam. Preliminary works and planning was undertaken by the Queensland Government as a contingency measure, to ensure water security and allow for additional short term water supply if required, in the event that the worst drought on record worsens. This included investigations into two mobile desalination plants in the Brisbane River, with the intent to review the water balance following the 2007/08 wet-season to reassess the need for any contingency works.

Following rainfall and beneficial inflows received by the region in January and February 2008, the QWC re-evaluated the water supply balance requirements for SEQ. This also considered future water supply objectives as identified in the recently released South East Queensland Water Strategy – Draft March 2008, including investigations underway to review potential future, fixed desalination sites.

As a consequence, the Government has decided that there is no requirement to progress any further with the proposed barge mounted Brisbane River desalination facilities, and will focus on planning and prioritisation of options for future permanent, fixed desalination sites.

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### 6.3.1.2 Water Demand Management

Demand management is discussed in Section 2.4.1.1 of the EIS.

The State and local governments have combined to implement initiatives to ensure significant reduction in household and commercial demand in SEQ. These initiatives are included in a portfolio of projects being implemented to ensure the future supplies in SEQ.

Provisions developed and implemented include:

- an average residential personal use target of 230 litres per person per day (lifted from 140 litres per person per day under level 6 restrictions);
- water savings targets for new houses (part 25 of the *Queensland Development Code*);
- requirements regarding the installation of water efficient fittings and fixtures in new dwellings and renovations (part 29 of the *Queensland Development Code*);
- development of best practice guidelines for business water use;
- requirements for businesses using more than 10 ML/a to prepare Water Efficiency Management Plans that outline how they will achieve best practice water efficiency;
- requirements for all businesses to ensure their urinals and cooling towers are efficient, and businesses using 1 ML/a or more to ensure that all internal water fittings on the premises are water efficient;
- requirements for rainwater tanks to be installed in new commercial and industrial buildings under the *Queensland Development Code*;
- requirements for sub-meters to be installed in new residential and commercial multi-unit developments under the *Queensland Development Code*;
- provision of water use information to residential tenants, in accordance with guidelines issued by the QWC;
- phased implementation of a standardised billing approach across SEQ, in accordance with guidelines issued by the QWC;
- completion of the pressure and leakage management program, which will reduce existing transport and distribution system losses by about 22,000 ML/a;
- expansion of the allowable use of greywater, where appropriate; and
- educational measures about water wise behaviour, such as the WaterWise schools program.

The water demand projections have been based on the inclusion of these measures. They are also based on power stations using recycled water, where available, to meet their water demand requirements. With these measures in place, there is still a considerable need for new water supplies in SEQ, including the Traveston Crossing Dam. The implementation of dry cooling of power stations, unallocated water in Paradise Dam, lower levels of service, decentralised water recycling, wide-spread adoption of composting toilets, treating and reusing public swimming pool backwash for irrigation, and clearing out sediment from existing dams were not considered as viable alternatives on the basis of economic and hydrological issues.

Options involving the proposed shut down of Tarong and Swanbank power stations were not considered on the basis that these options are beyond the scope of QWI.

### 6.3.1.3 Water Harvesting

Water harvesting involves pumping excess flows from a stream into an existing remote storage when the remote storage capacity is low. It can also involve pumping into adjacent especially built small-scale off-stream storages which may act as a small back up supply.

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The water harvesting studies were extensively reported on in Section 2.4.2.1 of the EIS.

Two of the options considered were studied in detail by Gilbert and Associates.

### ***Option 1***

Option 1 involved constructing a weir at Cole's Crossing (3,897 ML capacity) pumping 70,000 ML/a at a maximum rate of 1,000ML/day into Borumba Dam. An alternative pumping rate of up to 4000ML/day was also examined.

The hydrology section of the report showed that this option had a significantly higher failure rate (at a 70,000 ML/a diversion) than Traveston Crossing Dam (i.e. it failed 51 out of 109 climatic sequences). If the diversion rate is set at 150,000 ML/a, the failure rate is slightly less.

In summary the report concluded

"The difference in performance is a reflection of the difference in how water is able to be captured and stored.

What these results indicate is that the Traveston scheme which utilises a storage located on the Mary River has:

1. a markedly greater likelihood of capturing sufficient water soon after commissioning for commencement of full supply than the alternative schemes based on harvesting; and has
2. a significantly greater likelihood of being able to maintain sufficient storage for continued supply over the medium term."

### ***Option 2***

This proposal also involved a weir at Coles Crossing with a pump diversion to Borumba Dam and with an additional weir on the Mary River at Moy Pocket to provide extra opportunity for pumping. Raising of Borumba Dam with a hydro-electric power station was also included.

The study was based on the hydrological advice contained in the study conducted by Gilbert and Associates and looked at the optimisation of the scheme with costs, feasibility flow rates yields and hydrologic opportunities.

The study concluded that 70,000 ML/a could be provided at an estimated cost of \$3.1 Billion.

The Traveston Crossing Dam Project at a much lower cost \$1.59 billion and a virtual no failure risk is obviously a more viable alternative than these water harvesting options.

#### **6.3.1.4 Stormwater Harvesting**

Stormwater harvesting, in urbanised areas, involves the collection and storage of rainwater that falls on streets and hard areas within a town for later treatment and reuse.

Previous studies have shown that, while harvesting is viable on a small scale, it is not viable on a large scale because of the lack of suitable storage sites within a city. Brisbane and other towns in SEQ are unable to provide sufficient storage sites that would allow a yield equivalent to the 70,000 ML/annum available from Traveston Crossing Dam.

For example, a report prepared by Connell Wagner (Appendix C4) found that a review by the NSW Department of Environment and Conservation of 12 stormwater schemes had an average levelised cost of \$10,800 per ML, which is substantially higher than any of the water supply options being

planned for SEQ. Moreover, preliminary analyses undertaken by Cardno for the SEQ Regional Water Supply Strategy<sup>7</sup> concluded that the cost of non-potable water supplied from an urban scale stormwater harvesting scheme would be in the order of \$2,800 per ML, excluding the cost of land. Once water treatment, pumping and land costs are incorporated, costs would significantly increase.

The use of aquifer storage for stormwater has been suggested as being a viable alternative source of water. Such aquifer storage and recovery (ASR) systems still require engineered pre or post treatment of the water. This is due to the fact that anthropogenic contaminants such as organics, turbidity or non-native pathogens may not or cannot be successfully and acceptably attenuated by the natural processes within an aquifer. As well, there are many variables that affect the ability of an aquifer to provide a suitable passive treatment process; these variables need to be taken into account in addition to extensive and detailed geochemical and other parametric modelling undertaken. In addition to large number of variables influencing the success of any ASR program managed aquifer recharge is only viable where suitable aquifers exist in close proximity to where the water demand is. One of the constraining features of any ASR system is the large area/s required to store and pre-treat the captured runoff volumes prior to injection into an aquifer. Given the large areas required for wetland construction for storage and pre-treatment, there is not sufficient suitable land available in the urbanised regions of SEQ to make stormwater harvesting using ASR technology economically viable.

The QWC has recognised in the Draft South East Queensland Water Strategy that stormwater harvesting is generally not cost effective when compared to rainwater tanks or new sources of supply. The high cost of such schemes is generally due to the cost of the land required for the small dam or reservoir. The cost of constructing the collection, storage, treatment and distribution infrastructure can also be substantial.

There is currently insufficient scientific knowledge in the understanding of risks associated with the technical, economic and environmental aspects in securing new water supplies from otherwise wasted waters via aquifers. There are currently several research efforts underway to further understand the ASR on a large scale as well as the efficacy of such systems in the long term.

Given the uncertainties surrounding ASR, it is currently not an economically viable option for the provision of 70,000 ML/a at a risk profile that is required to secure an alternative supply of water in SEQ.

### **6.3.1.5 Recycling**

The use of recycled water is discussed in Section 2.4.1.2 of the EIS.

The Government recognises the benefits of using recycled water and has included a major water recycling project in the portfolio of projects being implemented to ensure the future supplies in SEQ as discussed in Section 6-2. The Western Corridor Recycled Water Project which is currently under construction will supply 182 ML/day (66,430 ML/a) by October 2008. It will be expanded to approximately 85,000 ML/a by 2026. Since it relies on (already) captured water being discharged into the wastewater system, it is not practically feasible to consider any significantly greater contribution from recycling without first augmenting the original supply of water. The draft South East Queensland Water Strategy also identifies other types of recycling that will be investigated as future water supply sources. Further, it should be noted that recycling uses more energy and produces more GHG emissions than traditional storage and treatment processes (energy

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<sup>7</sup> Cardno, 2006. *Review of Use of Stormwater and Recycled Water as Alternative Water Resources*, Draft Report SEQ Regional Water Supply Strategy, June.

requirements and GHG emissions are less than for desalination). This adds to the cost of water supplied from these sources.

### **6.3.1.6 Rainwater Tanks**

The advantages and disadvantages of residential rainwater tanks are discussed in detail in Section 2.4.1.3 of the EIS.

Marsden Jacob Associates has conducted two studies on rainwater tanks – one for the National Water Commission, and the other for the Australian Conservation Foundation. The former study (titled: *'The Cost Effectiveness of Rainwater Tanks in Urban Australia'*), was more extensive with greater focus on economic viability and shows that the cost of rainwater tanks is often very high, ranging from \$2.03-\$11.59/kL.

Key finding of Marsden Jacob Associates report for the National Water Commission were that:

- generally, the economic cost of water from rainwater tanks is higher than most bulk water supply alternatives;
- the economic cost is also highly variable depending on rainfall, roof size, and other key parameters;
- the economic cost is very high when retrofitting rainwater tanks, compared to the cost for new dwellings. This greatly diminishes scope to use rainwater tanks to offset new infrastructure developments, and is why governments are mandating installation of rainwater tanks for new dwellings but not existing dwellings; and
- the economic cost of rainwater tanks is higher when connecting to the internal plumbing than if only using water for outdoor use. However, the latter has less impact in terms of reducing demand for reticulated potable water.

The demand forecasts used for the study (and in Marsden Jacob's economic modelling) take account of upper bound estimates for water savings through implementation of a suite of demand management initiatives in SEQ, including installation of rainwater tanks.

As shown by the estimates of demand shortfall to be met by new augmentations (outlined in the QWC's Draft South East Queensland Water Strategy) the impact of forecast water savings on demand is not sufficient to avoid the need for major supply augmentation.

While the Government has included rainwater tanks in its overall demand strategy to conserve water in order to meet (the then) short term imbalances, rainwater tank supplies are of an order of magnitude too low to make any significant impact on the medium to long-term supply solution.

In addition, an energy assessment undertaken for the QWC concluded that pumps associated with rainwater tanks have an average energy efficiency of 2.9 MWh/ML, which would produce more greenhouse emissions on a per ML basis than Traveston Crossing Dam.

### **6.3.1.7 Groundwater**

Development of groundwater resources is underway in areas including Brisbane and Bribie Island, with supplies now coming on-stream. The yield from these groundwater resources is relatively small (9,100ML/a) in comparison to Traveston Crossing Dam (70,000ML/a). Investigations by the QWC have concluded that, apart from those resources currently being developed, other groundwater resources in SEQ are almost fully developed, with any potential sources only able to provide small quantities. Given that Traveston Crossing Dam will provide 70,000 ML/a, it is not considered viable for additional groundwater resources to be able to supply this yield. This is

because ground water supply sources are generally small and not considered to be economically viable.

### 6.3.2 Alternative Surface Water Supply Options

Submissions raised claimed that no other potential dam sites had been identified or assessed. Other submissions recognised that the assessment of alternative locations for surface water supplies were presented, however claimed the rationale was limited.

A range of surface water supply options were considered and are discussed in detail in Section 2.4.2 of the EIS. Each option was assessed in detail against a range of criteria including social, environmental, cost and reliability of supply.

As a result of the current major drought in SEQ, GHD was commissioned in June 2006 to prepare a desktop review of identified dam and weir sites in SEQ, for the Bulk Supply Infrastructure Task Group. The report included a review of existing water supply options in SEQ, and approximately 80 locations for potential dam and weir sites were identified. The reliability of supply volumes were reviewed for each of the 80 sites identified, with the following projects identified as having the potential to provide a significant contribution to the water demand in the region.

**Table 6-9 Alternative Surface Water Options (not in priority order)**

River System	Options Identified
Albert River system	Glendower Dam with barrage on the Albert River
Coomera River system	Coomera Dam
Logan River system	Cedar Grove Weir, Tilley's Bridge Dam with Cedar Grove Weir
Logan River system	Wyaralong Dam with Cedar Grove Weir (Teviot Brook sub-catchment)
Nerang River system	Raising of Hinze Dam to Stage 3
Water harvesting into Hinze Dam	From Coomera and Nerang Rivers and Canungra, Mudgeeraba and Tallebudgera Creeks
Caboolture River system	Zillman's Crossing Dam
Maroochy River system	Raising Wappa Dam
Mary River system	Cambroon and Traveston Crossing Dams
Mary River system	(Yabba Creek sub-catchment) – raising Borumba Dam to Stage 3
Mary River system	(Obi Obi Creek sub-catchment) – Kidaman Dam
Mary River system - (Amamoor Creek sub-catchment)	Amamoor Dam
Brisbane River system	Raising Wivenhoe Dam and raising Mount Crosby Weir

In addition, GHD 2006 report concluded that the options identified in **Table 6-9** would have the least environmental, social, archaeological and heritage impacts. In regard to yield, the GHD report illustrated that the Traveston Crossing site had by far, the highest yield of any site investigated across the whole of SEQ.

In addition to the options put forward by the GHD report, the Northern Rivers (NSW) dams option was included because this alternative was put forward by the Commonwealth Government (refer: SMEC, 2007, 'Integrated Water Supply Options for North East NSW and South East Queensland', Report prepared for the National Water Commission, February 2007) as an option that should be considered in detail. A suite of smaller dams were being proposed by the Queensland Coalition Party as a pillar of its alternative water infrastructure strategy (Queensland Coalition, 2006, 'Fixing the Water Crisis Queensland Never Had to Have', August 2006), and therefore also needed to be assessed in detail. Many of the smaller dams put forward by the Queensland Coalition in this

alternative had previously been shortlisted by Department of Natural Resources and Water as part of the preparatory work for the SEQ Regional Water Supply Strategy. A large component of the screening process undertaken for the SEQ Regional Water Supply Strategy was undertaken by GHD, with findings documented in a report: 'South East Queensland Regional Water Supply Strategy - Desktop Review of Identified Dam and Weir Sites', which was prepared for the Bulk Supply Infrastructure Task Group, June 2006.

The overarching objective in developing the short-list of supply options in Section 2.4 of the EIS was to identify options likely to represent the "next best" alternatives given the significant role that the Project will have in augmenting future supply in the SEQ Water Grid. Options not outlined in the EIS were ruled out on the basis of a fatal flaw analysis. A number of submissions suggested alternative surface water storages e.g. a property in the Lower Cooyar, or purchasing unused allocations from existing surface water storages. However, these alternatives did not satisfy the key criteria of reliably supply 70,000ML/a at the QWC's specified Level of Service.

The main reasons for selecting Traveston Crossing Dam are discussed in the EIS and the following is a summary of the most important aspects:

- there is no other single dam site in SEQ that can supply the required quantity of water;
- Traveston Crossing Dam provides the required quantity of water on a least cost basis;
- environmental aspects are less than the combined impact of several dams that would be required to provide the same supply;
- Traveston Crossing Dam has significantly less energy and GHG emissions issues in comparison to the next best alternative of desalination;
- flows in the Mary River catchment are very reliable and, in fact, the Mary River has the largest mean annual flow in SEQ ensuring the yield of the Project is of high reliability;
- moderate development in such a large river would be easier for the stream to tolerate; and
- the dam will reduce flooding in Gympie by up to 3.5 to 4 metres for a 1% probability flood (1 in 100 year).

In summary, the information presented above and as outlined in Section 2.4.2 of the EIS demonstrates the thorough investigation into surface water supply augmentation options in SEQ that has been conducted to make an informed policy decision to locate the proposed dam at Traveston Crossing.

### **6.3.2.1 Cost of Northern NSW Dams**

Submissions have raised the issue of the difference in cost estimates undertaken by SMEC and Hydro Tasmania. SMEC completed a desktop study with no field investigations or site visits in northern NSW. This work was required to be undertaken in a short period, with SMEC only being able to utilise information available at the time.

Hydro Tasmania was then engaged to review SMEC's report and further analyse and expand on these alternatives in more detail, which included:

- site visits to 3 dam sites that were considered to be similar to the Project; and
- more detailed investigation of:
  - computer modelling of the hydrology;
  - dam design / materials;
  - geology;
  - land acquisition;
  - pipeline and pump station delivery;

- water treatment; and
- impacts on existing infrastructure relocation.

Hydro Tasmania concluded that the estimated capital costs for alternatives would be higher than those in SMEC's report. This is mainly attributable to the greater size of pipeline assumed and lower velocities in the pipes; also to higher property acquisition cost estimates, the inclusion of water treatment, and generally higher cost estimates for the dams and pipeline construction.

The analysis by Marsden Jacob associates concluded that the NSW Northern River Dams portfolio was around \$650 million higher with the cost largely due to the pipeline and pumping costs to take water from the Clarence River in NSW to Wyaralong Dam. The environmental requirement for treatment at both the Clarence River and Long River ends of the catchments also creates a significant cost impost.

### **6.3.2.2 Cambroon Dam**

One submission identified that the EIS incorrectly listed the eastern bristlebird, fleay's barred frog, southern gastric brooding frog and southern dayfrog as having the potential to be impacted by a dam at the Cambroon site and that this therefore made the comparison of impact between the Project and a dam at the Cambroon site inaccurate.

The information presented in the EIS in regards to the likely presence of the species listed above was based on information presented in the Brizga and Associates report (2006) titled *South-east Queensland Water Supply Strategy Environmental Assessment of Logan/Albert and Mary Catchment Development Scenarios*. This information is believed to be a correct representation of the findings of this report.

### **6.3.2.3 Other Alternative Surface Water Supply Options**

One submission specifically suggested an alternative proposal for a surface water supply that involves an increase in the height of Borumba Dam by approximately 100 metres to provide a storage capacity of 2,000,000ML with an FSL at EL230m. The existing dam has a storage capacity of 46,000ML with a FSL at EL 135.01m. The height of the raised dam would be well over 140 metres when allowing for flood buffer.

It is further proposed to flood harvest from the Wivenhoe/Somerset system in times of "uncommon events" or flood flows through a pipeline. The proposed pipeline would be 60km long with 5 x 1m pipe barrels and a design velocity of 3m/sec capable of pumping 1000ML/d.

A response to this proposal is provided below in two parts.

## **Hydrology**

### ***Borumba Yield***

The submission refers to an additional yield from the raised Borumba Dam of 91,000ML/a. The submitter derived this figure by extrapolating QWC figures for the McMaha proposal i.e. 1,000,000ML storage provides a 51,000ML/a HNFY. However a detailed assessment of the QWC analysis indicates that to achieve the yield of 51,000ML/a the period between filling is 70 years. That is, the site is at its hydrologic limit of development at 1,000,000ML and raising it further to 2,000,000ML will not result in any additional yield beyond 51,000ML/a HNFY.

Also to be consistent with the Traveston Dam methodology, the "prudent yield" for the site would be of the order of 35,000ML/a to 40,000ML/a not 51,000ML/a. It should also be noted that, at the hydrologic limit of the site, there is a higher risk associated with relying on the yield figures particularly when considering the potential impacts of climate change.

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### ***Flood Harvesting***

The submission points out that it may be possible to flood harvest the equivalent of 80,000ML/a or possibly higher during flood flows. This would only be possible if you were able to harvest a significant portion of the flood when the flood is occurring. Since the floods do not occur every year in the system and would only occur for a matter of weeks, the size of the pumps and pipeline required would be orders of magnitude greater than the pipeline proposed which is only designed to pump 1000ML/d. An estimate using the methodology in the submission and assuming a pump capacity of 1,000ML/d indicates an additional yield of only 8,000ML/a.

Transferring water when not in flood does not make sense either and could potentially impact on the system yield. For example, if over the last few years (when Wivenhoe/Somerset has not spilled), we had been pumping 80,000ML/a from the Wivenhoe/Somerset system into a raised Borumba Dam, we would now be pumping the water back because the Wivenhoe/Somerset system would effectively be empty.

With at least 70 years between filling, flood harvesting from Borumba Dam when it is spilling would be a rare event and not worth considering.

### **Cost**

Since Borumba Dam at 2,000,000ML is significantly past its hydrologic limit, cost estimates for this level of development were not undertaken. However extrapolating GHD's updated costs for lower levels gives a capital cost of the raised Borumba Dam at \$1.3b. This does not include affected infrastructure but is similar to the costs figures shown in the submission.

The pipeline costs shown in the submission are low for the following two reasons:

- With the current global demand for steel and local demand for construction resources, the capital cost of the pipeline described above is estimated to be of the order of \$650m compared to the \$500m shown in the submission.
- The design velocity of 3m/s is high by industry standards. In this authors experience pipe design velocities of 1.5 to 1.8 m/s are considered more appropriate. However it has been noted that pipe design velocities of around 2m/s are currently being used. Adopting a design velocity of 2m/s will increase the pipeline cost to approximately \$1b.

### **Conclusion**

The two parts of the proposal in total will not provide an additional 70,000ML/a.

The raised Borumba Dam proposal at 2,000,000ML is past the hydrological limit of development at the site. Lower levels of development will provide of the order of 40,000ML/a. However these were assessed in the EIS and in fact a more modest raising of Borumba Dam forms part of SEQ's long term water supply strategy.

The flood harvesting proposal is in order of magnitude too costly at \$650m to \$1,000m (excluding pumping costs) for 8,000ML/a.

A number of other submissions suggested similar alternatives. However again, these alternatives did not satisfy the key criteria of reliably supply 70,000ML/a at the QWC's specified Level of Service.

## **6.4 Costs and Benefits of the Project**

Submissions received in relation to the EIS raised issues regarding the economic assessment supporting the Project. In particular, submissions question whether the analysis undertaken constitutes a full cost benefit analysis.

In the 2007 Economic Report, Marsden Jacob Associates adopted a cost benefit framework commonly used to assess urban water supply infrastructure which focused on the relative economic cost of supply options. In this section, the rationale of applying this approach is documented. In addition, a broader assessment framework is presented which includes non-market values (social and environmental impacts) and some ancillary economic costs and benefits (e.g. recreation, tourism, recreational fishing and flood mitigation) that are important to assess in considering the overall costs and benefits attributable to development of the Project.

Marsden Jacob's 2007 Economic Report applied the same cost benefit analysis (CBA) methodology that is widely used in assessing economic performance of water infrastructure for large urban regions, where it is accepted that new water supply augmentation is required to meet demand.

In this case, the 'alternative' scenario is characterised by development of other water supply infrastructure developments (as opposed to allowing the region to run out of water) and the principal benefit of one supply option over another is the avoided costs (i.e., if the whole-of-life costs – which comprise capital development costs, operating costs and refurbishment costs – are lower than the alternative water infrastructure developments).

A number of submissions on the EIS have noted that the benefit stream – i.e., the value from use or sale of water – is not included in Marsden Jacob's CBA. However, where it is Government policy to supply water to a region, estimating the benefits associated with utilisation of water *per se* is spurious, as benefits from use are attained under all viable options.

In the 2007 Economic Report, Marsden Jacob estimated the economic cost for five supply portfolios, namely:

- 'Traveston Crossing Dam portfolio' – i.e., a portfolio consisting of Traveston Crossing Dam and other water infrastructure developments included in the Government's overall water strategy ('base-case');
- desalination portfolio (alternative 1);
- Mary River dams portfolio (alternative 2);
- NSW Northern River dams portfolio (alternative 3); and
- smaller dams portfolio (alternative 4).

In each case the whole-of-life costs were estimated. Details of the portfolio modelling are provided in the 2007 Economic Report and include details of:

- supply modules, including yields and costs incorporated in each supply portfolio;
- model structure – i.e., cost parameters included in the model;
- sensitivity analysis (based on capital development cost escalation, escalation in variable costs, and climate change impacts); and
- data sources.

**Table 6-10** shows the results of Marsden Jacob's 2007 Economic Report. It is clear that the difference in the economic cost of supply portfolios modelled (when compared against the Traveston Crossing Dam portfolio) was very significant.

Moreover, it can easily be seen that adding an assumed value of water to each supply option would result in the same positive benefit stream being added to each option. This would have no bearing on the results in terms of the present value (PV) difference between alternative water supply portfolios.

**Table 6-10 Present value cost estimates for alternative supply portfolios, 2007-2056**

	TCD Portfolio	Desalination	Mary River Dams	NSW Dam + Wyaralong	Smaller Dams
	\$M	\$M	\$M	\$M	\$M
2012 Capacity (ML)	88,000	87,600	89,110	88,000	88,000
Capex	7,364	7,173	8,087	7,684	7,898
Fixed	1,589	1,887	1,827	1,747	1,963
Variable	737	949	817	910	839
Total	9,690	10,008	10,731	10,341	10,700
Difference with TCD Portfolio	0	318	1,040	651	1,009
Rank	1	2	5	3	4

Source: Marsden Jacob 2007.

There is no point of difference between supply options given that all options must meet regional level of service (LOS) objectives set out under the draft South East Queensland Water Strategy (LOS refers to the frequency, duration and severity of supply interruptions).

The QWC has noted that yields utilised in the portfolio modelling must comply with LOS targets:

“Importantly, all portfolio modelling is underpinned by yields for surface water supplies estimated from hydrological modelling that are consistent with LOS targets.”

Thus, the approach adopted by Marsden Jacob in the 2007 Economic Report is supported by the methodology forwarded, and utilised, by the QWC.

LOS objectives provide a basis for establishing a secure water supply through:

- timely implementation of supply and demand initiatives to meet future water needs as a result of population growth; and
- a predetermined Drought Response Plan.

Water restrictions are an effective and efficient means of managing the impact of these droughts but can have a significant impact on the community. The LOS objectives make clear the assumptions made by water supply planners and will inform investment decisions by the community.

The LOS objectives should reflect community expectations about water restrictions and their willingness to pay for improved security of supply.

Sufficient investment will occur in the water supply system with the objective of ensuring that medium-level restrictions:

- will not occur more than once every 25 years, on average;
- will last longer than six months no more than once every 50 years, on average; and
- need only achieve a targeted reduction in consumption of 15% below the total consumption volume in normal operations.

The frequency that combined regional storage reserves reach levels of 10% of capacity will be not more than once every 1,000 years. Regional water storages must not be permitted to reach

minimum operating levels. The choice of the LOS objectives has involved tradeoffs between financial costs, environmental impacts and the willingness of the community to accept restrictions on a periodic basis. Information gained from managing the Millennium Drought has been used to assist in the formulation of the LOS objectives. The experience of managing regional water security during the Millennium Drought has provided exceptional data on practical issues and community expectations. There is evidence that many people would value a more reliable water supply service than currently exists in SEQ and support investment to improve that service. As one expression of this value, there has been widespread take-up of rainwater tanks and other alternative sources of supply.

On the basis of the proposed LOS objectives, the community can expect to experience water restrictions no more than once every 25 years on average. Such restrictions would reduce total urban demand by an average of 15%, across the entire community. The LOS objectives seek to ensure that future droughts do not require high-level restrictions on the community. For instance, planning will aim to ensure that residents do not need to be limited to bucket water in future droughts.

Prior to the release of the 2007 Economic Report, Queensland Treasury had reviewed the approach adopted by Marsden Jacob at both the inception stage of the Project and during the latter stages of the Project (after model results had been presented). Subsequent reviews by Harry Campbell (Professor of Applied Economics at the University of Queensland) and adoption of the same methodology by the QWC confirms that the approach adopted was correct.

Professor Campbell noted that the benefits from water use to the consumer are fixed across options in this economic CBA, and confirmed that the approach undertaken by Marsden Jacob was appropriate:

*“Since the five supply portfolios each satisfy the chosen demand forecast they provide the same level of benefits to the consumer; in other words, in the benefit-cost analysis each portfolio provides the same level of benefit, and the choice of supply portfolio can be based on costs alone and does not require calculation of a benefit/cost ratio or internal rate of return. However the choice among supply portfolios could be framed in benefit-cost terms if desired: the benefit of the lowest cost portfolio is the avoided cost associated with the next lowest cost portfolio, resulting in the benefit/cost ratio of the lowest cost portfolio being greater than unity. This is a matter of presentation and in the present study a comparison of costs alone provides the greater level of clarity.”*

It is also instructive to note that the QWC, in the draft South East Queensland Water Strategy, has focused on least cost supply planning to compare combinations of supply and demand management options<sup>8</sup>:

*“The main purpose of portfolio analysis is to incorporate the principles of least-cost planning to compare the costs and benefits to the community of different suites of water supply and demand initiatives. Increasingly, governments are using this technique to find the most efficient supply solution.*

*A portfolio model was developed for South East Queensland to estimate the overall economic cost of combinations of supply and demand management options capable of meeting water supply needs for the period to 2056. The focus of portfolio modelling is on estimating the Net Present Value (NPV) for the whole-of-life cost (capital costs and operating costs) of alternative supply portfolios over the period. The NPV is defined as*

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<sup>8</sup> QWC, 2008, *South East Queensland Water Strategy*, Draft, April.

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*the lump-sum equivalent of all future economic costs in today's terms or at some other point in time. Future costs can be brought into a present value equivalent using an appropriate discount rate."*

The QWC also noted that the economic benefit should be couched in terms of the cost effectiveness of options (*vis á vis* the principal alternatives):

*"The economic benefit of a given portfolio is the cost savings relative to the 'next best alternative'. Hence the objective is to quantify, and then compare, the economic cost of supply for alternative portfolios. The option with the lowest economic cost is assumed to be the most efficient in terms of a narrow economic assessment... "*

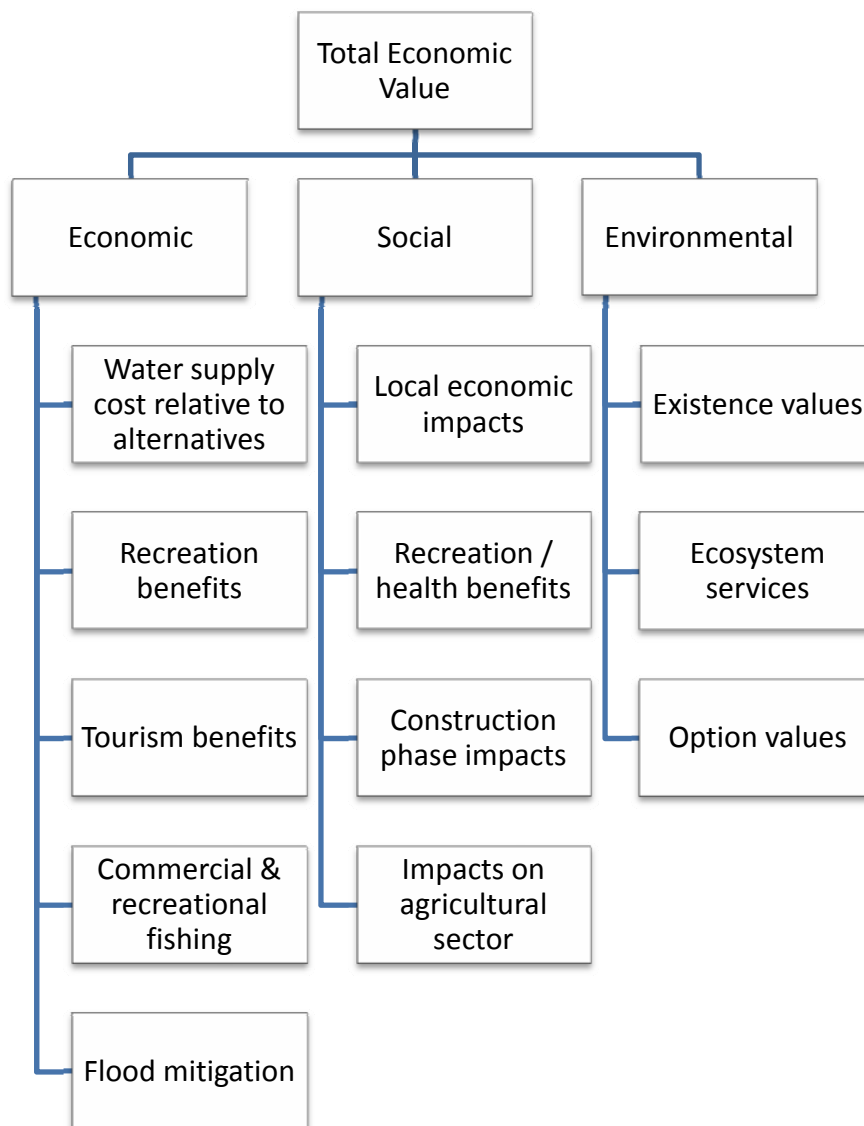
QWC noted that those demand management measures which were clearly cost effective, were common to all supply portfolios:

*"Most demand measures are not included in the schedule, as they will not impose significant additional costs on the community and are common to all portfolios. The cost effectiveness of these measures was separately addressed..."*

Moreover, focusing on the relative economic costs of supply options is consistent with the CBA framework for urban water supply infrastructure that has been adopted in other jurisdictions in Australia. Western Australia, South Australia, New South Wales and Victoria are all following this approach for their evaluation of desalination projects and in development of their overall water supply strategies.

While the comparative cost approach is the key focus in examining the economic efficiency of the Project, it is possible to include a wider range of 'non-market' costs and benefits in a broader cost benefit analysis which is illustrated in **Figure 6-12**.

Figure 6-12 Broader cost benefit analysis



Source: Adapted from: Alcamo, J., Hassan, R. M and Bennett, E., (editors), 2003, 'Ecosystems and Human Well Being: a Framework for Assessment', Millennium Ecosystem Assessment.

To apply this broader cost benefit analysis, a broader suite of economic benefits will be delivered as a result of the Traveston Crossing Dam:

- **visitation / tourism benefits** – over 1 million people visit SEQ’s existing dams each year. Visitation benefits of around \$243 to \$529 per visit have recently been estimated for iconic waterways in Australia;
- **cycle tourism** - now a major component of eco-tourism, with iconic cycle tours around the world generating large amount of tourism and providing large amenity value for residents. For example, expenditure by tourists using existing Australian cycle routes has been estimated at \$104 to \$177 per person per day;

- **recreational fishing benefits** – a recent study of recreational fishing in three Queensland freshwater dams has estimated total annual economic benefits ranging from \$1.1 million to \$4.5 million;
- **flood mitigation benefits** – an additional \$70 million is being spent to provide flood mitigation benefits. Hydrology modelling indicates that the impacts of the severe 1999 Gympie floods would have been substantially reduced; and
- **road safety benefits** – the Bruce Highway between Cooroy and Gympie has an RACQ rating of just two stars (the lowest rating currently given to any highway in Queensland), and is one of nine roads flagged by the RACQ for urgent attention.

These more holistic benefit streams are very significant, and are specific to the Project development. That is, these types of benefits will not be realised if alternative water supply infrastructure developments are constructed. Moreover, these benefits were not incorporated in the 2007 Economic Report because it focused on the economic efficiency of water supply, and hence an important role of this Supplementary Report has been to describe the broader suite of benefits associated with the Project.

#### **6.4.1 Costs estimates for Traveston Crossing Dam**

Submissions have questioned the accuracy of the costs of Traveston Crossing Dam outlined in the EIS. Cost estimates for the Project are provided in section 2.4 and 2.7 of the EIS. The capital development cost was developed as part of the preliminary dam design process completed by leading engineers from QWI in association with SunWater, and independently verified by Project Support (Costing & Delivery Engineers) along with an independent Expert Review Panel of Engineers (Emeritus Professor Robin Fell from the University of New South Wales, Richard Herweynen from Hydro Tasmania, and Graeme Bell from UNSW Global). An audit of the process to determine the costs of the Project was independently undertaken and verified by Pricewaterhouse Coopers.

Specifically, the original project cost estimate was prepared by SunWater. This estimate was reviewed by Project Support. The estimate was then updated by SunWater and Project Services to include a risk based contingency allowance. The updated estimate was then reviewed by the Expert Review Panel. It was this risk based figure that was included in the EIS.

Contingencies were applied to capital costs to reflect the risk of increases in real costs (as opposed to nominal costs). More specifically, risk was assessed for: (i) the volume of units required for construction; (ii) unit prices; and (iii) unplanned risks. Monte Carlo simulations (a statistical method for assessing risk) were used to generate an overall contingency factor. A probability rating of 95% was applied in developing the contingency factor (i.e. there is 95% probability the actual costs will be equal to, or less than, the capital cost estimates adopted by QWI).

Second, sensitivity testing was undertaken to examine the impacts on economic modelling results from a 30% increase in capital expenditure (capex) (EIS Table 3.3). Relative to the base-case, the cost advantage of the Project compared to the alternatives examined increased substantially when capex is increased by 30%.

##### **6.4.1.1 Land Costs**

The costs of the Project include the land purchasing costs for the Project (i.e. Traveston Crossing Dam, Stage 1), which includes the costs associated with:

- reasonable valuation, legal, accounting and financial planning fees for advice regarding the sale;

- an allowance for stamp duty to be incurred on the purchase of another property (equivalent to the stamp duty for the sold property); and
- a lump sum payment for disturbance costs and general expenses to allow the landholder to relocate.

Stage 2 of the Project is only considered a possibility which would be determined in approximately 30 years, having regard to the then circumstances and other alternatives which are available. Those costs associated with the Project requiring approval (i.e. Stage 1) are included in the EIS.

#### **6.4.1.2 Northern Pipeline Interconnector**

Costs for interconnection of the Project to the SEQ Water Grid have been included in cost estimates, which include a local pipeline connection and water treatment plant. The Northern Pipeline Interconnector (NPI) is designed to accommodate water from potential future sources on the Sunshine Coast, including the Traveston Crossing Dam. The NPI is primarily a stand-alone drought contingency project that will deliver water from existing storages on the Sunshine Coast into Brisbane, other areas on the Sunshine Coast and the SEQ Water Grid as directed under the *Water Act 2000*. Therefore, costs associated with the NPI are not considered to be part of the Project.

#### **6.4.1.3 Relocation of Bruce Highway**

Submissions have raised the issue of whether the full cost of the Bruce Highway should be attributed to the Project. The Bruce Highway costs attributable to the Project include the land costs associated with relocation of the road due to the Project footprint, along with the costs associated with the Bruce Highway upgrade being constructed earlier than was originally planned in 2015. The full cost of the Bruce Highway is not attributable to the Traveston Crossing Dam, as the upgrade of the Bruce Highway was a project that would have been required irrespective of the construction of the Traveston Crossing Dam. The costs attributable to the dam are those costs that have arisen as a result of the construction of the Traveston Crossing Dam (i.e. land and bring forward costs).

#### **6.4.1.4 Relocation of Local Roads**

Submissions have questioned the accuracy of cost estimates for the relocation and upgrading of local roads and in particular bridges.

Figure 2-7 of the EIS indicates that \$268 million has been estimated for the relocation and upgrading of local roads. This estimate is considered to be accurate based on the phase of costing that they are at. The detailed design and works for the roads packages will be conducted by the alliance when appointed, therefore, the cost estimates provided in the EIS are the most accurate possible based on the preliminary design.

#### **6.4.1.5 Cost of Water Restrictions**

Submissions have raised issues that, because the Project will not be completed until 2011, the costs of water restrictions until that time should be taken into consideration. However, the completion date for the Project is consistent with the alternatives. Therefore, including the cost of restrictions (i.e., until the completion date) would be irrelevant, as it would have exactly the same impact on all options considered. In some cases, alternatives will take longer.

It should be noted that the Project is expected to provide its first yield within months of commissioning. It is not necessary for the dam to fill completely before it can supply water.

#### **6.4.2 Sustainability of Traveston Crossing Dam**

Submissions have also raised the issue of the sustainability of the Project. The issue of sustainability is addressed in Section 17.4 of the EIS.

QWI recognised the potential impacts that the Project may have and engaged CSIRO Sustainable Ecosystems to advise and assist in developing a set of sustainability principles to inform and guide the process of Project design, construction and operation, and then by extension, to other major projects for which QWI is the Proponent. A second component of the work involved developing a method to assess the benefits of any proposed actions.

The CSIRO team, which consisted of sustainability, catchment management, ecological and economic specialists, met with QWI and developed the issues that defined sustainability across the three core areas of social, economic and environmental capital. The team drew on data and information gathered by QWI as part of the EIS process, a visit to the Project site, its collective extensive worldwide experience, as well as publications related to the World Commission on Dams, guiding principles for the planning and project cycle (in Bird and Wallace, 2001) and impacts of large dam projects (Brismar, 2003).

As a starting point, the team assumed that current best-practice engineering design and construction techniques and “standard” mitigation measures would apply to all phases of the Project. These traditionally focus on minimising or avoiding potential negative impacts, particularly during the construction phase. While these measures are essential and a major component of legislative compliance, they tend not to address the potential positive impacts or the longer term implications of the Project. Both components are relevant to the goal of achieving sustainable outcomes.

QWI recognises that the principles of sustainable development are relevant considerations for many of the approvals required for the Project both under Federal and State legislation and are important in addressing development of major infrastructure in the 21st century.

It was recognised that most of the direct negative impacts of the Project would be in the local area, while the bulk of the positive impacts (relating to water supply security and flow-on economic benefits) would be felt, in addition to within the local area, at regional, State and national levels outside the area of negative impact.

The CSIRO principles therefore focused on the need to address equity issues across the geographic distribution of negative and positive impacts. This resulted in a focus on the enhancement of positive outcomes at a local and sub-regional scale by assisting the community of the Mary Valley to take advantage of the opportunities offered by the construction and operation of the Project. ‘Community’ in this sense refers not only to the human community but also to ecological communities.

### ***Outcomes***

The outcome of the first stage of the process was to define the Vision, Goals, and a number of Principles related to each goal. These preliminary outcomes will be further discussed and refined as the Project progresses.

### ***Vision for the Mary River Catchment***

*Promote sustainable regional development and enable communities to adapt to life in the changing rural landscapes of the Mary River catchment through partnerships and innovative projects.*

### ***Goals for Sustainability:***

*To plan, design and enable innovative projects that:*

- *promote the development of sustainable communities through opportunities generated by Traveston Crossing Dam;*

- 
- *encourage sustainable local enterprises that benefit from the development of Traveston Crossing Dam; and*
  - *contribute to the conservation of riverine communities and the restoration and management of ecosystem processes that support sustainable catchments.*

### **Design Principles for Sustainable Communities**

The “Bristol Accord” ([www.communities.gov.uk](http://www.communities.gov.uk)), developed in December 2005, defines Sustainable Communities as “places where people want to live and work, now and in the future”. These communities “meet the diverse needs of existing and future residents, are sensitive to their environment, and contribute to a high quality of life. They are safe and inclusive, well planned, built and run, and offer equality of opportunity and good services for all”. While developed in Europe with the aim of creating genuinely sustainable European communities, there are many common features for consideration in thinking about the development of sustainable communities in the Mary River catchment.

Some design principles for sustainable communities in the Mary River Catchment that flow on from the Bristol Accord include:

Sustainable Communities:

- Principle 1. Ensuring that the communities of the Mary River catchment also benefit from the natural resources utilised in SEQ;
- Principle 2. Designing and developing options for relocating displaced residents within the local area;
- Principle 3. Providing for intergenerational equity through planning and design for future communities;
- Principle 4. Involving the community in investment decisions;
- Principle 5. Promoting and enabling social connectivity for people in changing landscapes;
- Principle 6. Supporting environmental education programs; and
- Principle 7. Encouraging recreational activities that promote physical activity and outdoor nature-based experiences.

### ***Design Principles for Sustainable Local Enterprises***

The development of the Project opens up new opportunities for the establishment of sustainable local enterprises that utilise the newly developed resources such as the lake edges, large areas of open freshwater for recreation and increased tourism. Local enterprises can benefit from becoming a part of the construction and operation phases. Other opportunities will emerge for landholders and lessees to develop the newly formed rural landscapes that have shoreline frontage for recreation, agriculture or revegetation to achieve economic and/or amenity values. Developing these new enterprises and managing their operation needs to be informed by sustainability principles that, for example, integrate conservation and production values and reduce per capita resource use and waste generation. Importantly, sustainable local enterprises will engage local people in ongoing employment and community development.

Sustainable Local Enterprises

- Principle 1 - Create employment opportunities during construction and operation of Traveston Crossing Dam by facilitating growth in the scale and capacity of local businesses;
- Principle 2 - Promote entrepreneurial and innovative local business opportunities;
- Principle 3 - Integrate conservation and production across rural landscapes;

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- Principle 4 - Promote eco-tourism, agri-tourism and cultural tourism founded on local landscapes and heritage values; and
  - Principle 5. Enhance recreational opportunities that develop and utilise the new landscapes provided by Traveston Crossing Dam.

***Design Principles for Ecologically Sustainable Catchments:***

The construction and operation of the Project will involve the planning, design, development and management of newly created aquatic and terrestrial ecosystems within a changed rural landscape. The sustainable development of these newly developed ecosystems will rely on the integration of knowledge gained from ecosystem rehabilitation and restoration ecology elsewhere combined with local environmental knowledge. Of particular relevance to science, conservation and local people is the ecology and behaviour of iconic freshwater species such as the Queensland Lungfish, Mary River cod and Mary River Turtle.

Ecologically Sustainable Catchments:

- Principle 1 - Encourage and facilitate whole of catchment restoration of riparian vegetation and wetlands for nature conservation and water quality enhancement;
- Principle 2 - Encourage and facilitate sustainable land management practices in the catchment through knowledge transfer and providing support for appropriate actions;
- Principle 3 - Provide for the conservation of the Mary River cod, Mary River Turtle, and Queensland Lungfish through habitat management and any other management practices determined through research;
- Principle 4 - Maintain the health of downstream aquatic ecosystems by mimicking the natural hydrological regime through managed dam releases; and
- Principle 5 - Encourage, facilitate, or support research and actions targeted at improving the environmental sustainability of the catchment, aquatic ecosystems, and/or native biodiversity.

**6.4.3 Sustainability Implementation**

This set of principles was used by QWI to develop an initial list of potential sustainability initiatives that aim to deliver environmental, economic and / or social benefit to the region, with outcomes that can be assessed and measured. In order for this assessment to be feasible, a range of measurable performance indicators are required that might include measures relating to water quality or conservation status, carbon balance, business activity, number of tourists, emigration and immigration rates, or community cohesion.

The EIS provides a detailed explanation of the proposed sustainability initiatives that QWI has identified in Section 17.4 Sustainability. These are summarised as follows:

(A) Freshwater Species Conservation Centre

QWI and the Queensland Government have announced the development and \$35 million funding of a Freshwater Species Conservation Centre on the shores of the Traveston Crossing Dam. The Centre will also work with the existing community Gerry Cook Cod Hatchery at Cooroy through provision of \$600,000 for a new building and facilities and working cooperatively, focussing on the Mary River cod. Further to this commitment, QWI has provided \$64,000 to the hatchery for a new shed to replace the old one that was severely damaged by storms.

Initial scoping work for the Freshwater Species Conservation Centre is underway and site locations are being examined. Preliminary design on associated infrastructure such as road access has been investigated and concept designs are being prepared.

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## (B) Native Timber Plantations

2,200 hectares of native timber plantations are being investigated to be developed as part of the Project. The objective of QWI is to achieve carbon sequestration, industry and environmental benefit, whilst financial benefit would be available to lessees to negotiate with the plantation company. Assessments undertaken for the Project indicate the plantations will provide a major positive benefit and provide substantial carbon credits for the Project.

QWI has commenced a 20 hectare native hardwood timber plantation trial to provide valuable data on the type of plantations that should be considered. QWI has commissioned Timber Queensland to develop a prospectus to provide growers, landholders, suppliers and industry with a business framework. Suitable land is being sourced, within the land purchase boundary, for a range of plantations including a research and development trial for Medihoney. Griffith University has entered a Memorandum of Understanding (MOU) with QWI to provide verification of the carbon offsets gained through QWI's plantations activities by parameterising the national Carbon Accounting System FullCAM model to local conditions and species and by undertaking a continual audit of the developing plantation estate.

## (C) Design for Turtles

In conjunction with experts at the EPA, QWI has incorporated a number of design elements into the Project to specifically cater for turtles. The studies and research undertaken for the Project indicated the most critical factor affecting the continued presence of the Mary River Turtle is the predation of their eggs and accidental damage through trampling by cattle. To address this issue a "benign by design" objective is part of the overall project design.

Research conducted at the \$35 million Freshwater Species Conservation Centre will include studies into the Mary River Turtle. It will allow researchers to investigate what sort of impoundment facilities are appropriate to allow breeding.

QWI has partnered with the Burnett Mary Regional Group to deliver a program that will enhance biodiversity through rehabilitation and enhancement of habitat and key research initiatives. Specific activities being explored include:

- instream habitat translocation and improvement through translocation of large woody debris and rock (riffles) to areas downstream of the proposed dam wall to assist in key breeding habitat replacement and to aid in bed and bank erosion;
- fish passage improvement works – improvements to fish/fauna passage within the Middle Mary catchment such as Six Mile Creek, Deep Creek, Sandy Creek, Eel Creek and Calico Creek; and
- research and monitoring activities.

## (D) Sustainable Riparian Farm Management

QWI, through the Department of Primary Industries and Fisheries (DPIF), will provide targeted assistance to landholders adjoining the river system in the catchment and particularly adjoining the storage, to develop farm management plans that minimise potential conflict but maintain productivity. Assistance is aimed at achieving profitable farms that minimise their potential impacts on the environment.

QWI has partnered with the DPIF to deliver a \$2.75 million Food and Fibre Futures package which will create sustainable rural landscapes through facilitating agricultural development in the

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Traveston Crossing area. Key initiatives that will be supported are the adjustment, economic development, agribusiness partnerships, and policy coordination and advice programs.

#### (E) Kandanga Township Revitalisation

In addition to engineering mitigation measures, QWI have developed a number of short and long term strategies to ensure the community is able to maximise opportunities that arise from the Project.

QWI has worked with local town groups and provided funding and support to grass roots initiatives to help develop sustainable communities including sponsorship of a bowls competition, painting shopfronts, a new public toilet with disability access, bus pull-in bays, and air conditioning for the general store, Friends of Kandanga shop and the Kandanga Fire Brigade control building.

QWI is consulting with local council on an upgrade to the sewage and water supply to Kandanga. Concept plants have been developed for the relocation of the Kandanga Bowls Club, and QWI has agreed to contribute \$2.5 million to the new facility.

#### (F) Recreation and Tourism Planning

The Traveston Crossing Dam offers significant recreational and tourism opportunities. QWI has developed conceptual plans providing for recreational facilities focussed on the dam, zoning of the dam for particular types of recreation, and locations for camping, horse riding, mountain bike trails and the like. Land will be set aside for these purposes and expressions of interest will be issued for development. Importantly, the concept planning will integrate the environmental mitigation measures to ensure, effective environmental management is the priority for any development and use of the dam.

Ground truthing has been undertaken and detailed design is underway on the overall trail network strategy including recreational nodes and possible provisions for camping sites.

QWI is discussing tourism opportunities with Tourism Sunshine Coast and Tourism Queensland to expand on initiatives from the Sunshine Coast Hinterland areas of Kenilworth, Maleny and Montville to include the Mary Valley. QWI has also reached agreement with the Cooloola Regional Development Bureau (CRDB) to undertake a scoping study which will assess the feasibility and work plans for an Economic Development Officer and Events/Promotions Officer. QWI and the CRDB will investigate the possibility of implementing the recommendations of the scoping study.

#### (G) Educational Opportunities

Opportunities will be available for local schools to participate in initiatives offered by the Traveston Crossing Dam and associated activities and projects. The components of the Project, together with existing facilities in the region, would offer a number of activities of interest in the one locality which will be a major attraction for education and tourism alike. The range of opportunities includes:

- Freshwater Species Conservation Centre and its incorporated Environment Education Centre;
- the aquatic environment of the dam, river and streams;
- refuge islands, turtle nest banks, fishway and turtle ramp; and
- recreational area and facilities, timber plantations, natural forests.

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QWI will facilitate the development of promotional material that highlights the facilities and environmental features and range of activities of interest and tool kits for education purposes which will promote knowledge of the environment and the locality and its surrounds.

QWI has developed a series of training initiatives to ensure maximum participation in the Project. This includes a partnership with Wide Bay Institute of TAFE to ensure the local business and workforce are skilled appropriately to take part in the Project. The company has also engaged with relevant government agencies, registered training organisations and industry (refer Section 27.1 of the EIS). Initiatives already undertaken include funding and support for local community jobs plans and funding for blue card accreditation training.

#### (H) Mary Valley Rattler

To support this iconic tourism drawcard, QWI proposes to provide enhanced access the facility by raising platforms at Amamoor, Kandanga and possibly Imbil, to an appropriate height and design for use by the elderly or mobility impaired persons. Also, QWI is undertaking structural inspections of the bridges crossed by the train to assist operators in the long term. The Mary Valley Rattler, together with the other additional attractions in the area, will become even more of a central feature than it is now.

To secure the long term future of the Mary Valley Rattler, QWI purchased a second engine for the Mary Valley Heritage Rail Society. QWI has also undertaken repair work at the Amamoor Railway Station after storm damage.

#### (I) Local Industry Participation plan

QWI has instigated a local business register to provide guidance and support to business in regards to appropriate preparation, resource requirements, training, certificates, to ensure they are well positioned to maximise the business opportunities of the Project. More than 720 suppliers have registered on the voluntary register as at 20 June 2008.

QWI has engaged local industry group AIEM Net to provide consultative services to increase local business participation and preparation for the Project. QWI funding of a Community Project Programme Consultant at AIEM has encouraged local business participation in a range of programs and training. By April 2008, AIEM had held 27 information forums to prepare local businesses for opportunities associated with the Traveston Crossing Dam. More than 1,500 local business representatives have attended forums at Gympie, Wide Bay TAFE, Nambour, Maryborough, Hervey Bay, Bundaberg, Kingaroy and Twin Waters.

AIEM have also organised two site tours to other major infrastructure projects in SEQ for local suppliers. AIEM are working with major contractors on briefings for the local business industry.

#### (J) Apiculture

As part of its overall approach to facilitating a sustainable hardwood timber plantation program at the Traveston Crossing Dam site, QWI and Timber Queensland will be including a significant trial of melliferous planting just downstream of the dam wall. Timber Queensland has identified areas within the Project locality of over 2000ha available for native hardwood plantation.

In addition to this, QWI has had preliminary discussions with DPIF to consider further scientific investigation and has committed funding of \$200,000 over a three year period to assist research into bee nutrition and honey production.

QWI is sourcing land for Medihoney to conduct a research and development trail to develop trees that yield a greater quantity of nectar containing enhanced levels of anti-bacterial and anti-inflammatory components. This honey has the potential to provide approximately six times more revenue for the local beekeeping industry than standard honey.

### ***Sustainability Outcomes***

Each of these projects outlined above contribute to the vision, goals and sustainability principles for the Project as follows:

#### Sustainable Communities

Principles		Projects and Activities									
		A	B	C	D	E	F	G	H	I	J
Principle 1.	Ensuring that the communities of the Mary River catchment also benefit from the natural resources utilised in South East Queensland	✓	✓		✓	✓	✓	✓	✓	✓	✓
Principle 2.	Designing and developing options for relocating displaced residents within the local area					✓					
Principle 3.	Providing for intergenerational equity through planning and design for future communities		✓		✓	✓	✓			✓	✓
Principle 4.	Involving the community in investment decisions		✓			✓	✓			✓	
Principle 5.	Promoting and enabling social connectivity for people in changing landscapes					✓	✓	✓		✓	
Principle 6.	Supporting environmental education programs	✓						✓			✓
Principle 7.	Encouraging recreational activities that promote physical activity and outdoor nature-based experiences					✓	✓	✓			

#### Sustainable Local Enterprises

Principles		Projects and Activities									
		A	B	C	D	E	F	G	H	I	J
Principle 1.	Create employment opportunities during construction and operation of Traveston Crossing Dam by facilitating growth in the scale and capacity of local businesses	✓				✓	✓			✓	
Principle 2.	Promote entrepreneurial and innovative local business opportunities		✓		✓	✓	✓	✓		✓	✓
Principle 3.	Integrate conservation and production across rural landscapes		✓		✓						
Principle 4.	Promote eco-tourism, agri-tourism and cultural tourism founded on local landscapes and heritage values	✓				✓	✓	✓	✓	✓	✓
Principle 5.	Enhance recreational opportunities that develop and utilise the new landscapes provided by Traveston Crossing Dam					✓	✓	✓	✓	✓	

## Ecologically Sustainable Catchments

Principles		Projects and Activities									
		A	B	C	D	E	F	G	H	I	J
Principle 1.	Encourage and facilitate whole of catchment restoration of riparian vegetation and wetlands for nature conservation and water quality enhancement		✓		✓						
Principle 2.	Encourage and facilitate sustainable land management practices in the catchment through knowledge transfer and providing support for appropriate actions		✓		✓			✓			✓
Principle 3.	Provide for the conservation of the Mary River Cod, Mary River Turtle, and Queensland Lungfish through habitat management and any other management practices determined through research	✓		✓	✓						
Principle 4.	Maintain the health of downstream aquatic ecosystems by mimicking the natural hydrological regime through managed dam releases	✓									
Principle 5.	Encourage, facilitate, or support research and actions targeted at improving the environmental sustainability of the catchment, aquatic ecosystems, and/or native biodiversity	✓		✓	✓						

### 6.4.4 ISF/Cardno Report

Several submissions have raised issues regarding the consideration of the alternatives raised in the ISF/Cardno report “Review of Water Supply-Demand Options for South East Queensland, 2007” (Turner et al, 2007). The alternatives raised by Turner et al (2007) were considered in considerable detail in Section 2.4 Alternative to the Project of the EIS.

Turner et al (2007) proposed an alternative strategy for achieving water balance that was considerably different in analytical approach and demand-supply options to that adopted under the SEQ regional Water Supply Strategy (SEQRWSS).

As part of the overall assessment of alternative options to the Traveston Crossing Dam, the Turner et.al study was considered in detail. The Queensland Water Commission commissioned Marsden Jacobs and Associates to conduct a full and detailed analysis of the options presented by the Turner et.al report. The MJA evaluation “Evaluation of ISF/Cardno Report: ‘Review of Water Supply-Demand Options for SEQ’” concluded that the options presented were overly dependent on unproven and therefore unacceptably high risk demand management strategies, and the planning of smaller surface water storages with lower supply reliability compared to Traveston Crossing Dam. In particular, the MJA assessment concluded:

- the water savings are based on underestimated cost estimates and unrealistic penetration rates for key demand management options;
- there are significant errors in the demand projections adopted in the report;
- it fails to properly assess supply risks associated with the smaller dams;
- the adaptive management strategy is extremely high risk for a population of 2.7 million people. Simply put, this increases the risk of not being able to meet essential water demands for the region’s population;
- there is a range of problems relating to the cost and yield estimates for the smaller surface water storages proposed. Detailed analysis of these options has already been undertaken by SEQRWSS and they have been proved to be inefficient supply options;

- 
- the smaller dams favoured by the report's authors include 3 storages in the Mary River. Hence social and environmental impact in the Mary River/Gympie region would not be avoided; and
  - key issues relating to the implications for regional water supply reliability are not adequately addressed.

The ISF/Cardno strategy would greatly reduce supply security while increasing the frequency of water restrictions and increase the need to build high cost contingency supplies.