QUEENSLAND WATER
INFRASTRUCTURE PTY LTD

# TRAVESTON CROSSING DAM

## Environmental Impact Statement

## Executive Summary

October 2007

SINCLAIR KNIGHT MERZ
SKM

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The Environmental Impact Statement Executive Summary presents the key findings of the EIS for the Traveston Crossing Dam Project. A full understanding of the Project, the potential benefits and impacts and the proposed mitigation measures can be obtained by reading the suite of documents entitled "Traveston Crossing Dam, Environmental Impact Statement" dated October 2007.

SINCLAIR KNIGHT MERZ
SKM

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# 1. PROJECT AND PROCESSES – OVERVIEW

## 1.1 Background to the Project

Water security in South East Queensland (SEQ) is absolutely critical to long term social cohesion and economic growth. Most parts of SEQ have been affected by a lack of reliable rainfall over recent years and a subsequent significant reduction in security of water supply. Water levels in major storages have fallen to the point where level 5 water restrictions, and planned level 6, are required to maintain adequate supplies. This has come at a time of high and continued population and economic growth in SEQ.

The Queensland Government is now faced with the situation where demand for reticulated water in SEQ is approximately 480,000 ML/a under non-drought conditions but the prudent take from existing sources of supply is approximately 440,000 ML/a. Further, in accordance with the medium series population projections, at least 140,000 ML/a of additional prudent take will be required by 2026 and 330,000 ML/a by 2051. A high series population projection/high water savings, scenario will require an additional prudent take of 210,000 ML/a will be required by 2026 and 490,000 ML/a by 2051 (MWH, 2007).

A multi-faceted strategy has identified both short term and long term measures to meet the need for a secure supply of reliable water in SEQ. The short term measures provide for additional supply infrastructure and other initiatives (including amongst others, groundwater development, water harvesting and recycling) which together will provide an additional prudent take of 261,000 ML/a, sufficient to meet the region's demand for water to the year 2026 (MWH, 2007) and possibly beyond. The earliest components of the strategy to be implemented were demand management and water use efficiency initiatives, the Tugun Desalination Plant and the Western Corridor Recycled Water Scheme.

Analysis undertaken to date shows that the Traveston Crossing Dam (the Project) represents just over 27% of the anticipated total yield of current proposed supply initiatives in SEQ by 2015 (**Figure 1.1**).

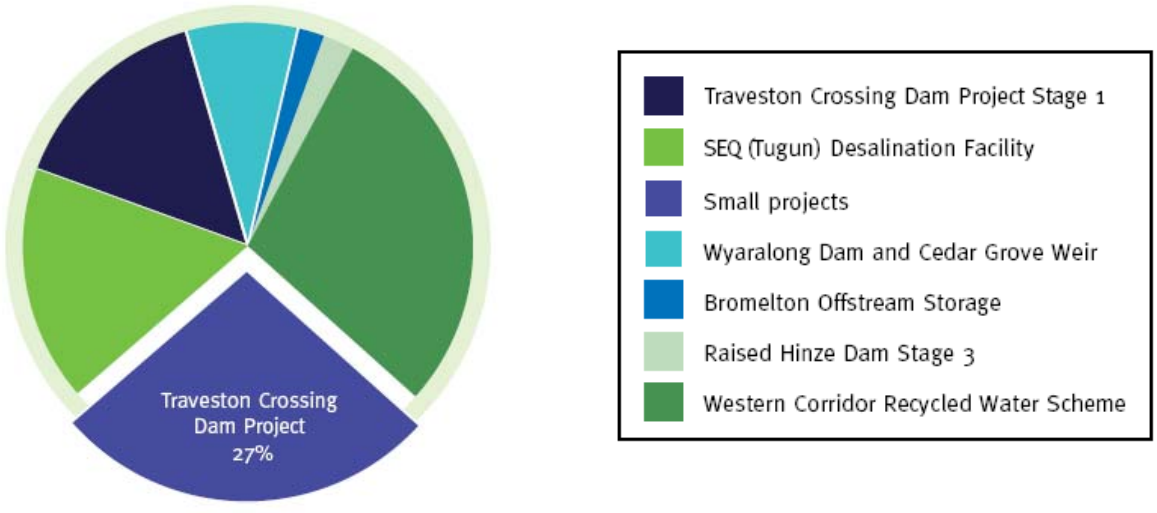


**Figure 1.1 Anticipated Yield of Proposed Supply Initiatives**

Total yield and the spatial distribution of surface water storage are two critical elements for water security in SEQ. Currently, SEQ urban water supplies are highly reliant on rainfall in the North Pine, Somerset and Wivenhoe catchments, to the north-west of Brisbane. These catchments supply 72% of the yield from above ground storages, while catchments to the south and south-west supply 16% and catchments to the north, closer to the coast, supply just 12% (MWH, 2007). The Traveston Crossing Dam site has been identified as best meeting the need for new, high yield surface water storage in the northern sector of the SEQ water supply grid (**Figure 1.2**).

The site for the dam is situated in a coastal rainfall catchment (Upper Mary Valley) of some 2,100 $m^2$ in area. The Upper Mary Valley is a hydrologically efficient catchment which receives up to 55% more rain on average per year than the Wivenhoe Dam catchment. Investigations indicate the dam will be full or near full more than 80% of the time and will have lower evaporation rates than both Wivenhoe Dam and Borumba Dam.

The Mary River has SEQs largest mean annual flow and is also one of the most undeveloped rivers in terms of water storage and infrastructure. The Mary River has a mean annual flow (after taking existing water entitlements (6%) into account) of more than 2,300,000 ML/a, which is more than double that of the Brisbane River. The dam will account for just 4% of mean annual flows in addition to the current 6% extracted.

Consequently, the Traveston Crossing Dam Project has been identified as one of the Queensland Government's major new water infrastructure initiatives for the SEQ region under the South East Queensland Infrastructure Plan and Program. The Project is also included in Part 8 of the *Water Act 2000* as a measure to be carried out by Queensland Water Infrastructure (QWI), to be constructed by 31 December 2011.

## 1.2 The Project

The Project involves the construction and operation of a major new dam and associated infrastructure and the construction or relocation of existing infrastructure likely to be impacted by the Project.

The Project is located on the Mary River in SEQ, some 27 km upstream of Gympie in the Mary River catchment (**Figure 1.3**). When completed in 2011, the dam will deliver an additional 70,000 ML/a of water to SEQ. The dam has a proposed Full Supply Level (FSL) of EL 71.0 m Australian Height Datum (AHD). At this FSL, the dam will provide storage capacity of approximately 153,000 ML and will inundate some 3039 ha. The main channel of the Mary River will be inundated for a length of some 36.5 km.

The dam is proposed to be constructed as a Roller Compacted Concrete (RCC) dam across the valley floor with a wall height of up to 59 m above its foundations (approximately 25 m above ground level), an earth embankment and saddle dam structure on the left abutment with a conventional mass and reinforced concrete spillway on the right abutment. Flood gates, multi-level water offtakes, a fishway and turtle ramp will be incorporated into the design.

# SEQ Water Grid


## About the Water Grid

The South East Queensland Water Grid will provide a network of two-way pipelines to connect all major bulk water sources in the region.

The water grid will be able to move water from areas of water surplus and transport it to areas that face a shortfall.

The water grid will allow the coordinated use of all major SEQ water supply sources, including:

- the Wivenhoe/Somerset system
- the Hinze Dam
- the proposed Traveston Crossing and Wyaralong dams
- the desalination plant at Tugun on the Gold Coast and
- the Western Corridor Recycled Water Project.

This map of the South East Queensland Water Grid was produced in June 2007 and is indicative only.



- Western Corridor Recycled Water Project
- Northern Pipeline Interconnector
- Eastern Pipeline Interconnector
- Northern Regional Pipeline
- Southern Regional Water Pipeline and Pipeline to Desalination Plant
- SEQ (Gold Coast) Desalination Plant
- Alternative Supply to Local Townships
- Water harvesting into Hinze Dam
- Proposed Pipelines
- Existing Pipelines
- Existing Dam
- Proposed Dam
- Advanced Water Treatment Plant
- Water Storage Facility

Queensland Government

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**FIGURE 1-2**

TRAVESTON CROSSING DAM EIS

SEQ WATER GRID

DRAWING NUMBER

100562

DATE: SEPTEMBER 2007

I:\QENV\Projects\QE06430\SpatialArc_MXD\FiguresIFinal\Final_PrintExec_1-2_SEQ_Water_Grid.mxd Produced: 4/10/2007. This figure should be read in conjunction with the data disclaimer at the front of this report.

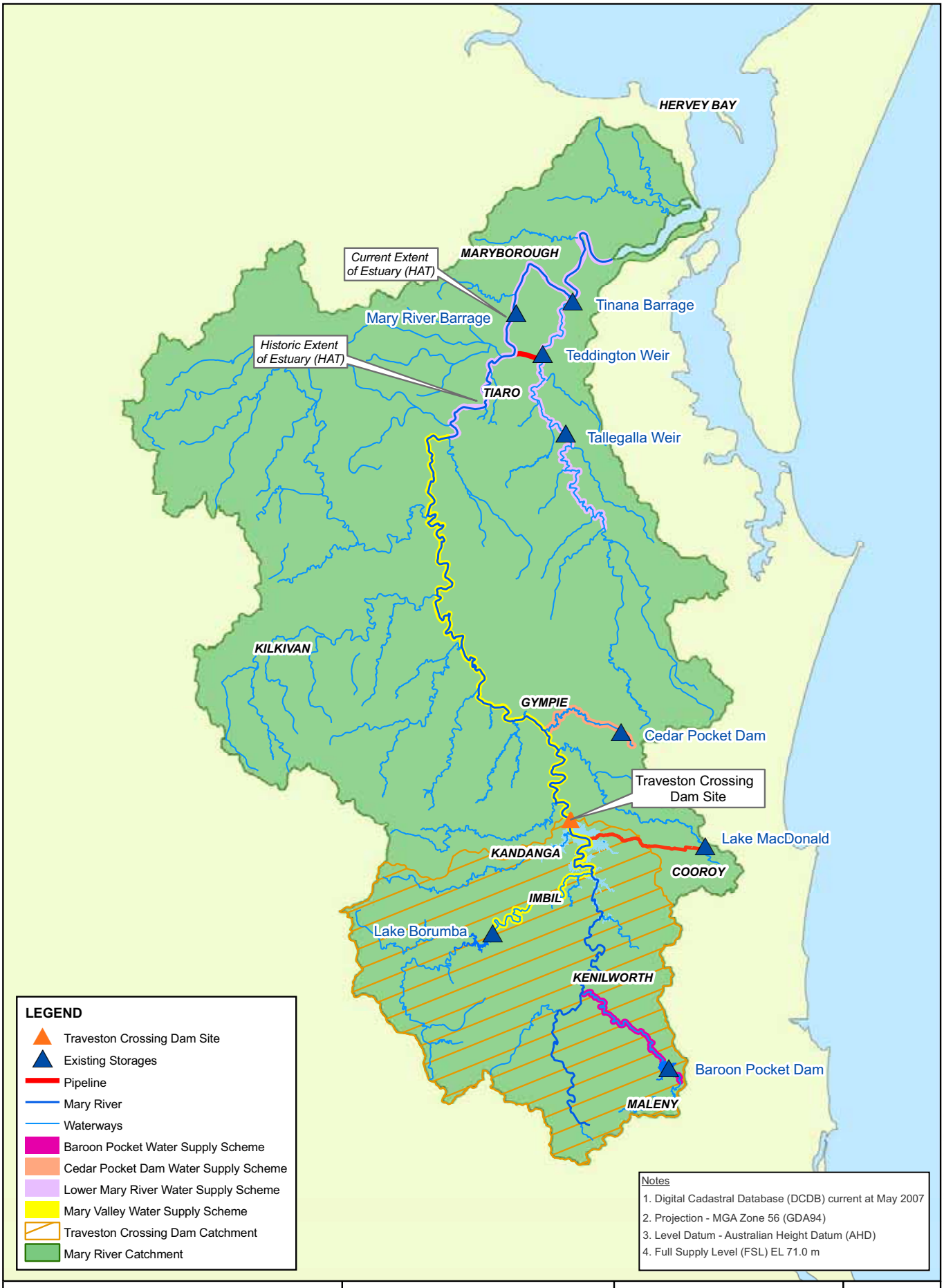


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**FIGURE 1-3**

TRAVESTON CROSSING DAM EIS

LOCATION OF PROJECT

DRAWING NUMBER

100563

DATE: SEPTEMBER 2007

Modifications to the following existing infrastructure are also included under the scope of the Project:

- Bruce Highway and a number of State and local roads and intersections;
- local government infrastructure;
- telecommunications infrastructure;
- power transmission/distribution infrastructure; and
- some private infrastructure within the inundation area.

Operational activities include periodic maintenance of the dam structure, inundation area and associated infrastructure, and ongoing monitoring along with flow management strategies in compliance with the *Water Resource (Mary Basin) Plan 2006*.

To provide planning flexibility for the future, and ensure investment of public money is prudently made, the Project includes elements that are partly driven by taking into consideration a potential Stage 2 component (2035), such as land purchase and leaseback arrangements. The Queensland Government has yet to make a decision in relation to the development of Stage 2 as this will be dependent on future demand, project viability, and further environmental approvals.

Under a separate approval process, concept planning is underway for siting of a water treatment plant and a pipeline from the water treatment plant to the existing Noosa water treatment plant located at Lake MacDonald, the site of likely connection to the Northern Pipeline Interconnector.

### 1.3 Project Proponent

Queensland Water Infrastructure Pty Ltd is the Proponent for the Project. QWI was established in June 2006 by the Queensland Government to carry out the feasibility and development of new water infrastructure projects in SEQ, including the Project, Wyaralong Dam on Teviot Brook in the Logan River catchment, Cedar Grove Weir and Bromelton Offstream Storage.

QWI has employed a senior and middle management team with a wealth of experience in delivering large scale infrastructure projects, supported by an extensive range of specialist consultants with expertise in delivering sound environmental and technical advice for water infrastructure projects.

The contact details of QWI are:

Queensland Water Infrastructure Pty Ltd
Level 8, 119 Charlotte Street, Brisbane, Qld, 4000; or
PO Box 15940, City East, Brisbane, Qld, 4002
Tel: 1800 225 384
Fax: (07) 3406 7292
Email: info@qldwi.com.au
www.qldwi.com.au

### 1.4 Aim and Objectives of the Project

The aims and objectives for the Project are aligned with the sustainability principles developed by CSIRO for the Project (Section 1.9).

The aim of the Project is as follows:

"A project that contributes 70,000 ML/a of water to the community of SEQ by December 2011 and promotes 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.

The sustainability objectives of the Project are as follows:

- promote the development of sustainable communities through opportunities generated by the Project;
- encourage sustainable local enterprises that benefit from the development of the Project; and
- contribute to the conservation of riverine communities and the restoration and management of ecosystem processes that support sustainable catchments."

## 1.5 EIS Process

The EIS has been prepared to inform the Proponent, decision-makers and stakeholders, including Government agencies, Native Title parties, landowners and others whose interests may be affected by the Project, community groups and the public about the need for the Project, potential environmental, social and economic issues relating to the construction and operation of the Project, and how these issues could be managed.

The content of the EIS is determined by the requirements of the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)* (EPBC), the *State Development and Public Works Organisation Act 1971 (Qld)* (SDPWO), the regulations made under those Acts, and the Terms of Reference (ToR) issued by the Coordinator-General (CG).

The controlling provisions of the EPBC Act relevant to the Project are:

- Sections 12 and 15A (World Heritage);
- Sections 16 and 17B (Ramsar Wetlands);
- Sections 18 and 18A (Listed Threatened Species and Communities); and
- Sections 20 and 20A (Listed Migratory Species).

The EIS will contain the most significant information available to decision-makers when considering approvals for the Project, although it will not avoid the need for QWI to provide all information required under the relevant legislation for individual approvals. Primarily, the EIS:

- describes the existing environmental, social and economic conditions likely to be affected by the Project ;
- describes the need for the Project, nature of the Project, and its potential environmental, social and economic impacts both beneficial and adverse;
- assesses the significance of potential environmental, social and economic impacts and proposes acceptable standards and levels of impact;
- suggests measures to mitigate or avoid any significant adverse impacts; and
- describes the outcomes of consultation with stakeholders about the Project.

Alternatives to the Project, including the option of not building the dam, building other dams, recycling and desalination, as well as a cost benefit analysis has been undertaken on behalf of QWI and as part of the EIS.

## 1.6 Project Approvals

The SDPWO Act provides an independent environmental impact assessment process for important projects and that process is, under a Bilateral Agreement between the State and Federal governments, accepted as the assessment process under the EPBC Act.

On 20 October 2006, the CG declared the Project to be a 'significant project' for which an EIS is required pursuant to section 26 of the SDPWO Act and on 29 November 2006, the Federal Minister's delegate determined that the Project constituted a 'controlled action' under Section 75 of the EPBC Act, due to its likely potential impacts on Matters of National Environmental Significance (MNES), thereby requiring approval under the Commonwealth Act.

Draft Terms of Reference (ToR) for the EIS were prepared by the CG, and advertised from 9 December 2006 to 19 February 2007 and a final ToR was issued on 7 August 2007. The EIS has been prepared in accordance with the final ToR issued by the CG, and to satisfy the requirements of both the SDPWO Act and EPBC Act.

The EIS will be available throughout the public display period, where submissions may be made by the public and referral agencies. After consideration of the EIS and submissions, the CG will review the EIS and may require a Supplementary Report to address specific issues. The CG will then prepare a report evaluating the EIS (and Supplementary Report if required) and other related material. The CG report will be publicly notified, and a copy provided to the Federal Minister to enable the decision making process under Part 9 of the EPBC Act to commence.

Approvals required under State legislation will be sought following the publication of the CG's evaluation report. For any development approvals required under the *Integrated Planning Act 1997* (Qld) (IP Act), the CG's report may state one of more of the following:

- the conditions that must attach to the development approval;
- that the development approval must be for part only of the development; or
- that the approval must be preliminary approval only.

Alternatively, the CG's report may state:

- that there are no conditions or requirements for the project; or
- that the application for development approval must be refused.

Consideration is being given to seeking to have the Project declared as a prescribed project and also a critical infrastructure project in accordance with Part 5A of the SDPWO Act. This will not affect the assessment process. The making of such a declaration in relation to any project has the purpose of facilitating the undertaking of the project by providing for a scheme to ensure timely decision-making for certain decisions and processes which are relevant for that project.

Under Division 3 of Part 6 of the SDPWO Act, 'local bodies or approved persons' may be directed to undertake works. QWI is a corporation whose shares are wholly owned by the State and is therefore a 'local body' for the purposes of the SDPWO Act. In a Regulation made under the SDPWO Act, the Governor in Council approved the Project as authorised works under s.100 of the SDPWO Act. The Regulation directs QWI to undertake all works for the Project.

The effect of the direction under the *SDPWO Regulation 1999* (because of Schedule 9 of the *Integrated Planning Regulation 1999*) is to make all aspects of the development (i.e. the Project) exempt from assessment by the relevant local governments under the relevant planning schemes.

In Queensland, the majority of development assessment and approval processes occur through the Integrated Development Assessment System (IDAS) established under the Integrated Planning Act 1997 (the ***IP Act***). The SDPWO Act provides links to the IP Act to enable the significant project EIS to meet the requirements of IDAS. This is achieved in the following way:

- consultation with government agencies which occurs during the EIS preparation should enable the EIS to address the requirements for approvals required for the Project;
- the EIS process, including public notification, is taken to fulfil the 'information and referral stages' and 'notification stages' of IDAS for certain development applications (those involving a material change of use or requiring impact assessment). This means that no further information requests or public notification of individual applications under the IP Act are required after the completion of the EIS for those applications;
- a properly made submission about the EIS is taken to be one about impact assessment applications for the Project under IDAS;
- at the completion of the EIS process, the CG prepares a report evaluating the EIS and makes recommendations about approvals required for the Project and may state conditions to be attached to approvals under the IP Act. While the assessment manager may attach conditions to the approval, additional conditions cannot be inconsistent with those stated by the CG in his report;
- the CG may only recommend that an approval is not granted where the environmental effects of the Project can not be adequately addressed;
- the CG's report is taken to be a concurrence agency response about any development application under the IP Act for the Project; and
- after a relevant application is lodged and on receipt of the CG's report, the assessment manager moves directly to the decision stage.

A list of key approvals required for the Project and the responsible authority is attached (**Attachment 1**).

### 1.7 Submissions

A public notice will be advertised in relevant newspapers circulating in the local area, the State and nationally. This notice will state:

- where a copy of the EIS is available for inspection;
- where a copy of the EIS may be obtained at a stated reasonable cost;
- that submissions may be made to the CG about the EIS; and
- the submission period which is the period nominated by the CG during which a submission may be made;

Submissions regarding the EIS should be received on or before the last day of the submission period, and need not be in any particular form but must be signed by each person who made the submission, state the name and address of each person who made the submission, also state the grounds of the submission and the facts and circumstances relied on in support of those grounds and be made in writing, addressed to the Queensland Coordinator-General at the address stated below or as otherwise notified in the public notice:

The Coordinator-General
Project Manager
SEQ Infrastructure (Water) – Traveston Crossing Dam
PO Box 15009
City East QLD 4002
Tel: 1800 996 829
Fax: (07) 3237 7530
Email: travestoncrossingdam@infrastructure.qld.gov.au

A submission made as outlined above must be considered by the CG in preparing the evaluation report. Any submission accepted by the CG, may be amended by written notice given to the CG during the submission period or may be withdrawn at any time before a decision is made about the EIS.

For any development approval under the IP Act which is for a material change of use or requires impact assessment, section 37 of the SDPWO Act states that the information and referral and the notification stages do not apply but that any properly made submission to the CG is a properly made submission about the application for any such development application. Any person who wishes to make a submission about any such development application should therefore make a submission about the EIS in order to gain standing for any appeal regarding any such development approval.

### 1.8 Consultation Process

An extensive consultation program has been undertaken between October 2006 and October 2007. A variety of communication activities and tools were used to seek broad community input, and the issues and opportunities identified through stakeholder engagement informed the EIS technical studies.

The objectives of the community consultation program were to:

- add value to the study's decision-making process;
- inform stakeholders about the study objectives, drivers, processes and consultation opportunities; and
- provide easy and accessible ways for stakeholders to participate in the consultation process.

The EIS consultation commenced prior to the release of the Draft ToR and throughout the period of the development of the EIS. The process during the public display of the EIS will be similar to that of the Draft ToR, with QWI providing a program of community consultation strategies and ensuring the EIS is available through a range of outlets such as websites and local libraries, and in different formats, including CDs and hardcopy.

### 1.8.1 Scope of Community Consultation

The consultation has included communities located in and around the Project area, elected Federal, State and local government representatives and government officers, industry sectors, traditional owners, special interest groups and organisations in close proximity to the Project area, road users, public utilities and media.

### 1.8.2 Consultation Phases and Activities

Specific communication activities to facilitate effective two-way communication include four community Information Days and ongoing engagement with key community groups and government representatives. In addition, three Project newsletters have been distributed to more than 43,000 stakeholders through letterbox delivery, insertion in local newspapers and at key community touch-points via static displays.

Further input has also been sought using an independent and professional survey. Stakeholders were also encouraged to make comment via written submissions or via a toll-free 1800 number, the Project email address, fax and mailing address at any time.

The Community and Stakeholder Engagement Plan utilised a range of engagement techniques for the different stakeholder groups, including:

- whole-of-Government presentations;
- departmental presentations and forums;
- elected member briefings;
- key stakeholder focus groups;
- feedback mechanisms, e.g. 1800, email and feedback survey/s;
- newsletters and fact sheets;
- ads and public notices;
- website;
- information days and information day reports;
- static displays;
- corporate presentations to community organisations (Rotary etc);
- local business opportunities register;
- delivery of community feedback and comment to the EIS Project team; and
- reporting and evaluation.

The Community and Stakeholder Engagement Plan included a program of consultation and related activities through five phases of the Project:

- phase 1 – project inception and EIS preparation;
- phase 2 – public display of the EIS;
- phase 3 – State and Federal Government approvals of the EIS;
- phase 4 – project procurement and construction; and
- phase 5 – project operation.

### 1.8.3 Consultation Results to Date

During the period the EIS was being prepared, approximately 2900 stakeholders were registered on the database and 133 feedback forms were received and processed. The outcomes of the engagement process also included identification of the top 20 community issues (the top 10 issues are summarised below) and numerous specific technical issues. Issues raised were considered in the EIS.

### 1.8.4 Response to Issues Raised

The following provides an outline of the actions taken by QWI in response to issues that arose from consultation (**Table 1.1**).

**Table 1.1 Summary of Top Ten Issues Raised**

| Issue | Action/Strategy |
|---|---|
| Opposition in General | QWI provided a number of forums for those opposed to the Project to have their say. A detailed summary is provided in Community Consultation report. Points raised were generally included with the ToR for the EIS. |
| Social Impact | Matters raised by the community were taken into consideration in the preparation of a detailed social impact study. Refer to **Chapter 15. Social Impact Assessment and Economics** |
| Consultation Process for the EIS | QWI undertook a comprehensive consultation program to engage stakeholders in the Project. The Community Consultation report outlines initiatives undertaken. |
| Economic Cost | Feedback provided by stakeholders was taken into consideration for the EIS – **Chapter 15**. **Social Impact Assessment and Economics** and **Chapter 2. Rationale and Alternatives**. |
| Alternatives | A study into alternative water supply options is contained in **Chapter 2. Rationale and Alternatives.** Feedback provided during the consultation process was considered in preparation of this study. An alternative project suggested by a local resident was specifically investigated and reported. |
| Justification | Justification of the Project is included in **Chapter 2. Rationale and Alternatives**. Feedback provided during the consultation process was considered in preparation of this chapter. |
| Native Title/Cultural Heritage | A detailed report on cultural heritage is included in **Chapter 14. Cultural Heritage**. |
| EIS Process | The Project has been declared a 'Significant Project' requiring an EIS to be completed in accordance with the SDPWO Act.<br>The objectives of the EIS are to ensure that all potential environmental, social and economic impacts of the proposed Project are identified and to develop actions to mitigate adverse impacts and enhance positive impacts.<br>The EIS will be assessed by the CG under Queensland's SDPWO Act, which also involves a statutory review by the Federal Department of Environment and Water Resources under the Australian Government's EPBC Act |
| EIS Process (Information) | QWI has published an Approvals Process Fact Sheet and widely distributed this to landholders and key stakeholders. It is readily available on the QWI website. QWI has also published an EIS process chart in advertisements in regional newspapers, and in a poster at Information Days. |
| Nature Conservation | The EIS includes a draft Environmental Management Plan (EMP) to minimise environmental risks and manage potential impacts of the dam's construction and operation. A draft EMP is included in **Chapter 18. Environmental Management Plans**. **Chapter 9**. **MNES** of the EIS specifically addresses Matters of National Environmental Significance. QWI held several meetings with specialist ecologists and adjusted the Project design in response to their inputs. |

A range of mitigation strategies were identified during consultation with community members to reduce the impacts of the Project on local communities and these have been addressed in the EIS.

## 1.9 Sustainability

QWI commissioned CSIRO Sustainable Ecosystems to develop guidelines and principles to ensure development, for which QWI is the proponent, was sustainable. For the Project, the CSIRO principles focussed on the need to address equity issues across the geographic distribution of negative and positive impacts, enhancing positive outcomes and assisting the region's community to take advantage of the opportunities offered by the construction and operation of the Project. The outcome of the first stage of the process has been a Vision, Goals, and a number of Principles related to each goal.

### 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.

In the cumulative impact assessment process undertaken for the EIS, the sustainability principles are revisited and the mitigation strategies and currently proposed sustainability projects developed through the EIS process are assessed against those principles in a qualitative manner (**Section 3.2**).

## 1.10 Rationale and Alternatives

The Queensland Government's strategy is to provide at least 210,000 ML/a of additional water supply by 2026, in addition to the savings made by demand reduction and water use efficiency. It further aims to develop a 50,000 ML/a supply buffer to provide security in case those latter initiatives do not provide the savings necessary, the worst-case reality of climate change eventuates, and in case of increased climatic variability, such as another significant drought.

Demand management is already included in the strategy, so it is not an alternative to surface water supply as the risks associated with overly optimistic savings are too high.

Rainwater tanks and groundwater cannot provide an appreciable portion of the required supply and the former cannot do so with the necessary level of security, nor at a reasonable cost.

Recycling at the highest level of any major city in Australia is already being undertaking as a priority component of the strategy.

Desalination is included in the Governments strategy with a target to supply over 21% of the minimum additional supply needs by 2026. This already constitutes the highest contribution to capital city urban supply by desalination in Australia. Desalination is an evolving industrial process that uses far more power than surface supply options and produces significant waste, without providing any indirect benefits other than water supply (such as flood mitigation).

As surface water supply relies upon tried and proven technology which can be supplied at reasonable cost, and the volume is available, it is therefore justified, prudent and feasible that this shortfall be addressed via surface water supply.

### 1.10.1 Surface Water Supply Alternatives

Traveston Crossing Dam is the preferred option ahead of other alternatives on the following basis:

- the Mary River has SEQ's largest mean annual flow and is also one of the most undeveloped rivers in SEQ in terms of water storage infrastructure;
- it is a geographically appropriate alternative to supply the growth areas of the Sunshine Coast (already supplied in part from the Mary River) and northern Brisbane;
- a northern river increases the geographic spread of catchments making appreciable contributions to urban water supplies in SEQ and decreases reliance on catchments north-west or south of Brisbane;
- in accordance with the Mary Basin Water Resource Plan (WRP), by developing the larger Mary River, the smaller but ecologically more intact coastal rivers can be afforded high levels of protection;
- the Mary River is a large river and can better tolerate a moderate level of development
- the Upper Mary River catchment is large and has the potential to store water from runoff events across 2,100 $km^2$, making the yield reliable;
- it provides more yield than any other dam, and yield is the ultimate purpose of the Project;
- the site can be expanded to provide significantly more yield if required (Stage 2). In its own right this expanded yield would be greater than any other SEQ alternative;
- the potential environmental impacts of the Project are similar to that, or less than, a combination of dams that could provide the same yield, particularly with respect to potential impact on rare and threatened species, State Forests, wildlife corridors and areas of scientific importance;
- the social impacts associated with the footprint of the Project are acknowledged as greater than some of the alternatives and in recognition of this, the Queensland Government and QWI have committed significant planning effort to ensuring this impact is minimised and short-term; and
- Traveston Crossing Dam is the only option that can provide considerable flood mitigation benefits to the town of Gympie and a smaller benefit to areas downstream, including the city of Maryborough. This is a significant social and economic benefit not offered by alternatives.

In relation to alternative sites in Northern NSW, Traveston Crossing Dam had much less environmental impact.

### 1.10.2 Economic Assessment of Alternatives

An economic cost evaluation of the Traveston Crossing Dam (Marsden Jacob Associates, 2007) reviewed alternative supply portfolios that included:

- desalination portfolio – series of modular desalination plants at the Sunshine Coast;
- Mary River dams portfolio – number of smaller dams on the Mary River and development of Glendower Dam on the Albert River;
- northern NSW dam portfolio – dam on the Clarence River coupled with Wyaralong Dam in the Logan River catchment; and

- smaller dams portfolio – small dams on the Mary River coupled with Glendower and Wyaralong Dams.

The key findings of the portfolio modelling are:

- the Traveston Crossing Dam (TCD) portfolio is ranked first and represents the least–cost supply portfolio. It is $318 Million lower than the next best supply option and is $651 Million lower cost than the next surface water portfolio;
- desalination is ranked second with lower capital costs in the overall portfolio but this is offset by higher fixed operating costs and higher variable operating costs;
- the NSW Northern Rivers Dam (+ Wyaralong) is ranked third. It is about $650 Million higher than the TCD portfolio due to higher water transfer costs to Wyaralong and inter-basin transfer related water treatment costs;
- the smaller dams portfolio is ranked fourth with costs being just over $1 Billion greater than the TCD portfolio reflecting the reliance on smaller /inefficient dams; and
- the Mary River dams portfolio is the highest cost portfolio being just over $1 Billion greater than the TCD portfolio due to higher capital costs due to lower economies of scale of a series of smaller less efficient dams.

A series of Sensitivity Assessments to test whether there is any change in the most economically viable portfolio if adjustments are made to the underlying assumptions indicated the Traveston Crossing Dam portfolio remains the most cost effective solution.

A table showing present value cost estimates for alternative SEQ supply portfolios, 2007-2056, referred to above, is attached (**Attachment 2**).

### 1.10.3 Costs and Benefits of the Project

Revenue streams for any given supply option are predominantly generated through the sale of water (other benefits also arise from tourism, flood mitigation. etc). However, for urban users, the price of water is common regardless of the supply option. In other words, urban water consumed in SEQ will be at the same price regardless of whether it is supplied by a dam(s), or desalination plant (s), or any other alternative supply option. Thus the price of water to urban consumers instead reflects the cost of provision from all supply options, not any one individual option.

In this case, the focus of the cost benefit is on the comparative economic performance of supply options. If regional water demand is to be met under all supply options (i.e. a basic caveat for all supply options under consideration) then the only material difference between options is the cost of supply.

The directly attributable Project construction costs (capital costs) are estimated at approximately $1.19 Billion. Inclusion of additional items, such as the Bruce Highway's attributable costs, connection pipelines to the Northern Pipeline Interconnector, pumping stations and treatment plant, raises the Project construction costs to $1.592 Billion.

The Project economic benefits are significant and will accrue at the local, regional, state and national levels.

At the State level, the provision of 70,000 ML/a of water will be pivotal in underpinning and supporting continued population and economic growth in Queensland. Water supply security will create certainty and encourage flow-on investment into Queensland.

At the national level, it is anticipated that the discounted National Welfare Benefit will be in the order of $3.44 Billion, driven by additional investment in the construction period.

At the local level, the benefits of the Project are also significant. The injection of $1.592 Billion for project construction will have flow-on effects for the local community that supply goods and services for construction. Similarly, the presence of a local construction workforce will have flow-on effects from the income they spend in the local economy.

Mitigation measures will also contribute significantly to the local community. These measures total more than $50 Million and have been incorporated into the cost estimate of the Project.

A summary of the economic benefits and costs of the Project are presented in **Table 1.2**.

**Table 1.2 Key Project Benefits and Costs Summary**

| Benefits | Location of Benefit | Costs | Location of Cost |
|---|---|---|---|
| Increased National Welfare of $3.44 Billion | National | Total Project Capital Cost $1.592 Billion, which includes mitigation measures | State, Regional |
| Avoided cost of $318 Million for next best alternative (desalination) | State, Regional | $1.1 Million per annum for dam operation | State, Regional |
| Increased Gross Regional Product of $219 Million (2009) | State, Regional | Business and agricultural gross output loss $29 Million, which includes disruption of approx. 60 agricultural businesses | Local |
| Increased Gross Regional Product of $244 Million (from 2013) | State, Regional | Temporary disruption and relocation of approximately 40 other businesses. | Local |
| Leaseback savings to landholders totalling $25 Million | Local | QWI lost rental income from discounted leaseback of $25 Million | State |
| Increased aggregate employment 1745 (2009) | State, Regional, Local | Dam design has spillway gates ($70 Million) for flood reduction downstream – greater cost than fixed crest dam | Regional, Local |
| Increased aggregate employment 778 (from 2013) | State, Regional, Local | Community disruption through project planning and implementation – 76 houses in 2011 | Local |
| Avoided employment losses of approximately 20,000 jobs and $3.895 Billion to the SEQ economy through more secure provision of water (based on 25% reduction in supply if the Project does not proceed) | State, Regional | Disruption of flora and fauna during construction and filling of the Project, until mitigation measures in place and habitat stabilises | Local |
| Flood height reduction in Gympie (reduction by up to 3.5-4 m in a 1 in 100 year flood event, resulting in significantly reduced impacts on CBD and low lying residential areas) | Regional, Local | | |
| Social, environmental and economic mitigation Strategies over $50 Million, including: | National, State, Regional, Local | | |
| Dam and environs recreational facilities, including canoe trails, boating facilities, picnicking shelters, horse trails, walking tracks, mountain bike tracks | Regional, Local | | |
| Kandanga Community and Sports facility, including a relocated bowls green, 25 m swimming pool, soccer and cricket fields | Local | | |
| Freshwater Species Conservation Centre for | National, | | |

| Benefits | Location of Benefit | Costs | Location of Cost |
|---|---|---|---|
| conservation of the Lungfish, Mary River Turtle and Mary River cod, along with educational and interpretive centre | State, Regional, Local | | |
| Additional steam locomotive and railway station platform upgrades at Imbil, Kandanga and Amamoor | Regional, Local | | |
| Food and Fibre program for local and regional agriculture | Regional, Local | | |
| Sewerage and water supply infrastructure to be installed in Kandanga. Kandanga currently uses septic systems | Local | | |
| Hardwood timber plantation, which will provide $CO_2$ offsets and employment for timber processing | State, Regional, Local | | |
| Local Industry Participation Plan to maximise business flow-on benefits to local and regional businesses | Regional, Local | | |

QWI (and relevant State Government agencies) are taking actions to prepare the region for the Project. The aim is to maximise opportunities for the local region while minimising the impacts. These initiatives have been included in the proponent commitments (**Attachment 3**).

### 1.10.4 Do Nothing Option

If the Project does not proceed, there would be an appreciable shortfall in water available to meet estimated demand. An assessment into the short term impacts of a conservative 25% shortfall in water supply volume, such as could occur if the Project did not proceed, to the SEQ economy concluded that Gross Regional Product would decrease by some $3.895 Billion and approximately 20,000 jobs would be lost. These impacts would occur via reduced productivity, profitability and employment (both in the short run and long run) and associated flow-on effects to the rest of the economy. The potential stranding of investments in some water intensive sectors could also occur (ACIL Tasman, 2007b).

If proposed initiatives targeting water savings were to fail to achieve their targets, there would be very significant shortfalls in the short-term.

## 1.11 Project Components

The Project includes the following components and all associated vegetation clearing and works:

- constructing and operating a new dam (FSL of 71.0 m AHD) on the Mary River;
- constructing a site access road;
- relocating sections of local government roads, State controlled roads and the Bruce Highway;
- relocating local power and telecommunications infrastructure;
- removing redundant infrastructure; and
- relocating private infrastructure required to support continued use of land not affected by the Project.

Operation of the water storage involves management of land inundated by the water at FSL and also additional land above this area comprising a:

- buffer area aimed at protecting water quality, bank stability, addressing safety matters, excluding activities with a high risk of adverse impacts on water quality and/or dam operations allowing for revegetation and control of access; and/or
- flood margin area where there is a risk of damage to the land caused by any increased extent or duration of temporary flooding as a result of the dam.

The Operational Area of the dam includes the dam wall, embankments, spillway, dam access road, associated infrastructure and facilities and a buffer for this area, as well as the inundation, buffer and flood margin areas.

All of the above components are within the area shown as the Proposed Project Designation Area (**Figure 1.4**).

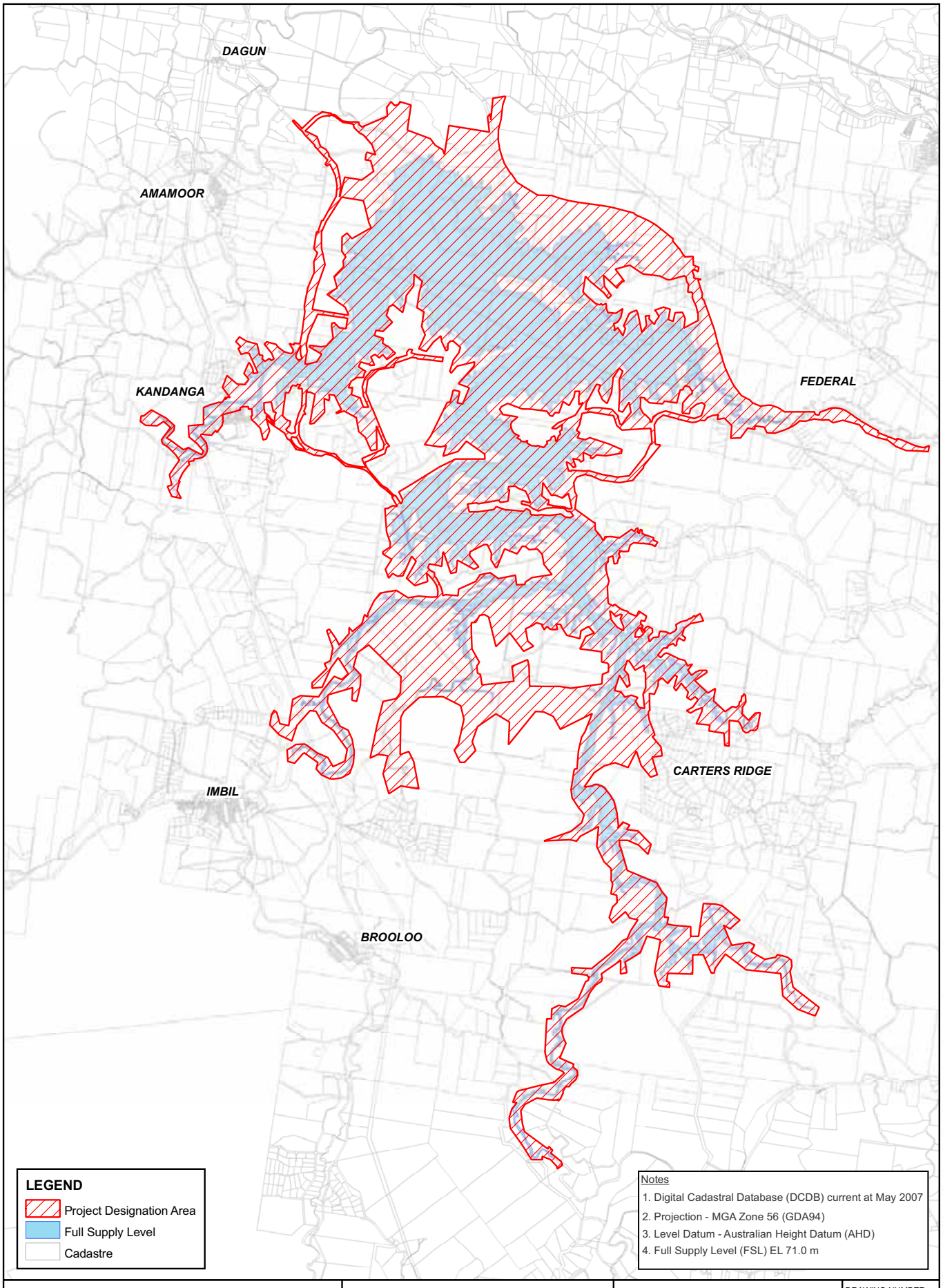


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**FIGURE 1-4**

TRAVESTON CROSSING DAM EIS

PROPOSED PROJECT DESIGNATION BOUNDARY

DRAWING NUMBER

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### 1.11.1 Project Parameters

A technical review panel of Australian dam experts has been formed by QWI to review the development of the preliminary design. The design parameters provide for an Extreme Hazard category dam in accordance with Queensland Dam Safety Management Guidelines and ANCOLD and also incorporates gates to provide flood mitigation to downstream communities. The dam will also incorporate features to mitigate environmental impacts such as fish and turtle transfer devices and outlet arrangements to facilitate the release of environmental flows.

**Table 1.3** provides details of design parameters for the dam.

**Table 1.3 Design Parameters for Traveston Crossing Dam**

| Parameter | Value |
|---|---|
| Anticipated Annual Take | 70,000 ML/a |
| Spill frequency | 23% of time |
| Storage Capacity at FSL | 152,429 ML |
| Average volume in storage | 127,000 ML |
| Average percent of FSL storage capacity | 83% |
| FSL | EL 71.0 m AHD |
| Average Channel depth | 12 m |
| Average Depth at FSL | 5.0 2m |
| Length of Mary River inundated at FSL | 36.5 km |
| Storage area at FSL | 3039 ha |

**Figure 1.5** illustrates the water storage levels of the dam (AHD).

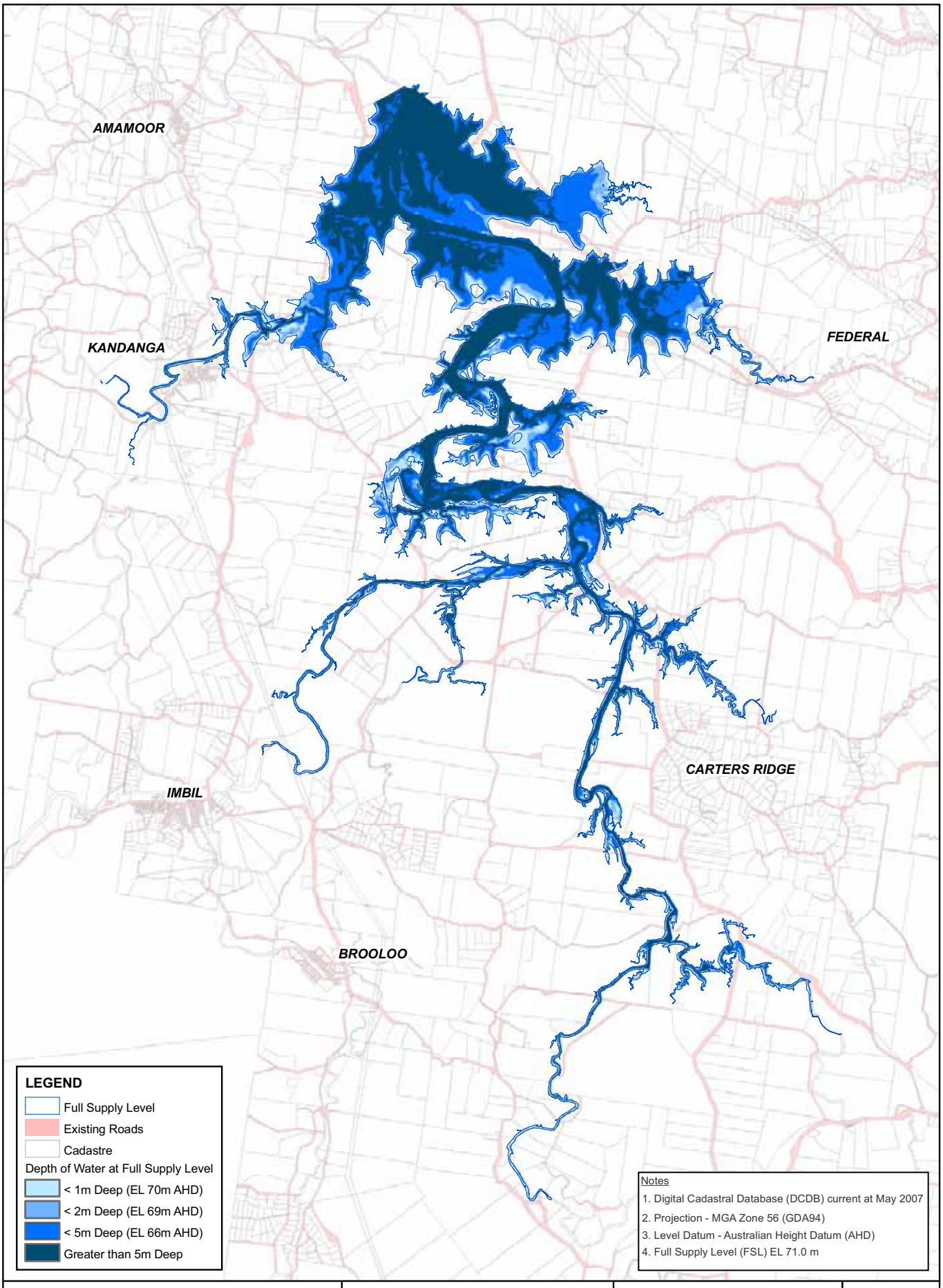


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**FIGURE 1-5**

TRAVESTON CROSSING DAM EIS

WATER STORAGE LEVELS

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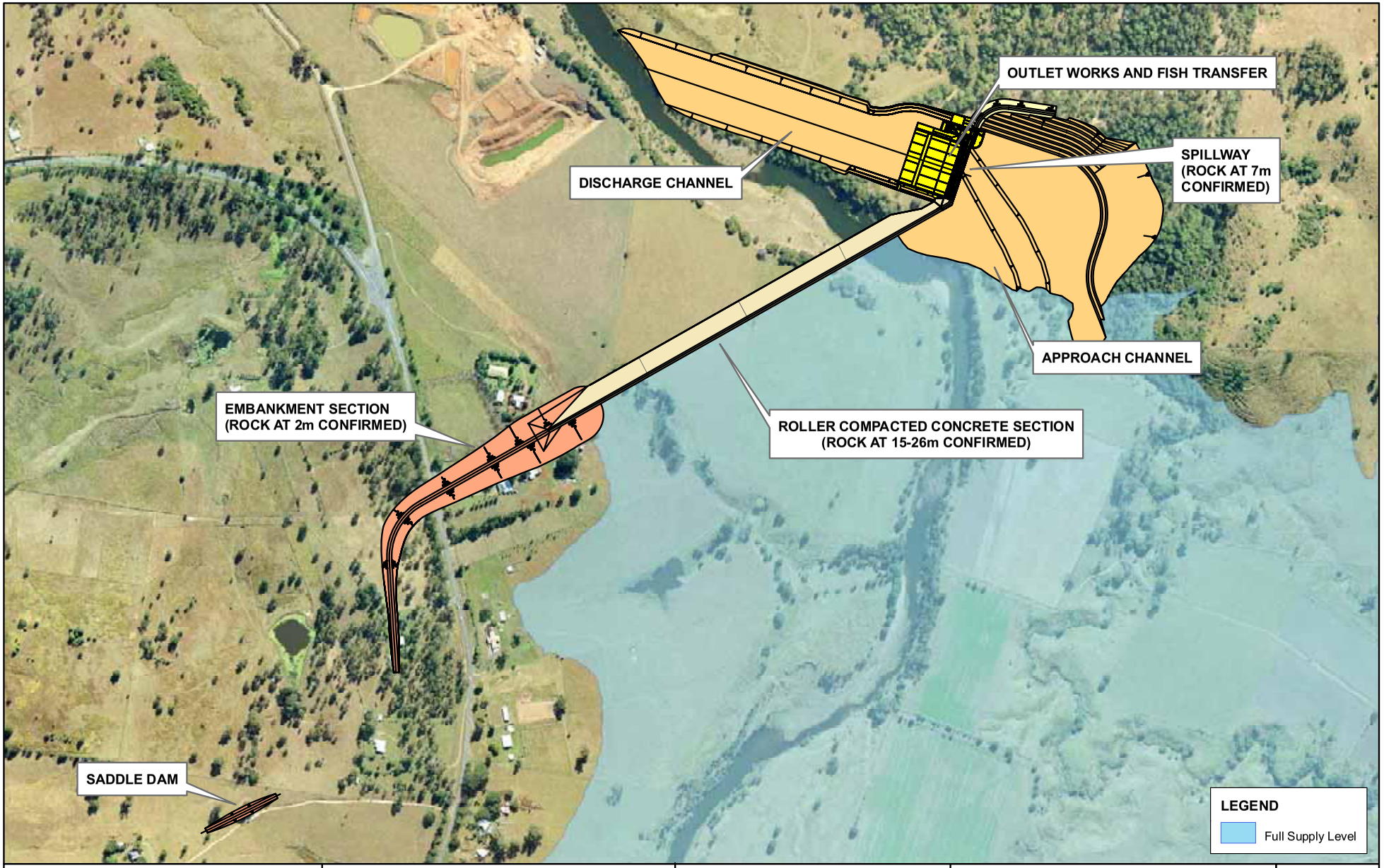
The preliminary design of the dam consists of a Roller Compacted Concrete (RCC) structure across the valley floor (main dam) with an earth embankment section on the left abutment (embankment dam) and a gated spillway on the right abutment (spillway). The design includes three intake structures and downstream outlet works. To prevent flooding of Coles Creek affecting the spillway foundations and approach channel, a coffer dam will be constructed over Coles Creek and a spillway channel will be constructed at the break out point downstream of the spillway discharge.

One creek diversion is proposed. Riparian flow will be maintained to ensure adequate flow for environmental and water supply purposes. An alternative high level by-pass for Coles Creek could be constructed upstream of the site with scour protection installed along the invert and into the river.

The arrangement of the preliminary design of the dam is shown in **Figure 1.6**.

### 1.11.2 Pre-Storage Activities

Pre-storage activities include land purchase, vegetation clearing, resource recovery and stockpiling. Vegetation will be cleared to FSL within the inundation area, except in the riparian zone of tributaries and the main channel (cleared to within 1.5 m of FSL) or where significant vegetation is near FSL. Valuable timber, soil, sand and gravel resources not used in construction, site rehabilitation, landscaping or other identified needs and opportunities, will be made available to the commercial market for extraction.




NOTES:

1. Digital Cadastral Database (DCDB) current at May 2007
2. Projection - MGA Zone 56 (GDA94)
3. Level Datum - Australian Height Datum (AHD)
4. Full Supply Level (FSL) EL 71.0m

N

0 100 200 300

Metres

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**FIGURE 1-6**

TRAVESTON CROSSING DAM EIS

PRELIMINARY DAM DESIGN

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### 1.11.3 Construction/Materials

Estimated quantities of material to construct the dam include three scenarios (**Table 1.4**):

Scenario 1: All RCC aggregate sourced from either Moy Pocket or Meadvale Quarry;

Scenario 2: 50% of RCC aggregate is sourced from the required spillway channel excavation, with the rest from Moy Pocket or Meadvale Quarry; and

Scenario 3: An embankment dam section is utilised instead of the RCC dam section.

**Table 1.4 Quantities of Materials for Three Scenarios**

| Material Type | Scenario 1 | Scenario 2 | Scenario 3 |
|---|---|---|---|
| Indicative quantities of imported rock and sand products | 779,500 $m^3$ | 442,500 $m^3$ | 160,800 $m^3$ |
| Indicative Quantities of Imported Cement and Flyash from either Gladstone and or Brisbane | 110,000 tonnes | 110,000 tonnes | 25,000 tonnes |
| Indicative quantities of imported flyash from either Gladstone or Brisbane | 90,000 tonnes | 90,000 tonnes | 20,000 tonnes |
| Indicative Quantities of Materials Sourced on Site | 513,700 $m^3$ | 850,700 $m^3$ | 4,644,000 $m^3$ |

Concrete will be supplied from onsite batch plants located within the dam construction footprint; one for conventional concrete and one for RCC. The estimated concrete and associated material volumes includes 754,192 $m^3$ of concrete, 3,129 tonnes of reinforcement and 30,364 m length of anchor or drainage drill holes.

### 1.11.4 Construction Timetable/Hours of Operation

The construction period is approximately 3 years (includes mobilisation, pre-construction works) and all infrastructure relocation must be completed within the same timeframe. The construction timetable has accounted for expected dry and wet weather periods and provides for appropriate activities to be undertaken in the optimal period of the year.

Earthworks will generally occur on a day shift schedule as will the drilling and blasting within the discharge channel, spillway and approach channel. An exception would be for the placement of the RCC which will be a two shift basis to expedite construction, which at particular stages will include night work.

### 1.11.5 Workforce and Accommodation

The Project will directly create 500-600 jobs over the three year construction period including 300-350 construction site personnel during the peak construction period. This total does not include off-site personnel, e.g. suppliers.

Crib rooms will be provided on-site and toilet and shower facilities provided in demountable buildings. Grey water will be re-used where feasible and toilet waste will go to pump-out facilities and transported off site to a waste water treatment plant. QWI has called for expressions of interest for development of a construction accommodation camp, subject to detailed discussions with Cooloola Shire Council and local communities and will include a separate assessment and approvals process at local government level.

### 1.11.6 Management of Extractions and Releases

Water for the SEQ water grid will be extracted from the dam and pumped to a nearby water treatment plant, treated and delivered into the grid. The SEQ water grid will provide the flexibility to manage bulk water supplies to provide maximum yield from all sources connected to it.

At the catchment level, releases from the water storage will be managed in conjunction with releases from Borumba Dam to give maximum yield while meeting the requirements of the Water Resources Plan such as environmental flow objectives (EFO's) and water allocation security objectives (WASO's) as well as seasonal flow objectives related to Annual Proportional Flow Deviation.

Existing water entitlements will not be affected and all environmental flow objectives will be met.

Flood releases will be managed through the operation of the gates on the spillway.

### 1.11.7 Relocation of Non-Private Infrastructure

A number of roads, power and telecommunications infrastructure will be inundated or rendered redundant and will require relocation or upgrade to accommodate a higher water level. QWI has consulted with the relevant Queensland Government departments, local councils and the infrastructure owners to determine changes necessary. QWI will purchase land necessary to accommodate the relocated roads and other infrastructure.

The Mary Valley Heritage Railway and Valley Rattler (including the Kandanga Amamoor and Imbil Railway Stations) are not within the Project area and will continue to operate as normal.

### 1.11.8 Stage 2 and Consequential Actions

At the time Traveston Crossing was identified as a suitable site for a water storage, the potential to accommodate a larger storage capacity and yield (Stage 2) was also identified. It was emphasized that Stage 2 was only a possibility, the need for which would be determined in approximately 30 years time. However, disclosure of this possibility was considered appropriate and consistent with an open process.

Responding to requests from a number of land owners, QWI have offered to voluntary purchase and lease back, at concessional rates, land which may be affected by Stage 2. Also, to provide further certainty for landowners, a Queensland Government commitment was given that the possible Stage 2 would not occur before 2035.

For matters of MNES, for a possible Stage 2, the Federal Minister has indicated these would be assessed at a later time if Stage 2 was to proceed.

The principal criterion for identifying the discrete works to accommodate a possible Stage 2 development is construction cost and technical efficiency. Works which accommodate a possible Stage 2 include:

Road relocation works:

- Bruce Highway;
- Gympie Brooloo Road north of Kandanga;
- Knobby Glen Road; and
- Kenilworth Skyring Creek Road realignment (Kress Road to the Bruce Highway).

Discrete dam works:

- construction of the RCC and embankment components of the dam wall by increasing the base width to provide structural integrity for increased water impoundment;
- construction of the dam crest height of the RCC and embankment sections 1 m above that which would otherwise be required for the Project;
- construction of an embankment style saddle dam on the left abutment allowing for the PMF for the possible Stage 2;
- installation of vertical slot lift gates and guides of a strength which allows future installation of the larger gates; and
- construction strength of the water intake structure and fishway to allow fitting of additional structure height at a later date.

These dam related features relate to approximately 6-8% of the footprint of the Project.

### 1.11.9 Climate, Natural Hazards and Extreme Weather Conditions

Measures taken into account for climate and its variability and weather or weather-related extremes during the construction and operation of the Project include:

- appropriate scheduling of construction activities;
- diversion strategy;
- temporary and permanent structures on site meet the requirements of the *Building Act 1975*, associated regulations for wind and fire resistance;
- flood, storm and fire management plans for both construction and operation;
- briefing personnel on personal safety during extreme weather events and fires;
- designing the spillway to pass the PMF for the site;
- designing the dam structures so they are not overtopped by the PMF; and
- providing for rapid draw-down of the storage in the event of a dam safety emergency.

## 1.12 Land Purchase Policy

QWI has implemented a Land Purchase Policy to purchase land (or an easement within particular flood margin areas) within the Operational Area as well as land required for infrastructure to be relocated, such as roads.

Also, recognising and responding to the concerns of land owners, the Queensland Government, and QWI published detailed information including plans of areas potentially affected by the possible Stage 2, and indicated that it would also voluntarily purchase land which may be affected by Stage 2. In addition, to provide some certainty for interested persons, a commitment was given that the possible Stage 2 would not occur before 2035.

In October 2006, all relevant landowners were provided by QWI with plans showing the area from each individual property that QWI wished to purchase or obtain an easement over.

For property that is partly within the storage area, QWI will negotiate purchase of the part of the property within the storage area or, will negotiate purchase of all the property at the request of the landowner where the balance of the property does not allow continuation of the current use of the property.

As at 30 September 2007, QWI had reached agreement on 65% of all properties affected by Stage 1 and the possible Stage 2. The properties are progressing to settlement, as documentation is executed and contracts become unconditional.

# 2. IMPACT ASSESSMENT

## 2.1 Methodology

The impact assessment process has utilised a significant number of existing studies and research, field studies and new research, published and unpublished information, professional and expert input and review, community and agency consultation and government and consultant professional input. References and material sourced have been referenced in the EIS. The level of confidence in the predictions of impact and the likely success of mitigation strategies is high but varies between disciplines.

## 2.2 Environmental Overview

The region typifies an east coast hinterland environment comprising a picturesque, quiet, and vegetated landscape characterised by a variable topography, a river system and streams, low density human settlement including rural properties, forestry, rural residential and small townships and service centres.

The Project area hosts a diverse range of flora and fauna, including rare and threatened terrestrial and aquatic flora species (slender milkvine, giant ironwood and ribbon weed); rare and threatened terrestrial fauna species (tusked frog, southern barred frog, elf skink, challenger skink, Australian cotton pygmy-goose, grey goshawk and koala); as well as 265 ha of remnant vegetation including 60 ha of the endangered RE 12.3.1. The Project does not impact directly on any area of conservation significance including National Parks, State Forests, designated wildlife corridors or Areas of Scientific Interest.

The Mary River aquatic fauna community is diverse, including the protected lungfish, Mary River cod, and the Mary River turtle. These and other large bodied species are culturally important and the lungfish and Mary River cod have been nominated as sacred by the local indigenous people.

However, the terrestrial and aquatic environment in the Mary Valley is far from pristine and, in an environmental context, is a highly disturbed catchment and heavily impacted by human activity. The catchment has experienced substantial clearing for agricultural and forestry purposes (85% of the inundation area is already cleared, as is 78% of the realigned Bruce Highway Corridor) and has a substantially diminished riparian zone with many non-native species, including weeds and noxious plants. The river system has also been significantly impacted by sand and gravel extraction, agricultural and urban runoff, erosion, bank instability and currently carries orders of magnitude more sediment to the Great Sandy Straits than prior to European settlement. Introduced and noxious aquatic plants can at times be present in large numbers.

The human community has strong social capital and capacity but is undergoing inexorable change through macro-economic reforms such as dairy deregulation, forestry regulation, influx of ‘treechangers’, drought, conversion of rural holdings to rural residential, and under-investment in infrastructure.

## 2.3 State and Local Government Requirements

The Project, or part thereof, is specifically referred to in the South East Queensland Infrastructure Plan and Program (SEQIPP) 2006, Wide Bay Burnett Integrated Regional Transport Plan 2002 and Transport 2007 and the Wide Bay Burnett Regional Plan.

The Project complies with State Planning Policies (SPP) including the State Coastal Management Plan, SPP 1/92: Development and the Conservation of Agricultural Land, SPP 2/02: Planning and Managing Development Involving Acid Sulfate Soils, SPP 1/03: Mitigating the Adverse Impacts of

Flood, Bushfire and Landslide, and SPP 2/07: Protection of Extractive Resources. The Draft Wide Bay Coast Regional Coastal Management Plan has also been considered.

The Project is exempt from assessment against local government Planning Schemes, however, a detailed assessment of compliance with the relevant schemes (Cooloola, Noosa and Maroochy LGA) indicates the Project does not conflict with the requirements of the Desired Environmental Outcome and relevant strategies of each Planning Scheme.

As a beneficial outcome of the Project, QWI has incorporated through lease agreements, additional landuse controls on land they own, to protect the water quality of the river system and storage.

## 2.4 Land Tenure

Land tenure in the Project area is largely held in freehold tenure (98%).

The Project area is currently not covered by any native title claims. There was one previously registered claim: Gubbi Gubbi People #2 (QC99/35; QUD 6034/99). This claim is now discontinued, having been voluntarily withdrawn by the applicant in February 2005. The withdrawal of this claim occurred after the commencement of the *Aboriginal Cultural Heritage Act 2003* (ACH Act), which is significant in the context of issues surrounding cultural heritage. Two other claims have been lodged, but were never registered and have now been discontinued. These are respectively the Kabi Kabi People #2 native title claim (QC06/06; QUD 65/06), which was discontinued on 7 September 2007, and the Kabi Kabi People #3 (QC06/07; QUD136/06) native title claim, which was discontinued on 9 August 2007.

## 2.5 Landuse

The Project area, as a proportion of the total land area in the catchment, is small. The Project will impact less than 1% of the land used for rural purposes and 1.7% of productive agricultural land in the Mary River Catchment.

The Project will have an impact on dairying activities, and possibly accelerate an established trend of decline in dairy farms in the catchment (205 dairy farms in 1996 to 100 dairy farms in 2007). As an indication, of the 20 dairy farms directly affected by the Project, the Department of Primary Industries and Fisheries (DPI&F) estimate 10 dairy farms would exit the industry irrespective of the Project.

Whilst in percentage terms the proportional impact of the Project on productive rural land in the catchment is small, a number of mitigation measures have been recommended to offset this impact and to leverage the opportunities for increasing and diversifying the productive use of rural land through the Project. These mitigation measures have been incorporated as proponent commitments (**Attachment 3**).

Activities that rely on current water licences and allocations to take water from the Mary River will not be affected by the Project. In some instances, the reliability of supply will be increased.

A total of 334 properties (comprising 76 dwellings) have been identified as likely to be impacted, either wholly or in part, by the Project.

The Project will affect 135 properties in the combined Kandanga and Amamoor districts in the north-east of the Project area, 34 properties in the Imbil and Brooloo districts, in the south-west of the Project area (though no properties in Imbil or Brooloo townships are impacted), 125 properties in the Federal, Cooran, and Traveston districts, in the north-east of the Project area and

40 properties in the Touchikoi, Carters Ridge and Belli Park districts in the south-west of the Project area.

Properties purchased by QWI are either leased back to the original owner (until required by the project for Stage 1 properties and to 2035 for Stage 2 properties) or tenanted to a third party, through the private rental market. Overall occupancy through the leasing of properties is approximately 97%, which is comparable to the broader rental market in the region. About 63% of properties purchased to date have been leased back to the original owner.

### 2.5.1 Landuse Controls in Buffer Area

As part of the land purchase policy, lease agreements on land owned by QWI and within the buffer area, incorporate a number of additional landuse controls. The controls are detailed in the lease conditions and seek to protect water quality, ensure public safety and minimise property and other damage in the event of a flood.

### 2.5.2 Beneficial Landuse Initiatives

To address community issues and to identify and implement beneficial outcomes, the Queensland Government through the Department of Infrastructure and Planning (DIP) is undertaking a detailed planning study under the direction of the Community Futures Task Force. Included in that process is the development of a comprehensive strategic plan for Kandanga and a recreation plan to optimise the relocation of facilities and the social and economic benefits of the potential recreation and ancillary land uses of the dam.

## 2.6 Infrastructure

Some elements of existing infrastructure will require relocation (**Table 2.1**) or upgrading however, the disturbance will be localised, minor and temporary. Existing or relocated corridors, such as road reserves will be used as much as possible to minimise disturbance to people, land and vegetation. Relocations will be undertaken by the relevant utility and will be paid for by QWI.

**Table 2.1 Infrastructure Relocation/Upgrade**

| Infrastructure | Comment |
|---|---|
| Telecommunications | Approximately 84 km of Telstra infrastructure will require relocation (mostly within road corridors) and some facilities will require replacement. There would be no discernable communication disruptions to any customer. |
| Power Supply | 11 kV and 33 kV overhead powerlines and associated infrastructure such as a substation will be relocated east and west of the dam and mostly within existing easements. A 132 kV powerline, which crosses one of the tributaries near Imbil and again near Kandanga, will not be affected by the Project. There will be some local outages but these will be supplemented by intermittent generator power to ensure supply is not affected. |
| Gas | There is no impact on the current gas infrastructure |
| Water Supply | A water treatment plant, pumping station and pipelines will transport the water to the SEQ Water grid. This is not part of the Project. The existing Noosa pump station intake will require minor adjustment. |
| Sewerage | Existing septic tanks on properties within the inundation area will be emptied and filled with an inert material. Assessed in detail in **Section 5.6 Contaminated Land** of the EIS. |

| Infrastructure | Comment |
|---|---|
| Roads | Approximately 11.5 km of highway (with 8 structures) and 35.2 km of local and state roads will be constructed by DMR or QWI. This length includes 10 bridges and a number of intersections. New access to properties will be constructed where required. |
| Rail | The function of the Mary Valley Heritage Railway line will not be affected by the Project. Kandanga Creek road which currently passes underneath the railway line will need to be realigned. Details are provided in **Chapter 13 Traffic and Transport** of the EIS. |

## 2.7 Geology and Soils

Both the Wandilla and Gympie geological provinces form the basement rocks of the Project area and are structurally stable whilst the land surface continues to be altered by ongoing processes of weathering and erosion. Based on the result of the seismic and structural geological investigation, no evidence of recent movement of faults has been identified nor suspected and the potential for reactivation of these fault systems is considered low. Geotechnical investigations indicate the basement rocks form a good foundation for the dam wall. A review (SMEC, 2007) found that the proposed design indicates the risk of leakage is insignificant.

Soils at the interface of the inundation area have low erosion potential, the most susceptible areas being adjacent to steeper slopes. Erosion can be managed through maintenance of vegetation at FSL and within the flood margins and overlay of erodible soils with non erodible soils. This has been included as part of the mitigation measures.

## 2.8 Landscape Character and Visual Amenity

The visual catchment is largely within 5 km of the Project. Assessment of landscape character and visual amenity objectives for the area are expressed in the SEQRP which covers part of the visual catchment and relevant local government Planning Schemes.

Comparing the magnitude of potential landscape and visual change to the sensitivity of the landscape, the overall significance of the changes was considered moderate to substantial. Much of this change, from a landscape perspective, could be considered beneficial. The beneficial aspects relate to the increase in variety and interest presented by the new waterbody within the landscape. The adverse aspects relate to the visually obtrusive elements of construction, physical elements and scale of the dam wall, and associated infrastructure, particularly as viewed from downstream.

The impact of these elements will require specific landscape design and management measures to rehabilitate and restore the new landscape to an acceptable level.

## 2.9 Land Contamination

Fifty-six properties within the Project area were identified as potentially hosting a Notifiable activity, of which seven are listed on the EPAs register. Further assessment and, if necessary, remediation of these sites will be undertaken in accordance with EPA guidelines. No unusual or particularly difficult circumstances of decontamination were identified. Construction and demolition sources of contamination within the operational area such as treated timber, above ground tanks etc will be removed to an EPA approved disposal site. Appropriate management of the process will ensure there is no risk to the water supply.

The management of septic tanks and their (potential) impact on the environment is a public health issue addressed in the *Public Health Act 2005*. Septic tanks in the Project area will be emptied and filled with clean soil. The proper installation and operation of septic tanks is a local government responsibility. QWI will work with the relevant local governments to ensure existing septic tanks do

not pose a risk to water quality of the storage and if necessary, remediation measures are undertaken.

The prevention measures for potential contamination from construction and operation activities are a management issue. Procedures for the proper storage and management of hazardous materials are detailed in the draft EMP.

## 2.10 Hydrology

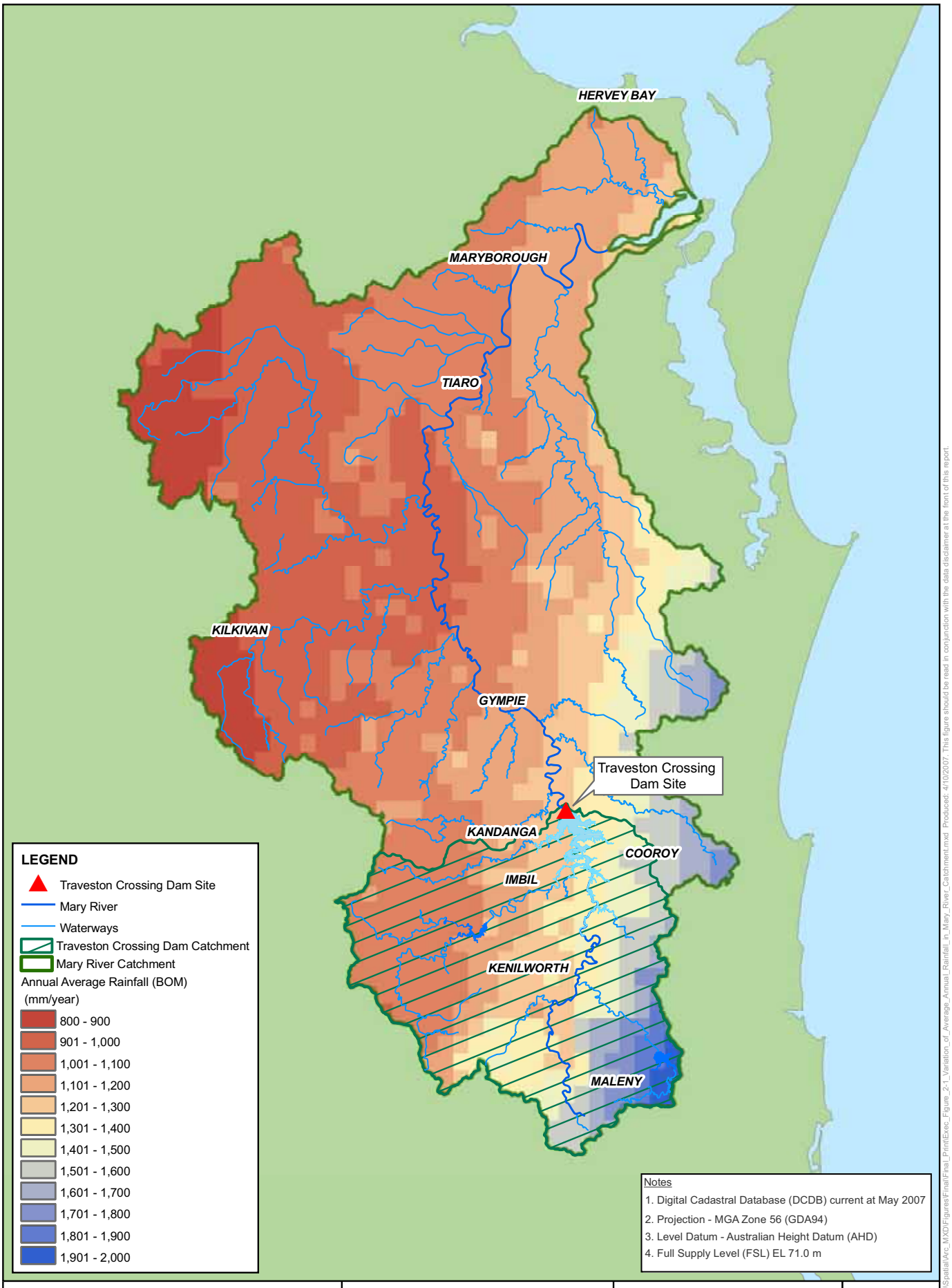
Rainfall varies substantially across the Mary River Catchment (**Figure 2.1)**, with the catchment of the dam within the higher rainfall area. Average annual rainfall of around 1170 mm occurs at the dam site.

The Mary Basin WRP includes a strategic reserve of 150,000 ML/a of unallocated water that may be granted for a project declared as a 'Significant Project' under the SDPWO Act. The Project has been declared a 'Significant Project' and it is from this strategic reserve of unallocated water that the dam yield will be drawn.

It is important to note that flows within the Burrum River and Sunshine Coast rivers catchments, that are included in the same WRP, do not interact with flows in the Mary River catchment and thus the dam will have no impact on these catchments.

Modelling which includes the effect of predictable climatic extremes on Mary River flows, and thus the availability of water, indicates that the Mary River system, with the dam as part of the system, will be able to provide both the water supply volume and environmental flows in accordance with the Mary Basin WRP.

Strategies will be developed for the 'first fill' of the dam to ensure water allocations and environmental flows are not affected during this time. There are no proposed changes to the method of operation for any licensed water diverters. The dam will have no impact on the access arrangements or license conditions of current entitlements other than those within the inundation area.




QUEENSLAND WATER INFRASTRUCTURE PTY LTD

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**FIGURE 2-1**

TRAVESTON CROSSING DAM EIS

VARIATION OF AVERAGE ANNUAL RAINFALL IN THE MARY RIVER CATCHMENT

DRAWING NUMBER

100567

DATE: SEPTEMBER 2007

### 2.10.1 Environmental Flow/Water Entitlements

During simulation, which includes the recent drought period (DNRW) the dam falls to a new low level but a significant fill event would have been experienced in 2003 (and more recently in August 2007). This fill event is significant in that it demonstrates that, even during a period of limited rainfall throughout SEQ, the catchment of the dam receives enough rainfall to fill the dam.

The dam generally performs very well because its capacity is about 153,000 ML, from which 70,000 ML will be extracted each year, the mean annual flow at the site is currently 606,000 ML and the median is 341,000 ML. It is therefore a relatively small dam in a relatively large and constantly flowing catchment.

Considerable flexibility exists in the operation of the outlets, the fishway and the gates, to state with confidence that optimisation will result in significantly better downstream flow regimes than currently is the case (in the models) without affecting the yield from the dam or existing entitlements downstream. This includes the fishway which will be able to operate almost continuously without additional dedicated environmental releases.

There will be no impact on flows upstream of the dam. Significant localised reduction of flows immediately downstream of the dam wall will occur, however, these impacts will decrease with distance downstream of the dam, as the contribution of the dam to overall flows is reduced by inflows from downstream tributaries. Mean annual flows will be reduced in the estuary by just 3% from current conditions.

### 2.10.2 Evaporation/Climatic Conditions

Taking evaporation, seepage and climatic conditions into account, modelling indicates the dam never fails (drops below the minimum operating volume of 3,940 ML) in the simulation period and is at or above full supply 23% of the time and above 50% capacity 92% of the time. The nett evaporation loss for the dam is 520 mm.

#### 2.10.2.1 Seepage/Leakage

The seepage allowance of 300 mm/year is consistent with estimates adopted for large storages in Queensland. It is expected that seepage or leakage from the reservoir will be low. Assessment of the potential for leakage in a recent review (SMEC, 2007) indicates the risk of leakage is insignificant.

#### 2.10.2.2 Flooding

The Project will have some impact on current flood levels upstream in susceptible low lying areas. However, downstream, the inclusion of flood gates will provide significant beneficial flood mitigation impacts, particularly in Gympie. **Table 2.2** indicates peak flood levels for the largest recorded floods. Moderate to major flooding occurs relatively often in Gympie – almost 30 times since recording began.

**Table 2.2 Recorded Flood Gauge Heights (m) in Mary River**

| River height station | Feb 1893 | Mar 1955 | Jan 1968 | Jan 1974 | Apr 1989 | Feb 1992 | Feb 1999 |
|---|---|---|---|---|---|---|---|
| Imbil | - | 11.73 | 6.50 | 9.75 | 8.80 | 8.90 | 10.70 |
| Gympie (GS 138900) | 25.45 | 21.44 | 18.75 | 20.73 | 19.65 | 21.40 | 21.95 |
| Miva | 23.08 | 21.84 | 18.92 | 20.80 | 18.30 | 20.45 | 20.65 |
| Maryborough | 12.27 | 11.23 | 9.25 | 10.95 | 6.60 | 9.50 | 8.75 |

*Source: (BoM, 2007a)

When modelled using a gate operation scenario that maximised downstream flood mitigation, the dam could have reduced the area flooded in the 1999 flood event by approximately 30%. This would have saved all houses and about 100 businesses from inundation, significantly reducing the effect of the 1999 flood. For the remaining 30 flooded businesses, flood levels could have been reduced by up to some 4.0 m; however, these businesses would have experienced flooding for 72 hours instead of 58 hours. The reduction in flood extent and levels is a significant economic and social benefit for the residents and business of Gympie.

The flood gate operation rules will be optimised to balance the flood mitigation benefits achieved downstream with the operational impacts upstream. This will require extensive consultation with the community and Emergency services and the Dam Safety Regulator to ensure the strategy is optimised against key flood impact criteria.

#### 2.10.2.3 Upstream flooding

Backwater effects from the dam will cause some localised flooding impacts in the areas surrounding the storage (**Table 2.3**).

**Table 2.3 Localised Flooding Impacts**

| Area | Impact |
|---|---|
| Kandanga | The Kandanga Bowls Club and other community facilities which are currently subject to flooding, will experience increased susceptibility to flooding. To ensure that accessibility and functionality of community facilities is maintained or enhanced QWI has signed an MOU with a number of community groups. The MOU facilitates the relocation of the facilities to a flood free area of Kandanga. Additionally, QWI will mitigate the impact of flood on the cemetery. A grassed verge system will provide immunity to the cemetery for floods up to and including the 1 in 100 AEP event. QWI will consider community proposals prior to finalising the design mitigation measures for the cemetery.<br>Flood affected properties will be purchased or flood effects mitigated via negotiation with landholders. Mitigation options include purchase, remedial works or the implementation of a water easement over the affected land. |
| Imbil | Flood modelling shows the serviceability of the bridge or roadway will not be altered and houses and community facilities will not be affected. |
| Carters Ridge | The Project will cause an increase in flood levels west of Carters Ridge. No community infrastructure is additionally affected by this impact. All affected properties are located within the land purchase area.<br>Flood affected properties will be purchased or flood effects mitigated via negotiation with landholders. Mitigation measures include remedial works or the implementation of a water easement over the affected area |

| Area | Impact |
|---|---|
| Federal | Flood modelling predicts increased flood levels during a flood event in Skyring Creek extending just downstream of Federal. In the 1 in 100 AEP flood event the Federal Hall and Federal School buildings are not impacted by flooding and will not be impacted by increased flooding with the dam.<br>Flood affected properties will be purchased or flood effects mitigated via negotiation with landholders. Mitigation options include purchase, remedial works or the implementation of a water easement over the affected land |
| Other Upstream Localities | Locations such as Brooloo, Belli Park, Kenilworth and Maleny will not experience any change to flood characteristic.<br>Several roads and bridges are inundated at full supply level of the dam, as well as a number that will be impacted by increased flood levels due to the dam. This includes the Bruce Highway. The impacted roads and bridges will be relocated, upgraded or closed as appropriate. All design of upgrades and relocations take into account existing flood immunity levels to ensure similar or better accessibility. |

## 2.11 Hydrogeology (Groundwater)

Groundwater impacts associated with the construction and operation of the dam are considered negligible. This is due to the low existing use of the alluvial and basement aquifer, the small extent of dewatering influence, and absence of a significant groundwater resource in the underlying bedrock.

## 2.12 Geomorphology

The Mary River system is subject to ongoing change and impact, both from natural and human activities, particularly since European settlement. Bank erosion occurs extensively throughout the length of the Mary River, caused by removal of bank vegetation and sand and gravel extraction activities and uncontrolled stock access. Bank erosion in the tributaries is largely attributed to access by stock and loss of riparian vegetation.

The Project will not impact flows upstream of the inundation area. As expected, localised hydrological changes from existing conditions will occur immediately downstream of the dam wall however, any changes in the flow characteristics considered important in terms of geomorphological change will decrease with distance from the dam wall and will be minor by Fisherman's Pocket.

### 2.12.1 Impact on Sediment Transport

A comparison of the fine and coarse deposition at the end of the Mary system is shown in **Table 2.4**. The dam will capture sediment transported off the land. Suspended sediment at the mouth of the river due to the Project is expected to be 20% less than at present, and present levels are highly elevated compared to natural. Sediment change reduces below the dam due to sediment contribution from tributaries and the high level of erosion downstream. Sediment trapping, particularly coarse sediment, within the storage would only have a minor impact on dam volume, with a potential 0.15 % reduction in dam capacity occurring each year.

**Table 2.4 Comparison of Total Fine and Coarse Deposition at Mary River Mouth for Three Scenarios**

| | Scenario | | |
|---|---|---|---|
| | **Pre-European (kt/yr)** | **Existing (kt/yr)** | **Post Dam (kt/yr)** |
| ***Fine deposition (floodplain)*** | | | |
| NRW model inputs | <1 | 50 | 37 |
| CSIRO model inputs | <1 | 24 | 20 |
| ***Coarse deposition (channel bed)*** | | | |
| NRW model inputs | <1 | 145 | 105 |
| CSIRO model inputs | 12 | 307 | 240 |

There will be minimal overall change in the estuary conditions, and those changes are towards the natural condition. Sediment supply to northern beaches will not be affected. Supply is more dependent in the short term on tidal processes than the yield of the Mary River due to the substantial time lag between sediments leaving the river and reaching the beaches (BPA, 1989). There will be no sediment related impacts on the Great Sandy Straits or Fraser Island.

## 2.13 Water Quality

The water quality in the Mary River catchment ranges from slightly to moderately impacted with high levels of nutrients and bacteria and elevated turbidity (at least partly associated with erosion). Water quality data from both historical (DNRW, EPA) and current (EIS 2006/07 survey) sources indicate that:

- both total nitrogen and NOx median concentrations exceed aquatic ecosystem Water Quality Objectives (WQOs) in the Mary River downstream of the dam;
- total nitrogen, ammonia and organic nitrogen were generally higher than ecosystem protection WQOs in tributaries within and adjacent to the inundation area;
- total phosphorus exceeded aquatic ecosystem protection WQOs in the Mary River downstream of the inundation area, but not within or upstream or in any of the tributaries;
- soluble reactive phosphate (SRP) occasionally exceeded WQOs in some tributaries;
- total suspended solids (TSS) were higher than both drinking water and aquatic ecosystem protection WQOs, both upstream and downstream of the inundation area in the Mary River main channel. Median TSS levels also exceeded aquatic ecosystem protection. Turbidity measurements were lower than WQOs;
- pH and conductivity values were within aquatic ecosystem protection WQOs in the Mary River and tributaries within and adjacent to the inundation area;
- dissolved oxygen levels were generally high in all reaches of the Mary River and its tributaries;
- No historical chlorophyll-α data were available within and adjacent to the inundation area. Records for Dagun Pocket indicated a median chlorophyll-a measurement that exceeded the aquatic ecosystem protection WQO. Chlorophyll-a concentrations exceeded aquatic ecosystem WQOs in several tributaries, with occasional high spikes in Coles Creek and Belli Creek;
- Maroochy Shire Council supplied *E. coli* and total coliform data for 2006-2007 from the Mary River at Kenilworth, 50 m upstream of the water treatment plant, and upstream of the inundation area. The drinking water WQOs for both these indicators were consistently exceeded; and
- soluble iron exceeded both WQOs in tributaries, while manganese did not. Tributaries often had levels of iron and manganese that exceeded Level 1 and Level 2 drinking water WQOs.

Overall, the negative impacts on water quality within and downstream of the dam site during the construction of the dam will primarily relate to suspended sediment and turbidity and are likely to be minimal. Impacts during construction will be managed by applying the appropriate erosion and sediment control measures detailed in the Queensland Guidelines for Erosion and Sediment Control.

The duration of the filling phase is dependent upon river flow at the time. In average circumstances it is highly probable that the dam will reach FSL within two years. As most tree and shrub material will be removed from the inundation area prior to filling this will minimise the effects of rotting organic matter on water quality during the filling phase. During operation the potential impact of stratification and turnover on water quality can be effectively managed.

The main mitigation strategy for stratification in the dam is monitoring of the vertical profile of storage water near the off-take point, and selective release of the highest quality water available. A multi level off-take (**Figure 2.2)** has been included in the dam design to provide the flexibility to undertake this mitigation strategy.

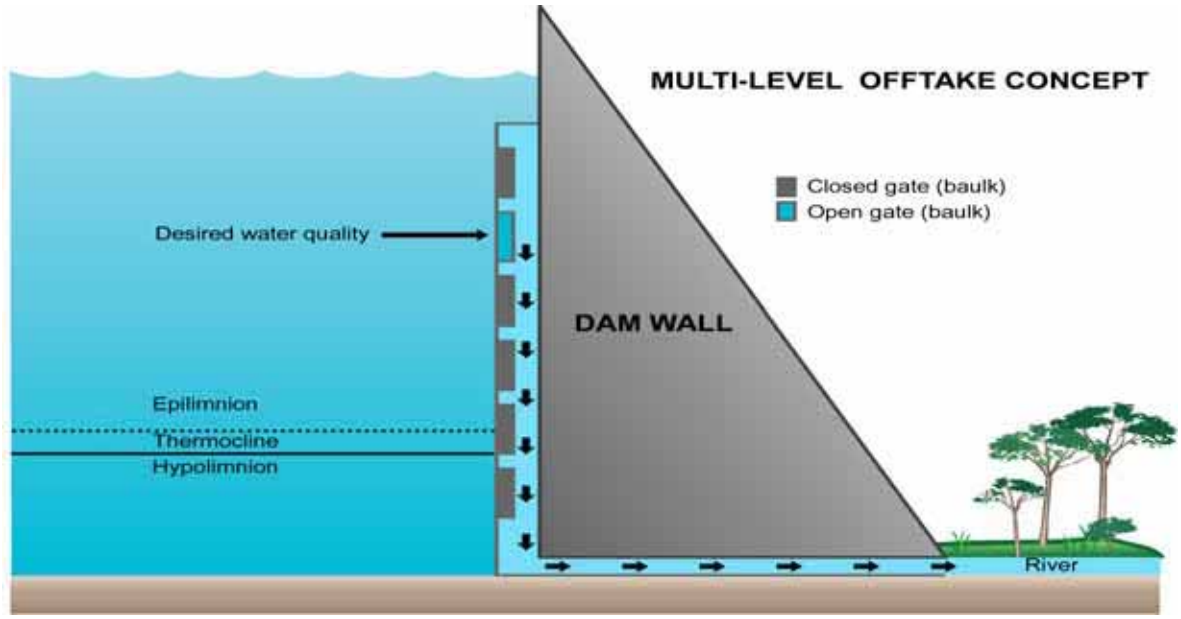



**Figure 2.2 A Conceptual Model of a Multi-Level Offtake System**

## 2.14 Terrestrial Flora

The vegetation landscape has been significantly modified, with 85% of the study area and 78% of the Project area cleared. Of the 3838 ha directly affected by the Project (inundation, road corridors and construction site area), approximately 288 ha of remnant vegetation will be affected by inundation or clearing. No Federally listed threatened flora communities occur in the area. Two flora species of State or National significance are known to occur within the inundation area: slender milkvine; and giant ironwood. The potential impact and mitigation measures on these species have been assessed (**Table 2.5**) and with mitigation measures in place, all impacts can effectively be offset.

**Table 2.5 Significant Flora - Impact and Mitigation (Summarised from EIS)**

| Species | Status | Potential Impact and Mitigation |
|---|---|---|
| slender milkvine (*Marsdenia coronota*) | V (NC Act, EPBC) | Slender milkvine was recorded at two locations in the Project area within RE 12.11.3. Only one of these sites is located within the inundation area to the south of the Skyring Creek stretch of the dam. Inundation to FSL is likely to result in the direct attrition of individual plants at the one known habitat patch in the inundation area. Impacts on the slender milkvine are not expected to be significant as the area of habitat impacted by the Project is small in comparison to the total extent present across and adjoining the Project area.<br>The loss of individuals of slender milkvine within the inundation area can be offset through establishment of ex-situ population of this species through translocation. It is intended that suitable translocation sites be identified within the Project area (above the FSL), and that propagated and/or removed individuals of slender milkvine are planted at several sites. Pilot propagation and planting trials should be initiated as soon as practicable to determine the translocation potential of the slender milkvine. It is proposed to monitor flora at the translocation sites to determine the success of the translocation and management actions. |
| giant ironwood (*Choricarpia subargentea*) | R (NC Act) | Giant ironwood was recorded at six locations across the Project area within RE 12.3.7, RE 12.3.11, RE 12.11.10 and RE 12.11.11. Three of these sites are located within the inundation area - within disturbed riparian forest along Kandanga Creek, within vine forest with River Oak in riparian fringe of Yabba Creek and on steep lower slopes fringing Mary River. Inundation to FSL is likely to result in the direct attrition of individual plants at these known sites.<br>Impacts on the giant ironwood are not expected to be significant, as the area to be inundated is minor. Furthermore, the EPA indicates that the taxon is considered fairly common and should be treated as 'common' status under the *Nature Conservation Act 1992*. It is expected that the status of this species will be reassessed over the next two years as the category "Rare" is itself gradually phased out. |

* CS – Conservation Status under the EPBC Act or the NC Act: E – endangered, V – vulnerable, R - rare

Preliminary assessment indicates the extent of the catchment area, ownership by QWI of considerable areas of land and also the opportunity to jointly approach vegetation offsets for a number of QWI projects means that offsets can be provided in accordance with the 'Policy for Vegetation Offsets' (DNRW, 2006) to mitigate the clearing of 59.87 ha of the 'Endangered' RE 12.3.1 and approximately 84 ha of the 'Of Concern' REs 12.3.2, 12.3.11 and 12.11.14 within the operational area.

Several locally significant flora species have been recorded. Road realignments are anticipated to impact on isolated patches of vegetation communities and vegetation offsets will be provided.

The spread of weeds will be minimised by adherence to a weed management plan and a beneficial outcome will be the focus on weed management through QWI lease conditions.

## 2.15 Terrestrial Fauna

The habitat landscape within the inundation area and adjoining areas has been profoundly modified but is home to seven Endangered, Vulnerable and Rare (EVR) fauna species including: tusked frog; southern barred frog; elf skink; challenger skink; grey goshawk; Australian cotton pygmy-goose, and koala.

Two culturally significant species, the Platypus and short-beaked echidna were identified in the Project area. Both listed as culturally significant under the *Nature Conservation Act 1992* (NC Act). Assessment and potential impact on fauna of conservation significance is provided (in summary) (**Table 2.6**).

**Table 2.6 Potential Impacts on Fauna of Conservation Significance (Summarised from EIS)**

| Species | Status | Potential Impact |
|---|---|---|
| tusked frog (*Adelotus brevis*) | V (NC Act) | The tusked frog is widely distributed throughout the inundation area, especially along tributaries, and reaches of the Mary River adjacent to tributaries. Flooding of the inundation area will impact on lowland habitat currently used by a portion of the local population. As the Tusked Frog is fairly ubiquitous in SEQ the species would likely recolonise flooded depressions and grass communities around the edges of the new storage. Habitat rehabilitation at areas upstream of the proposed FSL along Belli Creek and other tributaries will provide additional habitat. |
| southern barred frog (*Mixophyes iteratus*) | E(EPBC, NC Act) | The southern barred frog was detected at both vine forest and riparian gallery forest habitat on Belli Creek and Skyring Creek, and also in gallery forest habitat on the Mary River with the greatest number of specimens on the upland habitat at Belli Creek and some on lowland habitat at Skyring Creek. Flooding of riparian habitat will disturb the key microhabitat attributes for this species at its northern limit.<br>The southern barred frog is expected to persist in riparian gallery forest upstream of the inundation area, Rehabilitation at areas upstream of the proposed FSL along Belli Creek, Happy Jack Creek and other tributaries to will provide additional habitat. Habitat management for southern barred frog has been conducted to date on a property along Happy Jack Creek. This habitat will not be disturbed by inundation and there is potential to enhance this work, by extending habitat upstream. |
| elf skink (*Eroticoscincus graciloides*) | R (NC Act) | The elf skink was found in forest habitats with dense understorey and is anticipated to be widely distributed throughout the Project area, including in relatively degraded riparian forest and is widespread in the Sunshine Coast region. Habitat within the inundation area, although representing a component of this South East Queensland distribution, is not especially significant for this species. Therefore, inundation of this habitat is unlikely to have a significant impact on this species. |
| challenger skink *(Saproscincus rosei* | R (NC Act) | The challenger skink was captured in vine forest and riparian gallery forest during the fauna survey, including a relatively degraded riparian gallery forest site near Moy Pocket. There will be a loss of approximately 136 ha of potential habitat for this species due to the inundation of patches of REs 12.3.1, 12.3.2, 12.11.10 and 12.11.14.<br>The occurrence of this skink within the inundation area appears to be the northernmost known occurrence of this species in lowland habitats for the skink although the species is relatively common throughout the Sunshine Coast region, and is likely to occur in wet sclerophyll forest types surrounding the inundation area. |
| grey goshawk (*Accipiter novaehollandiae*) | R (NC Act) | The grey goshawk was observed near Skyring Creek and it is likely it utilises riparian habitat throughout the inundation area. It is widely distributed in coastal and sub-coastal areas from Victoria northwards through NSW and Queensland and across the Northern Territory to Western Australia. Furthermore, similar riparian habitat occurs extensively upstream and downstream of the inundation area. Therefore, habitat within the inundation area is not considered significant in terms of overall distribution of the species or as winter foraging areas.<br>The inundation of this habitat is not anticipated to have a significant impact on the grey goshawk, as it is highly mobile and can forage on similar riparian habitats within the Mary River Valley upstream and downstream of the inundation area. |

| Species | Status | Potential Impact |
|---|---|---|
| Australian cotton pygmy-goose (*Nettapus coromandelianus albipennis*) | R (NC Act)<br>M (EPBC) | The Australian cotton pygmy-goose was observed on a large farm dam near Moy Pocket outside the Project area during the field surveys. This species is likely to occur sporadically through the Project area in deeper river pools. The Australian cotton pygmy-goose favours natural and man-made deep water habitats (i.e. dams and wetlands) that are not abundant within the Project area. It is not anticipated that the loss of this habitat would have a significant impact on this species, as it is widespread and suitable habitat occurs in the surrounding region. The wetland habitat created by the new water supply may provide habitat for this species. |
| koala (*Phascolarctos cinereus*) | V in SEQ (NC Act) | The koala was detected at three sites within the inundation area during the field survey and is known to utilise open and mixed eucalypt forest. The majority of the inundation area does not currently provide suitable habitat, however, areas of RE 12.11.14 provide favoured habitat for koala and it occurs as scattered patches on the periphery of the inundation area, and within the Bruce Highway road corridor.<br>The sites where the Koala was found all contained stands of the favoured food tree, *Eucalyptus tereticornis*. However, other sites containing *E. tereticornis* did not have signs of Koala occupation. This suggests that the relatively isolated pockets of forest and woodland containing *E. tereticornis* are not all permanently inhabited by the Koala, and the species is more common in larger extensive stands of eucalypt forest on the valley sides and ridge tops outside the Project area. The small areas of habitat occupied by the local Koala population probably does not represent core habitat areas in terms of sustained occupation by breeding individuals. Consequently, the Project area is regarded as having less significance for the Koala than surrounding more extensive forest area, and the Project is not likely to have a significant impact on the species. |
| platypus (*Ornithorhynchus anatinus*) | CS (Q) | The platypus was recorded during the field survey, and is apparently widespread in the Mary River and its tributaries. The stream habitats of the study area represent good habitat for this species, and flooding to FSL will disturb the key habitat for this species. This is likely to have an impact on the occurrence of the platypus within the inundation area.<br>However, the platypus is widespread in SEQ and suitable stream habitat will remain upstream of the dam and within the Mary River and tributaries, and therefore impacts are not anticipated to be significant. |
| short-beaked echidna (*Tachyglossus aculeatus)* | CS (Q) | The short-beaked echidna was observed during the field survey within lowland vine forest (RE 12.3.1) and incidentally across the inundation area. The short-beaked echidna is widespread throughout mainland Australia and occupies a variety of habitats, including modified habitats such as grazing land.<br>Habitat within the inundation area is not considered to be especially significant for the short-beaked echidna, and therefore the loss of habitat resulting from the Project is not anticipated to have a significant impact on this species. |

* CS – Conservation Status under the EPBC Act or the NC Act: E – endangered, V – vulnerable, R – rare, M – migratory,

A Vegetation Management Offsets (VMO) strategy will provide the framework to mitigate impacts to significant regional ecosystems and vegetation and fauna communities. The VMO will comply with the guidelines detailed in the Queensland's 'Policy for Vegetation Management Offsets' (DNRW, 2006). The strategy will focus on providing VMOs in areas where vegetation connectivity can be enhanced and buffers for existing remnant vegetation generated. An initial study of the opportunities within the QWI Land Purchase Area (LPA) for the establishment of VMOs indicates appropriate type and extent of land is available.

The combined strategies of translocation of threatened plants, retention of riparian forest on the upper limits of the FSL, rehabilitation of riparian areas for frog habitat, creation of island refuges, re-vegetation of disturbed areas, retention of habitat logs and branches, weed and pest control, provision of vegetation management offsets to promote vegetation connectivity, installation of fauna friendly road crossings, and implementation of construction and operational phase EMP's, including Vegetation and Fauna Management Plans, are considered adequate to mitigate any

adverse impacts of the Project on the terrestrial flora and fauna of the Project area and in some cases, create a beneficial outcome.

## 2.16 Aquatic Ecology

### 2.16.1 Aquatic plant communities

Aquatic plant communities, comprising macrophyte vegetation, riparian vegetation and algae provide valuable habitat for fauna within freshwater ecosystems. Substantial macrophyte growth:

- increases overall biological diversity;
- stabilises sediment;
- filters nutrients and sediment;
- generates oxygen and holds carbon;
- provides habitat and food to macroinvertebrates, fish, turtles and birds; and
- provides potential egg laying habitat to lungfish and other species.

A healthy macrophyte community is a positive ecological attribute. For example, studies indicate that fish species richness in the Mary River is significantly correlated with macrophyte cover. This may relate to the strong macroinvertebrate abundance and diversity in shallow edge habitats with good macrophyte cover. In a catchment with elevated nutrient levels, healthy macrophytes provide a means of reducing the potential problems for downstream users.

The shape of the dam, good sediment base and elevated nutrient levels will foster abundant mixed submerged macrophyte and fringing/emergent vegetation in shallow areas of the dam. The total available shallow water habitat is sufficient to compensate for the loss or decrease of other habitat types given that diversity generally increases with area.

Most species will be able to colonise the shallow margins of the dam, particularly adjacent to where the multiple tributaries enter the storage. Similarly the somewhat contorted shape of the dam will generate macrophyte diversity through creating backwaters and embayments, open areas and islands. Each of these will be differently affected by wind fetch, adding to habitat diversity.

Data indicates that water levels in the storage are likely to be within ranges preferred by emergent/fringing and submerged macrophytes living in the shallow margins for much of the time. This is likely to be a major benefit to macrophyte-associated fauna (including lungfish).

It is possible that the storage will be colonised by weed species, including the noxious salvinia and water hyacinth. These have, historically at times, been significant issues for some storages in SEQ but strategies have been developed to control weed species outbreaks. The key for management will be to incorporate weed management from the outset so that they never reach significant proportions. This strategy is successful on all other dams in SEQ.

### 2.16.2 Macroinvertebrates

One macroinvertebrate species of conservation significance occurs within the catchment: the Queensland spiny mountain crayfish (*Euastacus hystricosus*). The species is listed as vulnerable under the EPBC Act and under the IUCN classification. It was not expected in the Project area as it prefers higher mountain regions and no individuals of this species were recorded during the EIS survey.

The macroinvertebrate fauna of the catchment is diverse and can be very abundant. The fauna is considered generally flexible in its ecological requirements, with few taxa limited to particular narrowly defined habitats such as riffles. The inundation footprint is only 9% comprised of riffle habitat. Macrophyte and edge habitat, both of which are predicted to be common in the dam, will support the majority of macroinvertebrate taxa in reasonable abundance.

### 2.16.3 Fish

The fish fauna of the Mary River is naturally diverse but has been modified by the introduction of native species for recreational fishing, and to a lesser extent, by exotic species. Fish of conservation significance in the Mary River include the:

- Mary River cod (*Macculochella peeli mariensis*), which is listed as endangered under the EPBC Act and is protected under the *Queensland Fisheries Act 1994* (Fisheries Act).
- Lungfish (*Neoceratodus forsteri*), which is listed as vulnerable under the EPBC Act, and protected under the Fisheries Act.

The Oxleyan Pigmy Perch (*Nannoperca oxleyana*) is listed as endangered under the EPBC Act and vulnerable under the NC Act. This species is not directly impacted by the Project as it occurs only in certain streams not connected to the Mary River main channel. Other species of fish present in the river have been described as being rare or threatened by the Australian Society for Fish Biology (ASFB) but two are not native to the Mary River and one is widespread in SEQ rivers.

#### 2.16.3.1 Mary River Cod

Mary River cod are regarded as endemic to the Mary River system. Current significant population bases for cod are in one tributary upstream of the Project (Obi Obi Creek), one downstream (Six Mile Creek) and one system essentially isolated from the freshwater reaches of the Mary River (Tinana and Coondoo Creeks).

There are other possibly significant populations in three other downstream creeks (Amamoor, Widgee, and Munna Creeks). Cod historically occupied much of the river length and tributaries but main channel populations are thought to be sparse. This has been attributed to land use change, particularly clearing of the riparian zone and riverine sand and gravel extraction, along with over-fishing. The EIS survey observed an abundance of large fork tailed catfish, which are voracious predators, in the downstream reaches of the Mary River and suggested this presents a predation bottleneck that likely limit the success of Mary River cod fingerling stocking programs in these lower reaches. Fork tailed catfish are naturally absent from upstream areas.

The number of cod observed during the 2006/07 EIS survey is a significant finding, suggesting the success of restocking, education programs and rehabilitation since the original population estimates of the early to mid 90's, where cod populations were regarded by most authorities as patchy and small. Cod are currently successfully bred in captivity at the Gerry Cook Fish Hatchery and fingerlings are stocked throughout SEQ, including many locations in the Mary River catchment.

The dam itself is expected to provide suitable habitat for cod but it has not been confirmed that Mary River cod breed in storages. Studies suggest:

- self-sustaining storage populations of Mary River cod may be possible if the right conditions are provided;
- there is evidence of the congeneric trout cod breeding in southern storages;
- Mary River cod are likely to find abundant suitable depth in the dam;

- cod do not need flow to breed because they breed successfully in aquaria;
- recreational anglers have caught good sized cod, derived from stocked fingerlings, from Lake Macdonald (www.fishingnoosa.com.au/jan02.htm); and
- the major feature of habitat complexity required is large woody debris and this will be added to the dam.

Mitigation measures for a reduction in large woody debris includes:

- selective retention of vegetation near FSL, particularly in existing riparian zones;
- re-vegetating selected areas on the fringe of the dam, such as tributaries, and on islands within the dam with native species tolerant of periodic inundation, which are known as good sources of large woody debris, and will provide food for aquatic species;
- artificially introducing snag habitat to the storage;
- artificial surfaces that may act as suitable shelter habitat for fish (this may include rocks or large diameter water pipes as currently used in the Gerry Cook Fish Hatchery); and
- re-vegetating and re-snagging other parts of the catchment (particularly where Mary River cod are known to occur but where current habitat values are sub-optimal).

With respect to the latter point, key sites for rehabilitation have been identified within the Recovery Plan for cod. Some of these are upstream of the dam on large tributaries and further consideration for rehabilitation as outlined in the Burnett Mary Regional Natural Resource Management Plan. The weirs on these systems may be considered by (DPI&F) for retrofitting of fish transfer devices in order that the habitat rehabilitation works achieve maximum benefit.

With respect to the potential for impacts on Mary River cod in general the following is noted:

- of the three recognised Mary River cod stronghold tributaries, Obi Obi Creek, Six Mile Creek and Coondoo/Tinana Creek, and other noted potentially important sites (Widgee Creek, Munna Creek and upper Amamoor Creek), only one of these is upstream of the dam and potentially impacted by the barrier effect;
- none of these sites is directly affected by flow regime change associated with the Project as they are tributaries and only Amamoor Creek is close enough to the dam to be potentially impacted secondarily by flow regime change within the main river. Some of these creeks are under stress from other impact sources; and
- the dam connects to a number of significant upstream tributaries where deep holes and reasonably dense macrophyte cover are present. These provide significant habitat for cod and other species and opportunities for them to move to and from the dam.

Modelling of flow regimes downstream of the dam indicate:

- the dam will have negligible impact on any of the critical flow requirements of cod during the key movement periods;
- flows maintaining connectivity for cod movement are predicted to occur a very large percentage of time at both key nodes downstream of the dam during both the May-June and September-October period. Hence no further flow optimisation is required; and
- flows equivalent to 2 year ARI and 5 year ARI are not expected to occur commonly during the September–October period when cod migrate from tributaries back to the home ranges in the Mary River main channel to spawn. Hence no flow optimisation is required for this key flow attribute.

The core reason why significant manipulation of the downstream flow environment is not required is that the dam capacity is relatively small compared to flow at the site so it will spill regularly. These spills will occur in natural sequence. As cod only requires slightly elevated flows, the reduction in the magnitude of these spill events compared to natural has no impact on the ability of the flows to stimulate cod movement. This is likely to be true of most other fish species that require a flow stimulus.

#### 2.16.3.2 Lungfish

Lungfish are not considered at risk of extinction and are regarded as 'Common/Secure' by the Australian Society for Fish Biology. Lungfish are widely distributed in the Mary River and their population appears healthy. Lungfish were commonly observed in the Mary River main channel and the Imbil Weir pool on Yabba Creek during the 2006/07 EIS survey and previous studies confirm its occurrence upstream, within and downstream of the Project area (as far down as the Mary River Barrage). No juveniles were observed in the 2006/07 EIS survey, but these are notoriously difficult to sample.

It is known that lungfish survive successfully in large dams but it is not known whether lungfish breed in dams. However, evidence gathered during a survey of lungfish in other SEQ rivers and dams (Hydrobiology 2007), indicate lungfish:

- survive successfully in large dams and take advantage of food resources in such storages;
- were often in better condition in the dam than when captured in rivers. This should be more the case in Traveston Crossing Dam because it is highly likely to support a substantial macrophyte population most of the time;
- may breed in the storage. The primary limitation to potential lungfish breeding is the maintenance of a substantial macrophyte population. This is unlikely to be a limiting factor in Traveston Crossing Dam; and
- may move upstream to breed, as they have done in the Burnett River (Brooks and Kind, 2002). Flows from the range of feeder streams entering Traveston Crossing Dam storage may present more diverse stimuli for this behaviour to occur than is currently the case in other dams which have very few tributary entry points.

The Brisbane River is the most highly developed and regulated in Queensland yet supports substantial and healthy lungfish populations downstream of and between the major storages and in the river upstream from Wivenhoe Dam.

**Management Approach**

The downstream flow environment is likely to suit cod and lungfish because it will stimulate macrophyte growth, particularly ribbon weed, and the dam itself will prevent sediment from infilling pools. It is proposed to add large woody debris to this reach and undertake rehabilitation of the riparian zone to enhance cod and lungfish habitat and add habitat diversity in general. The regulated flow regime below Wivenhoe Dam supports a large and healthy lungfish population, as does the reach of the Burnett River below Walla Weir.

The approach to assessment of impact on lungfish is similar to that for cod, with the mitigation strategies for one species providing similar benefits to the other.

QWI has adopted a multi-tiered approach to protecting significant species and it also applies to geographic aspects of management:

- maximise the probability of population maintenance associated specifically with this Project;
- maximise the suitability of habitat beyond the Project footprint for species survival (compensatory habitat in other parts of the Mary River); and
- establish a focussed Freshwater Species Conservation Centre to undertake targeted research toward modifying this and other systems in the region to foster the improved status of the species.

The research and management outcomes of the proposed conservation centre have been established and are described in **Appendix F-6** of the EIS. When these are implemented, along with the full range of mitigation strategies described here, sustainable outcomes for cod and lungfish are highly probable.

#### 2.16.3.3 Freshwater Turtles

Five turtle species were recorded during EIS surveys. These include the Broad - shelled turtle, Southern Snapping turtle, Saw-shelled turtle, Mary River turtle and Krefft's turtle. This represents the full known complement from the river. The Mary River turtle (*Elusor macrurus*) is listed as endangered under the EPBC Act and is a critical priority species under the EPA's 2006 Back on Track prioritisation framework. Southern Snapping turtle (*Elseya albagula*) is a newly described species and is not yet listed under the EPBC Act or Nature Conservation Act but a nomination is being considered.

The Mary River turtle is endemic to the Mary River and occurs throughout the river and to a lesser extent in Yabba Creek. Other tributaries within the inundation area have neither sufficient flow nor the critical instream habitat features (especially deep pools) required to support the species. Mary River turtles occur in highest densities in pools >3 m deep where cover is available such as submerged and emergent logs and snags or macrophyte beds. The habitat for turtles within the inundation area is currently very good.

The predation of eggs by feral and native animals is the critical threat to the persistence of the species within the lower Mary and throughout the catchment. Turtles also in other catchments have suffered physical damage or death as a result of the operation of dam water release mechanisms. This has largely been overcome by design at Paradise Dam and the design of Traveston Crossing Dam places as much importance on design for the benefit of turtles as it does for fish.

### Management Approach

Significant undertakings have already been made and will be finalised during detailed design with advice from agencies and experts. Incorporation of measures within the design as outlined below, are expected to provide a beneficial outcome for the turtle population. Turtles are highly likely to use the dam environment and this will be encouraged through habitat manipulation. Mitigation measures include:

- map all nest banks prior to works commencing;
- avoid disturbing the river and riparian zones for the maximum possible period to keep the river habitable for turtles, and other species, as long as possible;
- prior to inundation, individually remove nest banks and relocate to suitable areas around the dam FSL, near tributary entry points and on permanent islands in the inundation area;

- recreate nesting and habitat requirements (snags, fruiting trees in riparian zones) within the dam to replace the habitat lost through inundation;
- protect and rehabilitate key habitat immediately downstream from the dam;
- a specific turtle ramp be designed to provide passage past the dam wall;
- spillway and plunge pool designed to minimise physical damage to turtles and / or designed such that turtles were unlikely to venture near the spillway;
- ensure screens protecting the intakes on water off-take towers prevent turtle injury. The screens at Paradise Dam were an improvement on previous designs but further improvements are proposed;
- selective retention of vegetation and re-vegetating the fringing margins of the dam;
- introducing snag habitat to the storage; and
- compensating for the loss of snag habitat in the impounded area by re-vegetating and re-snagging other parts of the catchment (particularly where Mary River turtle is known to occur). With respect to this, re-vegetation effort should be placed in areas upstream and immediately downstream of the dam.

The most important mitigation measure, once the turtles have relocated and suitable habitat provided, is to control access to nesting sites by feral animals (such as foxes, dogs) and cattle to reduce the taking or trampling of eggs. This will manage the most critical threat to the turtle population and together with the proposed mitigation measures, will provide a significant beneficial outcome.

#### 2.16.3.4 Barrier to species movement

To facilitate movement upstream and downstream, the design for the dam includes a fish way and turtle ramp. QWI has specifically not yet adopted a final design as advice from agencies and experts is that the contractor should be intimately involved in the design and fully comprehend the aims and importance. The philosophy adopted by QWI with respect to overcoming barrier effects is not solely reliant on the fish way or turtle ramp but is a multi-faceted strategy with each component adding to the overall likelihood of success. The multi-faceted approach establishes primary, secondary and tertiary strategies and includes:

- state of the art fish way designed in conjunction with leading experts;
- turtle ramp; and
- commitment to use catch and carry in circumstances when the primary and secondary alternatives are not operational (e.g. low water levels).

All three threatened aquatic species (cod, lungfish and turtle) are known to be able to be captured and transported successfully so catch and carry of sexually mature adults is a viable option to prevent genetic isolation of populations. With respect to Mary River population sustainability in general, the same multi-level approach is offered:

- maximise the probability that the species will live and breed in the dam;
- maximise the probability that the species will be able to move past the dam (as above); and
- undertaking captive breeding and re-stocking programs for each species.

It is believed that the fish way will provide passage for a wide range of species and size classes, including demersal and pelagic fishes and crustaceans. Whilst there is no published data concerning the abilities or otherwise of Mary River cod to utilise fishways, there is no particular reason why lungfish and Mary River cod should not be able to use the fish lock in the same way that other large bodied mobile fish species are likely to. However, QWI will not rely solely on the fishway, as noted above.

The tiered approach to population management is anticipated to ensure the continued survival of the species but the ultimate tier, the Freshwater Species Conservation Centre, goes beyond this, with the aim to improve the status of the species.

### 2.17 Air Quality

Dispersion modelling shows that the main sources contributing to off-site particulate matter concentrations are wheel generated dust from heavy vehicle routes, and excavators, dozers and scrapers moving material around the site. Dust impacts from haulage of dusty materials can be experienced several hundred metres from transport routes.

Considering the above, and considering the dispersion modelling for the operation of the crushing and concrete batch plants includes strict dust management controls, dust management and minimisation measures are a very important component of the Project to maintain the qualities of the air environment in the locality. The draft EMP includes measures to ensure appropriate management and minimisation of dust are considered further as part of the detailed design of the construction program and construction activities.

The management of air quality impacts from construction works associated with road relocations and upgrading works are readily controlled through dust management and mitigation strategies via detailed air quality management plans prepared specifically for each section of the works. The management plans will include controls specific to sensitive receivers adjacent to the works.

An iterative and adaptive management approach will be adopted throughout the Project. Air quality monitoring, visual inspection and community complaints will be key triggers in initiating further investigation and modification to site work practices. Dust management plans based on this model have been successfully implemented to minimise dust emissions and effectively manage community impacts from similar construction projects. Community engagement, including a feedback and complaints response system in relation to project construction issues will also form part of the construction management plans.

The operation of the dam is unlikely to result in significant air emissions or impacts to local air quality. Electricity consumption to power pump stations and dam gates would result in indirect emissions at power generation sites, however, the electricity consumption is minimal and expected to result in minimal impact to the environment.

The proposed water treatment plant (not part of this Project), required to treat raw dam water prior to export via the Northern Regional Water Pipeline, would involve a sludge removal process. However, sludge handling associated with water treatment plants typically does not generate significant odour impacts. The potential for nuisance odours will be considered further during the detailed design to ensure odour nuisance is minimal.

According to roadside air pollution monitoring undertaken by the QLD EPA, air pollutant levels at open roadside sites do not exceed *Environmental Protection (Air) Policy 1997* (EPP(Air)) ambient air quality goals, even adjacent to roads with large traffic volumes and significant congestion (conditions which give rise to higher levels of exhaust emissions). Thus the diversion of the Bruce Highway and local roads is unlikely to result in exceedances of the EPP (Air) ambient air quality

goals. Also, dispersion and dilution of pollutants within open rural areas, with free flowing traffic, is generally far better than dispersion within urban traffic flow conditions.

However, the draft EMP requires the alignment selection and detailed design of the Bruce Highway will ensure minimum distances of at least 20 m between the road reserve and nearby dwellings.

Where significant flora or fauna communities are present near construction activities, management plans would incorporate measures to minimise the potential for impact on these areas. Further investigation into the likelihood and effects on these areas will be undertaken during detailed design of the Project.

## 2.18 Greenhouse Gas Assessment

A preliminary greenhouse inventory was also prepared for the Project to provide an indication of the relative benefits and impacts. The construction of the Project is likely to result in 0.044 Mt $CO_2$-e of greenhouse gas emissions due to energy consumption over an approximate two to three year period (0.017 Mt $CO_2$-e per annum). The construction program will be designed to maximise energy efficiency and minimise greenhouse gas emissions from the works.

The estimated net greenhouse gas emissions from clearing of 424 ha of vegetation within the inundation area and beneficially re-using approximately half of it, is approximately 96,545 tonnes. QWI's project with Timber Queensland aims to contribute to the offsetting of the Projects greenhouse gas emissions.

Following construction the Project would result in a change in land use from primarily animal production and grazing to inundation. The carbon stocks associated with open grassland were estimated at 451,010 tonnes $CO_2$ which could be released at a rate of around 5,000 tonnes $CO_2$ per year over a number of years following inundation.

The operation of the dam gates and associated infrastructure may result in annual greenhouse gas emissions of around 0.001 Mt $CO_2$-e through electricity and energy consumption, and energy efficiency in design measures would be included to minimise these.

Greenhouse gas emissions from construction and operation of the Project represent a small fraction of Queensland's annual greenhouse gas emissions, however, management measures will be further considered as the design develops.

## 2.19 Ozone Depleting Substances

The potential sources of ozone depleting substances associated with the Project would largely be restricted to the use of refrigerators, solvents and air conditioning plant during construction and operation.

The purchase, use and maintenance of any such items for the Project will be in accordance with the relevant State and Commonwealth Government requirements for these substances. The potential risks to emissions of ozone depleting substances is considered to be minimal.

## 2.20 Noise and Vibration

The main potential for impact on the current noise amenity would be the dam construction works, blasting and rock excavation, vegetation removal within the inundation area, road/bridge construction and increased traffic on existing roads and realigned roads. As the dwellings currently within the construction footprint will be QWI owned, the nearest sensitive receiver to the dam

construction footprint is some 200 m whilst six dwellings are located within a kilometre of the works area.

The noise modelling results show that the dwelling closest to the dam construction footprint not currently owned by QWI will be subject to noise which does not meet the project acoustic goals. Noise mitigation measures would be required to be installed by QWI.

Trucks will use the Bruce Highway and access the construction site directly via the construction access. Additional day time haulage represents a negligible (2%) increase of total daily heavy vehicle traffic on the Bruce Highway and will be indiscernible.

Blasting at the spillway site would be offset by the separation distance of 600 m between the blasting site and the nearest sensitive receiver. The blasting contractor will be required to provide a detailed management plan prior to commencement of work in the quarry.

Progressive clearing of vegetation involves machinery moving from one place to another within the inundation area, meaning that potential noise impacts will only be temporary (short-term) at any one location. Landholders will be advised in advance of clearing.

Vibration impacts are expected to be minor. Australian and international standards which provide vibration criteria have been adopted for the Project. For construction work which involves the use of heavy vibratory rollers and pile driving, a buffer distance of at least 20 m and 60 m, respectively, is recommended.

Operational noise impacts are expected to be minor. Sensitive receivers which will be impacted include 24 dwellings affected by the realignment of the Bruce Highway. The predicted traffic noise levels at 1 m from these dwellings are in excess of the $L_{A10(18\ hour)}$ 60dB(A) criterion and for the Federal State School, in the range of $L_{A10(18\ hour)}$ 61 and 64 dB(A). It is recommended that during the design stage, further acoustic investigation be conducted at the potentially affected buildings to evaluate the extent of noise mitigation required.

The Federal State School will be slightly further from the new alignment of the Bruce Highway however, modern acoustical standards adopted by the Department of Main Roads (DMR) will mean mitigation works will be applicable for the School. The DMR will liaise with the school.

For local roads, the low traffic volume along the realigned roads means the traffic noise impact would be relatively minor.

Project acoustic goals are aligned with the requirements of Queensland legislation and would provide an acceptable acoustic environment at dwellings that may potentially be affected by noise emissions from the Project. The Project acoustic goals will be incorporated into the environmental management plan for the Project.

In recognising the potential for construction noise and vibration impacts at residences near to the Project. QWI recognises that management of noise and vibration is a critical component of the Project and will require ongoing consideration and community engagement throughout the duration of the Project. A number of noise management procedures and commitments to practical and reasonable controls which could be adopted by the Project to manage noise impacts on sensitive receivers have been incorporated into the draft EMP.

## 2.21 Waste

The principles for sustainable waste management practices for the project are:

- implementation of the waste minimisation hierarchy:
  - waste avoidance;
  - waste re-use; and
  - waste recycling.
- water conservation, treatment and reuse;
- efficient energy usage;
- compliance with Federal and State waste management policies, the *Environmental Protection Act 1994* (EP Act) and associated regulatory instruments as a minimum; and
- effective waste disposal (as a last option).

All waste generated on-site during the construction and operation phase will be disposed of in accordance with a Waste Management Plan (WMP), which will include:

- waste stream characterisation and separation;
- assessment of waste reduction opportunities for identified waste; and
- management of waste in accordance with the waste management hierarchy.

Practices for the management of waste are outlined in the draft Waste Environmental Management Plan in **Chapter 18 Environmental Management Plan** of the EIS.

## 2.22 Matters of National Environmental Significance (MNES)

The controlling provisions of the EPBC Act relevant to the Project are:

- Sections 12 and 15A (World Heritage);
- Sections 16 and 17B (Ramsar Wetlands);
- Sections 18 and 18A (Listed threatened species and communities); and
- Sections 20 and 20A (Listed Migratory Species).

The Fraser Island World Heritage Area (WHA) is located ten km from the mouth of the Mary River, on the eastern fringe of the Great Sandy Strait. The Great Sandy Strait is listed as a Wetland of International Importance under the Ramsar convention. The Mary River flows into the Great Sandy Strait at its northern end. There are a number of EPBC Act listed flora and fauna and migratory and estuarine species identified as occurring within or in the vicinity of the Project area, including the Great Sandy Strait region. EPBC listed flora and fauna have been addressed in detail in the Terrestrial Ecology and Aquatic Flora and Fauna chapters of the EIS and summarised under the same headings in this Executive Summary. They are revisited in Chapter 9 of the EIS, which is specifically devoted to MNES issues. The key parameters that may lead to an impact on estuarine and near-shore environments, and identified in the TOR, are flow regime change, water quality and sediment transport.

### 2.22.1 World Heritage - Fraser Island

Sediment output from the Mary River does not drive sediment processes on the west coast of Fraser Island. This is driven by marine processes. The relevance of fluvial transport from the Mary River is to the Great Sandy Straits and not Fraser Island. The source of sediments for Fraser Island has been shown to come from fluvial, continental shelf and shoreline sediments whereas the

contribution of sediment from the Mary River to the maintenance of the geomorphic form and process of Fraser Island as a whole is negligible (BPA, 1989).

Studies for the EIS predicted that sediment transport will decrease by about 20% from the mouth of the Mary River and that current sediment export is orders of magnitude above pre-European levels. For these reasons, the dam is very unlikely to have any impact on the volume of sediment supplied to Fraser Island from the mouth of the Mary River. Further, when the riverine sediment mixes with sediments supplied from the shoreline and the continental shelf, the difference between pre and post dam levels are expected to be immeasurable

Discharges from the Mary River only potentially influence the marine and estuarine habitats of Fraser Island. The freshwater and terrestrial habitats or significant faunal communities which make up the majority of the island's world heritage values, would not be affected. Impacts upon the marine and estuarine habitats would only occur during flood flows, which will be largely unaffected by the Project. Therefore, no significant impacts, and in fact no impacts to the World Heritage properties of Fraser Island are predicted due to the Project.

### 2.22.2 Ramsar Wetlands (Great Sandy Straits)

A decrease of 20% in the sediment exported from the Mary River as a result of the dam will have no impact on the natural sediment supply to the Great Sandy Strait. The dam will trap some of this sediment but will make negligible difference at the river mouth as most of the sediment is sourced from downstream of the dam (Earth Tech). Also:

- reduction in fine and coarse sediment export will not have a noticeable impact on replenishment of sediment within the Strait as it is already orders of magnitude above natural levels;
- little impact would be expected on bar growth within the estuary and the Strait due to the complex sediment, hydrodynamic and flocculation processes affecting both the fine and coarse fractions in the estuary and the contribution of marine sediments to replenishment of sediment, particularly in the northern section of the Strait; and
- a minor impact may be expected on the distributions of sediment size fractions within the Strait. Again, however, this impact is expected to be minimal.

The Project does not entail any works in the wetland so no physical disturbance will occur. With respect to hydrology, seasonality will remain the same post dam, that is, summer dominant. Key flow statistics indicates:

- medium and high flows are reduced by between 2.5 and 14% compared to predevelopment conditions; and
- low flows will be affected to a greater extent than the high and medium flows (as they are now), withy 50$^{th}$ percentile and 90$^{th}$ percentile daily flows reduced in late winter and spring by up to 1/3$^{rd}$ compared to pre-development conditions.

The changes to the low flow regime may, at times, lead to increased salinity in the upper estuary. The risk of impact is small and the potential impact is minor. With respect to water quality, for the majority of the time, water released from the dam will be of the same or better water quality than if the dam was not present (with respect to nutrients ands sediment). By the time released water reaches the estuary, these benefits will have diminished to negligible levels as a result of other catchment inputs. As such, there will be negligible change in water quality in the estuary due to the dam.

#### 2.22.2.1 Mangrove and Saltmarsh Communities

Alteration of flow per se is not expected to affect mangroves and saltmarsh communities as high flows show little change post dam and at low flow, tidal movements dominate. Under operation of the dam, mangrove and saltmarsh productivity is predicted to remain stable, as nutrient concentrations in the estuary are not predicted to substantially change (expected improvements upstream are offset by nutrient loading downstream). Mangroves and saltmarshes will receive similar influxes of nutrients (including anthropogenically-sourced nutrients) into the estuary during moderate-high flow events as is current.

In the context of the effects of other processes on the geomorphology of the Mary River estuary and northern Great Sandy Strait (e.g. the influence of marine sediments in the northern Great Sandy Strait), the predicted modest reduction in fine and coarse sediment delivery due to the dam is unlikely to result in notable changes to the current Mary River estuary and Great Sandy Strait morphology. Therefore, the Project will not substantially alter any habitats currently colonised by mangroves and saltmarsh in the Great Sandy Strait.

#### 2.22.2.2 Seagrass Communities

There is no predicted reduction in suspended sediment load during major flood events, such as the one that caused widespread seagrass dieback in 1999. The dam is likely to have a beneficial effect by reducing the severity and/or longevity of adverse impacts on seagrass from flood by reducing the severity of flood events. The dam is unlikely to substantially alter any habitats currently colonised by seagrass, and the intertidal and shallow subtidal areas that support seagrass are expected to remain relatively stable compared with the current scenario.

#### 2.22.2.3 Benthic Macro-invertebrate Communities

Any changes to the magnitude of freshwater flows to the estuary are unlikely to affect in-benthic invertebrates as the larger flows will change relative to natural conditions to a very minor degree. Decreases in turbidity may occur at certain times of the year and could lead to changes in macro-invertebrate community structure. Decreases in the concentration of suspended solids may increase the distribution of macro-invertebrate taxa, which may lead to an increased abundance of organisms that prey upon these organisms, such as wader birds and fish species. The probability of this occurring is low. Salinity and nutrient levels are not expected to change to an extent that will cause a substantial shift a change to the in benthic macro-invertebrate community structure.

#### 2.22.2.4 Coral Communities

Alteration of flow per se is not expected to affect coral communities. A reduction in sediment export, particularly of fine suspended sediments, may be beneficial for the coral communities of the northern Great Sandy Strait and Hervey Bay, by reducing the turbidity and sediment deposition over these reefs, though again the probability is low. The subtidal areas that support corals are expected to remain unchanged compared with the current scenario.

#### 2.22.2.5 Fish and Fisheries

The Mary Barrage has already substantially truncated the estuary. The low flow regime will continue to be determined by the sum of water extraction from the catchment, particularly in non flood periods. There is a small risk that the salinity changes expected in the upper estuary at these times may lead to changes in community dynamics. Any change is unlikely to be significant.

The dam will not have a significant impact on medium to high flood flow events. Periods of reduced turbidity due to the dam may be of a short-term benefit to the growth of filter-feeding aquaculture species, such as pearl oysters, in the northern Great Sandy Strait. Changes to the

geomorphology of the Mary River estuary and northern Great Sandy Strait are predicted to be minimal, and are unlikely to negatively impact upon species important to commercial or recreational fisheries production.

### 2.22.3 Threatened Species and Communities

Five Federally listed threatened species and no threatened communities were found by field survey in the Project area.

#### 2.22.3.1 Slender Milkvine

The habitat area where the species was found in the inundation area is small. With mitigation measures, the Project will not lead to a decline of the species in the area. A translocation plan for the species will ensure the loss of individuals will be offset in another location with enhanced connectivity than what currently exists, will be provided through habitat rehabilitation. This will allow for the species to naturally propagate.

#### 2.22.3.2 Southern Barred Frog

The loss of existing riparian zone will impact on the habitat of the frog and may also isolate some individuals. Mitigation measures include retention of riparian zones to within 1.5 m of FSL, quarantine of habitat for relocation and rehabilitation purposes, enhancement of habitat, development of connecting habitat corridors and a targeted management and monitoring plan. These measures will lead to maintenance of the species in the local environment.

#### 2.22.3.3 Mary River Cod

The Project will modify the area of cod habitat but will not affect known critical habitat areas. With mitigation measures including snag habitat, artificial surfaces (rocks, pipes), fishway, back up catch and carry strategy and the outcomes of the research and development conducted at the Freshwater Species Conservation Centre, it is likely a beneficial outcome for recovery of the species will result.

#### 2.22.3.4 Lungfish

The Project will not reduce the area occupied by the lungfish and regulated flows regimes are known to favour lungfish. The species is known to occupy and live healthily in dams. Mitigation measures similar for the cod are likely to provide a beneficial outcome for the maintenance of the species.

#### 2.22.3.5 Mary River Turtle

The existing turtle habitat is that which will be most impacted by the Project however, the turtle is the species that will most benefit from the mitigation measures built into the Project. The turtle is currently subject to critical levels of predation of its eggs and young. Measures include translocation of existing nests, creation of protected habitat including island refuges, protection and relocation of turtles, inclusion of a turtle ramp, design aspects to protect turtles from harm during operation of the dam, and beneficial outcomes from the research Centre.

### 2.22.4 Migratory Species within the Project area

In relation to the occurrence of significant habitat within the Project area, the following is noted:

- the Project area does not contain habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species;

- the Project area does not support habitat known to be of critical importance to any species at particular lifecycle stages;
- none of the species recorded (White bellied sea eagle, White Throated Needletail, Black Faced Monarch, Spectacled Monarch, Satin Flycatcher, Australian Cotton Pygmy-goose and Rofous Fantail), is considered to be at the limits of its range in the Project area; and
- none of the migratory species recorded is known to be declining in the wider Project area.

### 2.23 Transport and Access Arrangements

The Project will inundate a number of roads and thus alternative routes and upgrades have been proposed totalling 35.2 km of roads (10.9 km on existing alignments), ten new bridges (seven bridges replacing existing bridges) and also a number of intersections. In addition, the Bruce Highway realignment totals 11.5 km with eight structures.

The location of these road segments is presented in **Figure 2.3**.

The objective of transport and access arrangements for the Project is to maintain local and regional accessibility, including individual property access; preserving vital links to schools, towns and neighbourhoods and safe and convenient access for landowners to their properties.

Roadworks will cause some disruption and nuisance including:

- temporary traffic diversions;
- realignment of traffic lanes;
- partial road closures (for works staged to minimise any disruption to traffic flow or property access); and
- intersection operational changes.

Traffic management to maintain acceptable travel time and safe access to all local properties at all times will include:

- ensure an open lane at all times;
- inform the local authorities and the local community about traffic diversions and delays;
- install proper signage to make the drivers aware about road works and to guide them through the work area; and
- staging of the construction works such as to evenly distribute the traffic flows throughout the working hours and trying to avoid, where possible, operating during the peak hours.

#### 2.23.1 Road Capacity

Excluding works related to the Bruce Highway and the new dam access road, additional light vehicle volumes due to construction workforce travel are likely to be on the Bruce Highway (480 vehicles per day) and northern section of Gympie-Brooloo Road (360 vehicles per day). The effective provision of buses or car pooling for the construction workforce will significantly reduce these total vehicle flows, as would location of a construction camp at or near the works site.

Existing traffic volumes throughout the road network are less than 1,500 vehicles per day, thus these roads retain significant spare capacity to safely accommodate the additional light vehicle traffic volumes.

For heavy vehicle haulage, **Table 2.7** indicates the route, volume and period for heavy vehicles on the basis of 100% of aggregate is sourced from outside the construction site (this is an unlikely worst case scenario).

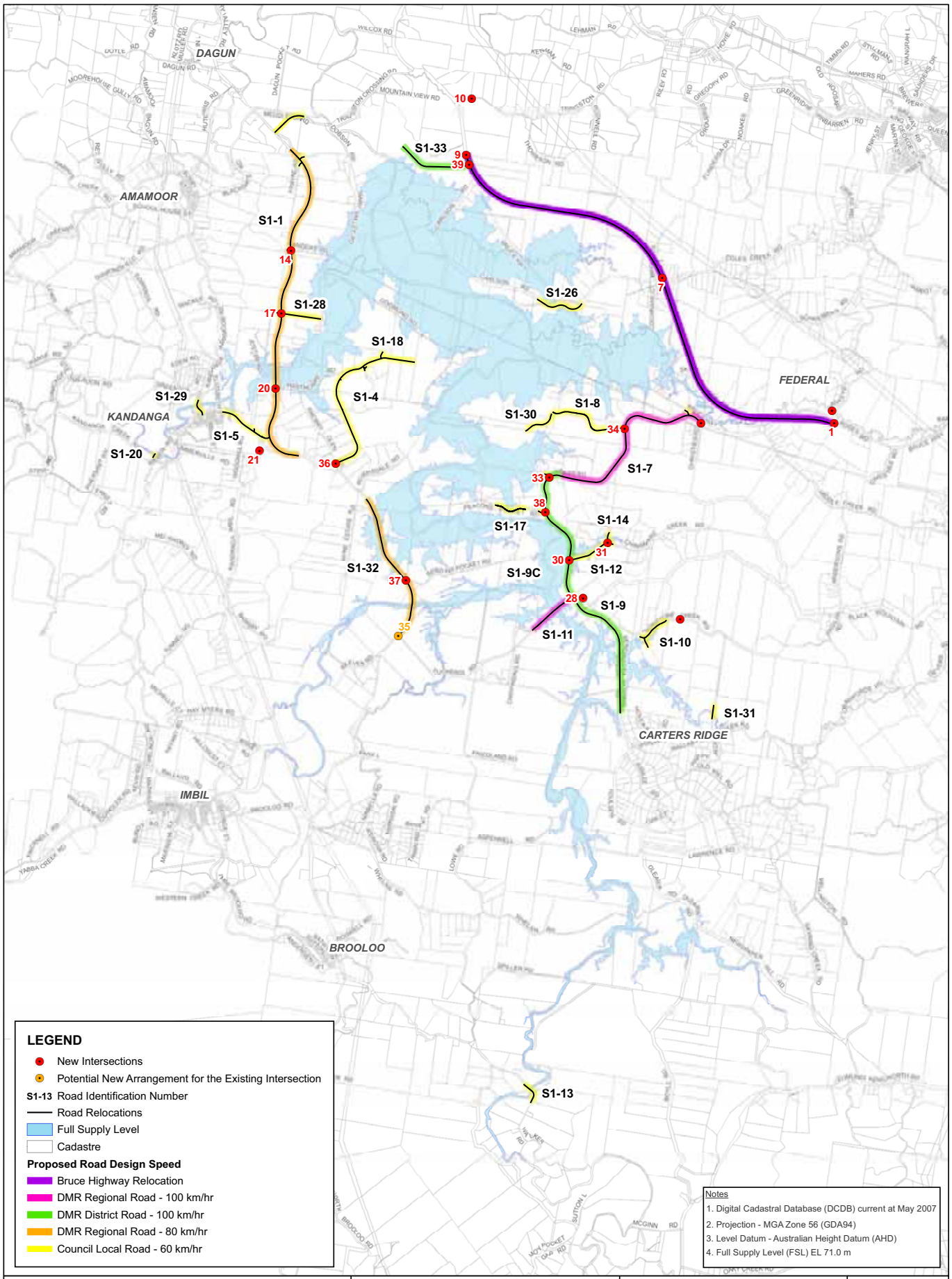
**Table 2.7 Summary of Heavy Vehicle Volume and Route (Aggregate and Rock)**

| Assumed Package | Existing Road Segments subject to Haul Route | Period[1] | Total Daily Volume[2] (vpd) |
|---|---|---|---|
| Meadvale Quarry | Woondum Road between Meadvale Quarry and Bruce Highway<br>Bruce Highway between Woondum Road and new dam access road | Oct 2008 - Dec 2009 (15 months) | 65 |
| | | Jan 2010 - Dec 2010 (12 months) | 75 |
| | | Jan 2011 - Sept 2011 (9 months) | 10 |
| Moy Pocket Quarry | Moy Pocket Road between Moy Pocket Quarry and Kenilworth - Brooloo Road<br>Kenilworth Brooloo Road between Moy Pocket Road and Imbil – Brooloo Road<br>Gympie – Brooloo Road (Mary Valley Road) between Imbil – Brooloo Road and western entrance to dam construction site | Oct 2008 - Dec 2009 (15 months) | 65 |
| | | Jan 2010 - Dec 2010 (12 months) | 75 |
| | | Jan 2011 - Sept 2011 (9 months) | 10 |

[1] Oct 2008 – Dec 2009 dam embankment aggregate only, Jan 2010 – Dec 2010 dam embankment + spillway + roads aggregate, Jan 2011 – Sep 2011 roads aggregate only

[2] Assuming 1 round trip=2vpd, aggregate truck load 16m$^3$ and 24 working days in a month

This additional heavy vehicle traffic will have only a marginal impact on the capacity of the roads.




QUEENSLAND WATER INFRASTRUCTURE PTY LTD

SKM

**FIGURE 2-3**

TRAVESTON CROSSING DAM EIS

PROPOSED NEW AND UPGRADED ROADS

DRAWING NUMBER

100570

DATE: SEPTEMBER 2007

### 2.23.2 Oversized Loads/Hazardous Material

An estimated 31 oversize loads will be required to deliver indivisible construction equipment to the dam site throughout the construction period. The origin of these loads is likely to be Brisbane. Standard permit approval processes and arrangements for these deliveries, such as escorting vehicles will apply on a case-by-case basis.

The transport of any hazardous or dangerous materials during the construction phase of the Project will be undertaken in accordance with the Australian Code for the Transport of Hazardous Goods by Rail and Road.

### 2.23.3 Pavement Impact

The additional road usage will impact on the pavement life of road segments. QWI will compensate relevant local governments for the reduced pavement lifespan caused by the Project in accordance with standard approaches.

### 2.23.4 School Bus Routes Impact and Mitigation Measures

During the construction period school bus trips could encounter longer than usual travel times due to lane closure or traffic diversions. Acceptable traffic flows will be maintained past the worksites on all bus routes and heavy vehicle movements will be, where possible, confined to outside student pick-up/drop-off times. The impact and mitigation measures for these affected services during the dam operations phase include:

- **P290** Service – Goomong Road to Kandanga State School. This bus route travels along Mary Valley Road and Goomong Road which will be inundated and the majority of the properties along Goomong Road are within the project area. The balance of properties which require school bus services, could be catered for by the P526 service, with a slight route deviation, using new road segments.
- **Carlson Road** Service travels along Bruce Highway and Carlson Road. Carlson Road will be fully inundated, however, a number of properties along the eastern end of Carlson road will remain. Should the school bus be required for these properties, access to Carlson Road can be gained from Bruce Highway by way of another road segment. The same bus route could cater for this area with an amended route.
- Routes **P1531** (Coles Creek Road to Noosa District School via Bruce Highway) and **S489** (Ironstone Creek Road/Chinamans Creek Road via Kenilworth Skyring Creek Road and Bruce Highway) will potentially encounter increased travel times during roadworks but there is no need for route changes. Additional safety mitigation measures will be included and actual work will avoid the school pick up and drop off periods.

### 2.23.5 Emergency Services' Impact

Several urban and regional offices of the Services (Police, Ambulance and Fire Brigade) are located within the region. There may be some delay as emergency vehicles need to slow down for works as well as a maximum increase of 2 minutes in travel time between some centres within the area, once works are complete.

A project reference group of community representatives will be formed prior to construction commencing to address any community needs including emergency services needs throughout the construction phase.

Upon construction completion the Project will have delivered a number of significant improvements to the existing transport network including major road upgrades, pedestrian and cycle improvements and bus stop enhancements.

### 2.23.6 Post Construction

Activities associated with the Project during the operational phase, maintenance personnel will be required to periodically attend to the dam infrastructure. Also, an increase in tourist trips is likely to occur as various recreation facilities (trails, canoe, boat and recreational fishing) will be provided. This additional traffic is not expected to have a significant impact on the surrounding road network during the operational phase.

#### 2.23.6.1 Travel Time Impact

Travel time analysis undertaken for both the existing network ('Without the Dam' Scenario) and the future road network ('With the Dam' Scenario) is shown in **Table 2.8**.

**Table 2.8 2011 Travel Time Comparison ('With the Dam' vs. 'Without the Dam') (Minutes)**

| To/From | Amamoor | Kandanga | Imbil | Brooloo | Carters Ridge | Cooran |
|---|---|---|---|---|---|---|
| Amamoor | - | 0 | 0 | 0 | +1 | 0 |
| Kandanga | 0 | - | 0 | 0 | 0 | +1 |
| Imbil | 0 | 0 | - | 0 | 0 | +2 |
| Brooloo | 0 | 0 | 0 | - | 0 | +2 |
| Carters Ridge | +1 | 0 | 0 | 0 | - | +2 |
| Cooran | 0 | +1 | +2 | +2 | +2 | - |

*Source: ARUP Traffic Network Model developed for the Bruce Highway (Cooroy to Curra) Strategic Planning Study

These results indicate that the revised road network resulting from the introduction of the Project has a marginal impact on the travel times between those centres located within the Mary Valley region.

#### 2.23.6.2 Road Impact

Comparisons of pre- and post-dam indicate:

- the realigned segment of Bruce Highway carries approximately the same volume of traffic;
- the segment of Bruce Highway immediately to the north of the realignment shows a drop of about 1,000 vehicles per day. This is complemented by an increase by the same amount on the northern segment of Mary Valley Road (as part of Gympie-Brooloo Road). The improved alignment of Mary Valley Road increases the road desirability in terms of through traffic;
- Traveston Crossing Road shows a decrease in daily traffic volumes of approximately 1,000 vehicles;
- Tuchekoi Road traffic volumes marginally increase by approximately 100 vpd;
- Kandanga Imbil Road traffic volumes remain the same; and
- the realigned Kenilworth Skyring Road has similar volumes.

The volume transfer between the roads within the revised road network is consistent with the proposed road hierarchy. Volume transfers to the new road links are consistent with the reductions in traffic previously using the abandoned or severed road links.

## 2.24 Cultural Heritage

### 2.24.1 Indigenous Cultural Heritage

The process for dealing with cultural heritage issues related to the construction and operation of the Project is dealt with in the Indigenous Land Use Agreement (ILUA) that QWI has executed with the Kabi Kabi People. The ILUA was authorised on August 11, 2007.

Assessment indicated fourteen specific places and a further six general areas as being proximal to the Project area. Three appear to be within the Project area (Dungall, Kandanga Creek and Kandanga Aboriginal Camp) while four (Kandanga township, Howah and the pathway from Howah to Belli creek, Tuncal and Bollier bora ground) are within several hundred metres of the inundation area.

A predictive model supports the potential presence of undetected ceremonial sites with the Project area. Stone artefact sites may occur anywhere within the landscape, although more likely in proximity to resources, particularly water. There is also the possibility of further burial sites in the area.

There is one example of a scarred tree site recorded on the ICHD located 1.7 km from any work area. This site is located next to a lagoon that contains large amounts of bungwall (*Blechnum indicum*), which formed the staple food of Aboriginal people of the hinterland. Additional scarred trees as well as camping areas are possible within the area. Stone arrangements, like bora rings, are both highly visible and will have attracted considerable interest and thus, if they have survived are likely to have been reported. None are known in the Project area or its immediate environs, however it is possible arrangements do exist.

Also relevant are the concerns raised by the Gubbi Gubbi People #2 in relation to the lungfish dala. The cultural significance of this species to the Indigenous community is accepted and acknowledged.

#### 2.24.1.1 Approach to Indigenous Cultural Heritage Management

QWI has opted to develop a Cultural Heritage Investigation Management Strategy (CHIMS) as part of the ILUA agreed with the native title parties. The CHIMS includes an overarching document that details the proposed management of Indigenous cultural heritage within the project area referred to as a Cultural Heritage Investigation and Management Agreement (CHIMA).

The following comprise the relevant stages of the CHIMA:

- Stage 1: Initial cultural heritage assessment;
- Stage 2: Management of the cultural heritage values during construction; and
- Stage 3: Post-construction heritage management measures.

### 2.24.2 Affected Non-Indigenous Cultural Heritage

Within the searched area one place was found to be currently included on the Queensland Heritage Register. This place is Kenilworth Homestead (QHR Place ID: 602043), located on the Mary River at least 6km to the south of the Project and as such will not be directly impacted.

No places are currently included on any of the reviewed state or Commonwealth heritage lists or registers within the Project area.

Queensland Railway Heritage Places Study (Ward and Milner, 1997) identified two places within the Project area. These were:

- Kandanga Creek Bridge, Kandanga; and
- Sections of the Mary Valley railway line.

The Mary Valley Rail line will not be affected by the Project. Kandanga Creek Bridge is subject to increased flooding however will not be structurally or operationally affected. QWI is, however, undertaking detailed structural surveys to provide certainty.

The Federal State School will require new access arrangements due to the Bruce Highway realignment. These works will consider heritage requirements.

Kandanga Farm, (which is possibly also known as Kandanga Homestead) is located within 500 m of the Project but not affected by the Project.

A list of all cultural heritage areas known or likely to occur in the Project area has been compiled as part of the EIS and provides for appropriate management or ongoing assessment. This has been included as part of the draft EMP.

## 2.25 Social Impact

### 2.25.1 Overview

The process and scope for social impact assessment has been informed by the ToR, review of social impact assessment guidelines[1], literature regarding social impacts of dams[2], and community responses to the announcement of the Project. The area surrounding and within the inundation area forms the primary Project area for social impact assessment.

The impact assessment was conducted some 12 months after the Project was proposed, during which time voluntary property purchase and other effects began. The response to the announcement and subsequent change events (e.g. property purchase) have been experienced by individuals and communities as positive, neutral or negative depending on circumstances, vulnerabilities and attitudes to the particular change.

The assessment has not specifically addressed the SEQ scale benefits associated with improved security of water supply. These benefits are very significant and are the core purpose of the Project. These benefits do not require mitigation or enhancement therefore the study concentrated on the local and regional scale impacts directly related to the Project.

### 2.25.2 Social Context

In combination, the Mary Valley and adjacent communities are:

- liveable and socially sustainable communities where good access to local social infrastructure, the physical environment, community networks and interdependencies between towns and rural localities contribute to support quality of life and strong communities;

[1] International Association of Impact Assessment (2002) International Principles for Social Impact Assessment, by Prof. Frank Vanclay, University of Tasmania;
[2] World Commission on Dams (2000), The Social Impact of Large Dams: Equity and Distributional Issues; and World Commission on Dams (2003), Environmental and Social Assessment for Large Dams.

- already experiencing change due to subdivisions of rural properties, housing market and household formation trends, and the inflow of lifestyle or 'tree change' residents although at a rate seen as generally compatible with the area's community values;
- rich in community networks, with high community capacity with significant numbers of community organisations, volunteer programs, networks or communities attached to schools; community and volunteer networks, community groups and personal networks; and
- stable, well-functioning and sustainable, and the community stability strongly influences their economic stability and have a long-term demonstrated ability to manage current and future developments within the constraints of limited resources, and within the ebb and flow of seasons.

However, whilst community networks are in good supply, few of the facilities are well equipped or resourced to respond to demographic change and growth and with a small population many are stretched and rely heavily on volunteers for support and funding.

The community is also impacted in its capacity to adjust and benefit from change by:

- low levels of social and economic resources in most localities. Most local communities have been affected, economically and socially, by macroeconomic reforms, the drought and demographic change. This has affected some households' well-being (due to stress, unemployment or reduced financial resources); and
- the cost of housing has increased significantly over the past five years. In Cooloola, median home purchase costs required around 32% of median household weekly income in 2001, and 56% in 2006. This indicator provides stark evidence of a sharp decrease in affordability and potential mortgage stress.

### 2.25.3 Social Responses to the Project

The Project is seen by many people to be accelerating the rate of change, and to be placing pressure on community values or the area's future sustainability. Positive effects on social capital identified in EIS consultation workshops and submissions include:

- people have been motivated to become more involved in community activities related to the Project;
- an increase in community care for other residents and the environment;
- heightened awareness of the value of community;
- formation of new community organisations, networks and relationships; and
- networks have strengthened, and the recently opened Kandanga Information Centre (partly assisted by QWI) is evidence of a strong community spirit.

Perceived negative effects on social capital since the announcement of the Project include:

- conflict leading to breakdowns in relationships and strains on organisations;
- social withdrawal, due to depression or a wish to avoid discussing the Project;
- reduced core membership of community organisations such as sporting clubs, facility committees and the CWA branch, due to property purchases or other choices to leave;
- diversion of energy from other community projects to action regarding the Project; and
- reduced civic trust due to the perceived failure of government representatives to take account of local knowledge and wishes.

For people opposed to the Project, information provided by the Queensland Government and QWI has not, and may never satisfy all their concerns and questions. Some interpretations of the available information have created misunderstandings and misinformation. This also has contributed to uncertainty and increased effects on quality of life. There is a lack of trust, and possibly a lack of understanding, in the assessment process from some members of the community.

This, together with the offer to purchase and leaseback all properties within the Stage 2 impact area which was made in response to community concerns, has contributed to many community members responding to both Stage 1 and Stage 2 impacts. This is despite the fact that QWI and the Queensland Government have clearly stated that Stage 2 would not proceed, if at all, until 2035.

Since the announcement of the Project in April 2006, additional community services, programs and facilities have been established to provide access to information about the Project and support services for residents and businesses. The Queensland Government, through the Community Futures Taskforce, established a One Stop Shop in Kandanga, which provides an information point, access to a counselling service and a community development officer. The counselling service is under the auspices of Lifeline Sunshine Coast, whilst the co-ordinator and community development officer are employed by Department of Communities.

A Regional Services Forum comprising Queensland Government agencies has also been established to facilitate government responses and support community development activities. To date these responses include:

- Queensland Rural Adjustment Authority (QRAA);
- Traveston Crossing Dam Business Adjustment Scheme;
- Computer training Department of Employment and Industrial Relations (DEIR);
- Increased provision of farm financial counselling (DPI&F);
- Studies in future investment opportunities in the food and fibre industries (DPI&F);
- Funding for Valley Ranges Soccer Club fun day (DLGSR);
- Four school residential recreational camps at Currimundi Active Recreation Centre (DLGSR);
- Student support (Education Qld);
- Kandanga Information Centre (QWI/Friends of Kandanga)
- Kandanga public toilet facilities (QWI/Cooloola Shire Council);
- School bus laybys (QWI/DMR);
- Worker Assistance Program (DTRDI); and
- Mary Valley Tourism Project (DTRDI).

The Traveston Crossing Dam Business Adjustment Scheme provides eligible businesses adversely affected by the announcement of the Project with an avenue to seek financial assistance for business advice, restructuring or exit strategy advice. The Business Exit Assistance provides a one-off payment to eligible businesses, where as a result of the announcement of the Project or subsequent construction and operation requirements, exiting the business is identified as the only realistic option.

### 2.25.4 Social Impacts

Properties directly affected by the Project are subject to purchase offers and a leaseback option at a special rate for owners to remain on their property until 2011. All sales have been voluntary. Other properties that have purchase offers for a possible Stage 2, are in response to community request to provide certainty for their future. As a consequence, owners of 'Stage 2' properties have been offered volunteer purchase arrangements and are able to remain on their property until 2035 under a lease back scheme. As at 30 September, QWI has reached agreement to purchase 65% of properties required and 63% of these properties have been leased back to the original owner, while the balance has been leased to a third party.

Consultation and input from the community has identified a number of issues of concern. Many of these concerns are strongly felt whilst some members of the community also perceive beneficial outcomes as follows.

### 2.25.5 Property Impacts

Property impact concerns of the community include:

- changes to property values, since the commencement of the land purchase scheme;
- lease-back arrangements for owners of both Stage 1 and Stage 2 properties;
- restrictions upon the use of land within the buffer area;
- potential impacts associated with the purchase of properties comprising community uses such as the Kandanga Bowls Club; and
- stress associated with the land purchase process, relocation of friends and family, and effects on residents' health.

Increases in housing prices across the primary Project area were strong from 2003 and have since escalated indicating sales purchases for the Project have not adversely affected the property values, and have probably contributed to this market increase. Prices recorded for the Kandanga and Carters Ridge areas over the past twelve months compare well with other rural, or 'lifestyle' localities and many urban areas in SEQ (**Table 2.9**).

**Table 2.9 Recent Land Price Ranges, Selected Areas, 2007**

| | Urban Dwellings (<2,000 $m^2$) | Rural Residential (<3 ha) | Rural 'Lifestyle' (<20 ha) | Rural (>20 ha) |
|---|---|---|---|---|
| Amamoor | 270,000 – 300,000 | 340,000 | 410,000 – 620,000 | 425,000 – 1,200,000 |
| Belli Park | | | 495,000 | 645,000 – 678,000 |
| Bollier (Imbil) | | | 495,000 | |
| Carters Ridge | | 289,000 - 534,000 | 405,000 – 690,000 | |
| Imbil | 195,000 – 249,000 | 495,000 | 400,000 – 445,000 | 445,000 – 549,000 |
| Kandanga | 260,000 (note 1) | 345,000 – 350,00 | 579,000 | |
| Beaudesert Shire | 240,000 – 340,000 | 550,000 | 729,000 – 1,380,000 (note 2) | 3,100,000 (note 3) |
| Boonah Shire | 299,000 – 350,000 | 249,000 – 425,000 | 429,000 – 875,000 | |
| Esk Shire | 220,000 – 265,000 | 350,000 – 649,000 | 345,000 | 560,000 |
| Gatton Shire | 250,000 – 260,000 | 305,000 – 475,000 | 395,000 – 675,000 | 580,000 – 850,000 |

Source: www.realestate.com.au *(August 2007)*

Note 1: excludes 'Kandanga House" listed at $495,000, and 80 Main Street listed @ $330,000

Note 2: Price for large colonial house with extensive enhancements (tennis, pool, A/C) on 10 acres

Note 3: Price for 100 acre thoroughbred complex and spelling paddocks

Rates revenue loss is proportionately negligible. Cooloola Shire rate revenue will reduce by some $298,000 ($2007) in total (or less than 1% of monies raised through rates) For Noosa and Maroochy shires, rate revenue will reduce by some $10,000-$20,000 in total for each Shire.

With the property discounted lease-back scheme, 63% of the purchased properties are still occupied by the former owners whilst occupancy of QWI owned properties is 97%, allowing properties to remain in use. For owners of properties identified as required for a possible Stage 2, the lease-back scheme provides access to the capital value of their property while offering a concessional lease rate in return. This allows the owners to access and use capital which otherwise is tied up in their land, while still deriving the benefits of property use over an approximate 28 year period (i.e. 2007 to 2035) at a discounted rate.

The establishment of a construction accommodation camp would alleviate to a large extent the potential for short term stress on the local housing supply in the Mary Valley and adjacent communities. Also, a landuse strategy is underway by the OUM to identify land in Imbil/Brooloo and Kandanga for residential development.

Population analysis undertaken for the Project, 'with' and 'without' the Project, indicates a short term population loss of approximately 205 people, a very similar population level reached by 2016, and growth gain in the longer term with people attracted to the area through new recreation, business and amenity opportunities.

Local business will benefit from the injection of significant expenditure into the local economy through employment, housing and construction-related demand for goods and services. The Queensland Government is extending a range of programs to ensure local business and workers are able to benefit from the Project. To date, over 500 businesses have registered their interests for business opportunities related to the Project with QWI.

Kandanga Community Facilities (the Kandanga Memorial Bowls Club, swimming pool, recreation grounds and Kandanga Cemetery) are not impacted by the Project at FSL. The Project will increase the susceptibility to flooding of these facilities. This has caused anxiety, particularly related to the cemetery. Whilst a standard engineering mitigation is possible (grassed verge) to protect the cemetery, because of ongoing community concerns, QWI is prepared to consider alternative mitigation measures put forward by the community.

In regard to the Kandanga community centre, the proposed relocation and upgrade of the facilities through a Memorandum of Understanding (MOU) with QWI and relevant sporting clubs, would result in a substantial beneficial outcome with long term community benefits. It is acknowledged the proposal may not be supported by all residents of the town. Discussions with other facility owners and committees regarding relocation or re-provision of facilities including the soccer grounds swimming pool have also been initiated by QWI. In addition to the possible relocation of community facilities in Kandanga, planning is being undertaken for the enhancement of Kandanga's main street, the upgrade of infrastructure and the identification of new residential areas.

The planned realignment of the Bruce Highway would remove direct frontage of the Federal State School to the highway. This would provide for an alternative access to the school, improving safety access. Because of modern acoustical standards, acoustical mitigation measures would be incorporated by DMR after consultation with the school. Neither the school or hall buildings will be affected by flooding in a Q100 event.

Community facilities in other townships such as Imbil, Brooloo and Carters Ridge/Ridgewood, would not be affected by the Project FSL, or by additional flooding as a result the Project.

Some areas will experience road realignment works. These will be temporary and access will be maintained. Following road realignments, local access and connectivity in the Mary Valley would be improved with better pavements, new bridges and safer intersections.

For emergency access, once works are completed, there will not be any significant increase in travel times and in many cases, reduced travel times as a result of better road surface and safer intersections in many areas. Some areas such as Federal and Carters Ridge are prone to bushfires and work on both local roads and highways would need to maintain good access for fire protection services. The effect of road relocations and access changes for ambulances and other emergency services originating from Cooroy and Gympie would also need to be reviewed when road alignments and designs are finalised.

### 2.25.6 School Enrolments and Recreation

Whilst some children have left the local schools due to property purchases for the Project, children from newly tenanted QWI properties have enrolled, keeping enrolments stable overall. **Table 2.10** shows school enrolments between February 2000 and February 2007.

**Table 2.10 Local School Enrolments 2006-07**

| Year | Kandanga Creek SS | | Kandanga SS | | Federal SS | | Mary Valley College | |
|---|---|---|---|---|---|---|---|---|
| | Enrolment | % change | Enrolment | % change | Enrolment | % change | Enrolment | % change |
| 2000 | 44 | | 77 | | N/A | | 212 | |
| 2001 | 47 | 6.8 | 69 | -10.4 | | | 206 | -2.8 |
| 2002 | 49 | 4.3 | 65 | -5.8 | | | 185 | -10.2 |
| 2003 | 51 | 4.1 | 57 | -12.3 | | | 205 | 10.8 |
| 2004 | 45 | -11.8 | 57 | 0.0 | | | 218 | 6.3 |
| 2005 | 35 | -22.2 | 45 | -21.1 | | | 201 | -7.8 |
| 2006 | 30 | -14.3 | 45 | 0.0 | 95 | | 194 | -3.5 |
| 2007 | 24 | -20.0 | 53 | 17.8 | 111 | 16.8 | 176 | -9.3 |

Source: Education Queensland (www.education.qld.gov.au)

The construction workforce and families would likely increase demands on community services, schools, playgroups etc. with demand likely to be expressed in Gympie rather than the Mary Valley. This demand would need to be monitored, and provision of on-site or local health services considered. The Project would likely have positive benefits for sport and recreation clubs in the Mary Valley, through an increased participation and membership base drawn from Project workers and their families.

There will be no discernible impact on commercial or recreational fishing in the Mary River, its estuaries or the Great Sandy Strait.

The Project would provide an increased level of recreational infrastructure, including enhanced access to water based sport, boating, trail based recreation (i.e. horse, bike or walking trails), and picnic and BBQ facilities located adjacent to the storage, or lake with flow-on benefits to the local tourism industry and emerging economies.

The dam would be available for the following water-based recreational uses:

- canoe trail on the lake linked to shore-based facilities including camping and hiking tracks;
- sailing, including launch facilities;
- boating in a zoned area of the storage; and
- fishing, both shore-based and from boats.

Adjacent to the storage, nature-based recreational activities are likely to include:

- equestrian trails (potentially linked to the National Trail);
- hiking tracks linked to the canoe trail and equestrian trail facilities;
- touring cycle facilities, possibly associated with the Mary Valley Rattler;
- mountain biking tracks or off-road facilities accessed from a main spine trail / track;
- river-based camping and picnicking/ day stay facilities (e.g. constructed landings, water supply, toilet facilities, barbecue facilities and rubbish removal); and
- activities associated with the Information Centre at the Freshwater Species Conservation Centre.

The Mary Valley Heritage Railway (the 'Valley Rattler') is unique in the region's tourism market. Its value to the local economy could be increased with supplementary developments such as galleries, crafts and skills sharing spaces near the Mary Valley Rattler's stations. The planned upgrades to some stations will assist with making the attraction more available to the elderly or mobility impaired.

### 2.25.7 Aboriginal People's Contemporary Values and Uses

The Mary River encompasses the traditional lands of the Kabi Kabi people (sometimes known as the Gubbi Gubbi people). While the ability of Indigenous people to access the Mary River and places of importance may have been constrained by development within the Mary Valley before the Project announcement, they have maintained their cultural and spiritual links to the Mary River and surrounding land and return regularly to renew their connection to the land, for family gatherings and fishing. Being able to access land is also important in relation to the sharing of knowledge between older and younger generations, as much of the knowledge sharing about the culture and history is passed on through practical measures (e.g. being able to show places and areas of significance to younger generations).

### 2.25.8 Health and Safety Impacts

The demands of coping with sudden changes perceived as negative have demonstrable effects on stress levels. The Mary Valley population has already experienced other events which have caused stress including the drought, dairy deregulation, regional forestry agreements and the planned highway upgrade. In some cases, existing stress may have been compounded by stress impacts relating to the Project. Anecdotal evidence from the Gympie Mental Health Team indicates prior to the Project's announcement, the rate for presentation to the Gympie Hospital for mental health issues from the Mary Valley area was about 3 in 1,000 people, which is the benchmark for the District. In the post-announcement period, the following effects were observed:

- March 2007, some eleven months after the announcement of the Project, the rate of presentation from the Mary Valley area was around 12 in 1,000;

- July 2007 the rate of presentation of adults from the Mary Valley had returned to 2005 levels, but active management of several people continued;
- the rate of presentation of young people from the Mary Valley with mental illness increased after the Project's announcement, with some over-representation of children and young people in mental health treatment remaining; and
- the Mental Health Unit noted an increase in presentation of people from the Mary Valley with psychological and psychiatric conditions a few weeks after each event in the Project process.

The need for continued adequate resourcing for primary and mental health services was identified by Government agencies.

The primary Project area is regarded as a safe community. Crime rates remained stable in the period following the announcement. There is no evidence to indicate increases in conflict or family violence in Queensland Police, Department of Communities or Department of Child Safety records since the Project announcement.

The inclusion of flood control gates would provide considerable flood mitigation benefits to the town of Gympie, and a smaller benefit to the city of Maryborough and represents a significant social, safety and economic benefit.

For communities downstream, acknowledging that the Project would not affect environmental flows or water allocations, residents in downstream areas and adjacent communities are not expected to experience significant negative impacts on community well-being or sustainability.

### 2.25.9 Mitigation Measures

It is likely most impacts will trend from negative to positive over time. Many existing residents would experience negative impacts on community values such as connectivity and harmony, whilst many existing and future residents would benefit from increased amenity and employment options. A substantial number of mitigation measures to offset negative impacts has been recommended in the EIS, and many Queensland Government measures have already been implemented.

In regard to QWI commitments, it is believed the commitments listed below will not only offset most actual negative impacts but will result in substantial beneficial outcomes. This level of parallel investment in an infrastructure Project is unprecedented in Queensland and will result in significant beneficial social and economic impacts to the local community as well as SEQ.

Mitigation strategies recommended for consultation and implementation by QWI are outlined below in **Table 2.11**, **Table 2.12** and **Table 2.13**, and include:

- Kandanga regeneration;
- Mary Valley community and economic development; and
- regional communities engagement.

**Table 2.11 Kadanga Regeneration**

| Strategy 1 | Kandanga Regeneration |
|---|---|
| Pre-approval | ■ Continue to provide clear, factual information about:<br>■ the progress of the EIS and approval processes;<br>■ construction program;<br>■ extent of land purchases and road reconstruction requirements;<br>■ progress with land use planning;<br>■ reconstruction and community development initiatives; and<br>■ training, employment and enterprise programs. |
| Post-approval | ■ Undertake consultation to develop:<br>■ mitigation strategies (early and ongoing);<br>■ community engagement strategies;<br>■ environmental management measures; and<br>■ monitoring processes including community involvement.<br>■ Locate construction camp to ensure community values such as quiet and peaceful amenity and family-oriented communities are not affected.<br>■ In designing, planning and siting the construction camp, consider its potential future use (e.g. affordable housing, recreational use, functional open space)<br>■ Investigate provision for upgraded sewerage, water supply and road access for town centre and adjacent residential/business areas |
| Construction Management | ■ Ensure residents in properties adjacent to the construction site are aware in advance of construction activities.<br>■ Consult with Queensland Police, Queensland Ambulance, Queensland Fire and Rescue Service and Queensland Transport regarding road safety management for the Mary Valley during construction.<br>■ Ensure construction traffic management planning to prevent any safety concerns regarding shared use of roads.<br>■ Ensure all construction employees and contractors are aware and comply with the Traffic Management Plan for the project.<br>■ Investigate and take appropriate action on all community complaints regarding road safety pertaining to the project.<br>■ Provide a complaints response system in relation to project construction issues, including:<br>■ promotion and provision of phone contact with construction management staff during hours of construction;<br>■ a follow up procedure which notifies complainants within 24 hours of the intended response to the issue raised; and<br>■ where appropriate, public reporting of complaints resolution. |

| Strategy 1 | Kandanga Regeneration |
|---|---|
| Town Centre Development | ■ Negotiate, seek funding and develop an integrated community recreation facility (including but not limited to bowling club, swimming pool and sporting fields)<br>■ Where appropriate, develop pedestrian and bike paths between school, rail station, town centre, recreation complex and Kandanga Creek<br>■ Investigate opportunities for establishing tourist stop-off facilities in a designated location, consistent with the proposed sustainability measures<br>■ Implement recreation planning proposals<br>■ Assist with refurbishing Kandanga community hall, possibly as part of an integrated community centre, with safety fencing to support child and family services provision<br>■ Investigate existing and future need for residential aged care units, to guide implementation in advance of 2011 lease-back completion<br>■ Issue invitation to not-for-profit providers to tender to build and operate aged care accommodation units on QWI owned land<br>■ Work with relevant community members and OUM/ CFT to implement preferred cemetery options<br>■ Consult with Mary Valley Heritage Railway Society and Kandanga, Imbil and Amamoor station committees regarding station/platform improvements including disability access<br>■ Consult with Qld Police and DES to address construction and operation planning issues (e.g. emergency response scenarios)<br>■ Consult with Kandanga school community and DETA regarding:<br>  ■ use of impoundment area and interpretive centre; and<br>  ■ provision of access to water sports and recreational facilities. |
| Social capital and Sense of community | ■ Provide and source funding and in kind assistance to key initiatives by incorporated community, sporting, recreation, education and cultural groups<br>■ Investigate potential to re-use existing housing and community buildings within Kandanga and the Mary Valley |
| Employment, Training and Enterprise | ■ Work with relevant agencies and business groups to develop an integrated information and support program to assist repositioning of businesses to new opportunities<br>■ Support a promotion campaign for Mary Valley and adjacent community businesses (non-Project/construction supply related) targeting the regional market |
| Housing | ■ Consider use of dwellings purchased by QWI for construction workforce accommodation<br>■ Where suitable, relocate dwellings at the completion of the Stage 1 lease back period to elsewhere in the Mary Valley<br>■ Investigate the feasibility for flexible housing types within the construction camp to cater for both single workers and workers with families |

**Table 2.12 Mary Valley Community and Economic Development**

| Strategy 2 | Mary Valley Community and Economic Development |
|---|---|
| Managing Landuse Change | ■ Work with local catchment, farming and land care groups to ensure scenic, environmental and passive recreation values of riparian area sustained and enhanced where possible<br>■ Implement recreation planning proposals developed as part of the EIS |
| Connectivity | ■ Integrate consultation inputs into road planning and access arrangements<br>■ Ensure provision of bus facilities (pull in bays) to support school, community and tourism purposes during construction and for the longer term<br>■ Ensure appropriate traffic management during construction to prevent any safety concerns regarding shared use of roads |
| Strengthening Community Capacity | ■ Maintain a community engagement process for the duration of the construction phase<br>■ Provide assistance to support for Building Rural Leaders program (DPI&F)<br>■ Lead and support development, with community engagement, of interpretive/ education centre.<br>■ Engage Mary Valley and adjacent residents in delivery of recreation planning initiatives |
| Strengthening Farming/ Enterprise Capacity | ■ Develop co-operative relationships with land owners and consult on land management practices and emerging and alternative approaches to sustainable agriculture<br>■ Maintain maximum possible flexibility in relation to use of existing farming land and redevelopment of other farming uses on remnant land<br>■ Facilitate Food and Fibre Futures Initiative with DPI&F<br>■ Assist Cooloola Economic Development Officer in promoting local enterprise development in the Mary Valley |
| Rural Tourism Strategy | ■ Consult with Local/Regional Council regarding identification of potential site for 24 hour stopover facility, and initiate commercial partnership for development<br>■ Plan for potential public tourism facilities as outlined in the recreation planning strategy<br>■ Assist the Cooloola Regional Development Bureau (CRDB) and other regional entities with tourism development plans<br>■ Work with local catchment, farming and land care groups to ensure scenic, environmental and passive recreation values of riparian areas are sustained and enhanced where possible |

**Table 2.13 Regional Communities**

| Strategy 3 | Regional Communities |
|---|---|
| **Information** | ■ Provide clear, comprehensive information to communities in upstream and downstream LGAs on:<br>  ■ water supply, environmental flows and water rights<br>  ■ progress of the EIS and approval processes<br>  ■ training, employment and enterprise programs<br>  ■ environmental management<br>  ■ consultation<br>  ■ monitoring |
| **Consultation** | ■ Meet with downstream Local Governments, community members and businesses, to:<br>  ■ explain the forward process<br>  ■ discuss water supply, water rights, environmental flows and other related matters<br>  ■ provide for ongoing communication with regional stakeholders as identified through consultation<br>  ■ co-operatively address outstanding concerns, and explore potential benefits in downstream communities. |

Recreation planning is being undertaken by QWI to enhance potential benefits for amenity, recreation and tourism.

A number of tourism and recreation-based mitigations (**Table 2.14**) are proposed to allow:

- the replacement of recreational facilities impacted by the Project to occur in a coordinated manner, and to meet the community's current and future sport and recreation needs;
- impacted communities to restructure and adapt to the predicted changes of the Project, while accommodating and enhancing existing values;
- opportunities for sustainable economic development in the Mary River Valley, building on tourism and recreation-based activities;
- opportunities to enhance existing community patterns and economic ventures with a recreation-based theme; and
- the potential to optimise the strategic advantages of the Mary River Valley in terms of its physical setting and natural values, and its location relative to a range of markets.

The proposed tourism and recreation mitigations generally focus on those communities that would be impacted by the Project. Some would also benefit communities in the broader Mary Valley region and adjoining local government areas.

**Table 2.14 Indicative Implementation Plan – Tourism and Recreation Initiatives**

| **Mitigations (Works)** | **Responsibility** |
|---|---|
| Selected multi-purpose recreation trails (e.g. walking, cycling, equestrian). Trails mostly alongside current local road reserves.<br>Work required for signage and road marking | QWI – with input from local groups & employment schemes |
| Urban Nodes – visitor facilities, day use etc | |
| Special purpose areas – western day use, eastern day use & boating | |
| Landscape development – all areas | |
| Other works<br>• Mary River canoe trail<br>• Integrated tourist signage<br>• Mary Valley Rattler – upgrades & facilities<br>• Mary Valley Mountain Bike Championship Course | QWI – with input from local groups & employment schemes |
| **Mitigations (Programs)** | **Duration and Responsibility** |
| Events coordination | 5 years – QWI through Cooloola Regional Development Bureau (CRDB) |
| Events sponsorship | 3 years – QWI responding to applications |
| Environmental education – local and tourists | 3 years – QWI with local organisations |
| Area marketing & development | 5 years – QWI – through CRDB |
| Mary Valley tourism & recreation data base (web access) | 1 year – QWI – through CRDB |
| Tourism Infrastructure Development | 3 years – QWI in response to applications to a registered community fund |
| Tourism Product Development | |
| Community Recreation & Development (application based through a community fund) | |
| **Mitigations (Development)** | **Duration and Responsibility** |
| Land use planning for tourism development. | OUM and Cooloola Shire Council |

However, for some residents, the only way to resolve uncertainty and perceived threats to security and local values is for the Project to not to proceed. An on-going commitment to information, consultation and negotiation is required to address impacts on community values, including relationships and trust in government experienced during the pre-construction period.

## 2.26 Economic

The following provides commentary on the localised economic implications and mitigation measures.

The Project will generate transient (approx. three years) and longer term opportunities for the local and regional communities through the injection of capital during construction of the Project and more enduring benefits though a significant number of local capital investments in the order of $50 Million, additional and more diverse skills base of the local workforce, increased competitiveness of local business and increased diversity of business opportunities.

The Project is not without negative economic impacts, particularly until 2009 before construction starts. A number of government programs have been initiated to assist local businesses in this period and to position business to leverage the opportunities the Project and associated investment will generate. These include assistance to relocate and to purchase new properties, strategies to identify future scenarios and opportunities for retaining and stimulating agricultural development, development of realistic and practical business opportunities, business assistance packages, job training programs, relocation assistance and wage subsidies.

A summary of impacts as they occur over time is shown in **Table 2.15**.

**Table 2.15 Impacts Over Time**

| Time | Event |
|---|---|
| Announcement to 2009 | ■ Adverse economic impacts to local businesses most pronounced in this period as businesses relocate. Mitigation strategy is to utilise State assistance during this time; and<br>■ Local businesses to utilise discounted leaseback rates. |
| 2008 | ■ DPI&F implements agricultural strategies. Completion by December 2011;<br>■ TRDI implements Mary Valley Economic Development Strategy. Completion by 2010; and<br>■ Qld Tourism implements Tourism Action Plan – completion expected by 2010. |
| 2009 | ■ Construction starts;<br>■ Up-skilling of labour commences;<br>■ Workforce arrives in the valley and increases demand for local goods and services;<br>■ Local and regional businesses begin supplying goods and services for Project construction; and<br>■ Adverse economic impacts to local businesses begin to subside. |
| 2010 - 2011 | ■ Strategies by DPI&F (Agriculture), TRDI (Economic Development Strategy) and Tourism Qld well advanced, and in some cases completed and programs underway; and<br>■ Construction underway and stimulating capital into local economy. Flow-on effects from up-skilling, employment, and supply of goods and services. |

| Time | Event |
|---|---|
| 2012 | ■ Project Operational;<br>■ Strategies by DPI&F (Agriculture), TRDI (Economic Development Strategy) and Tourism Qld completed and programs underway;<br>■ New businesses attracted by these studies establishing;<br>■ Forestry plantations underway (approximately 22 yr life time);<br>■ Local businesses transitioned and operating within new economy; and<br>■ Yield commences supplying benefits to Queensland. |
| 2013 | ■ Dam providing full yield with anticipated benefits to welfare, GRP, GSP, aggregate unemployment and capital stocks materialising;<br>■ Continued ramp up of new businesses to the local area resulting from strategies and programs implemented by Government and interaction with existing local community strengthening; and<br>■ Adverse impacts to local community anticipated to be minimal. |
| 2034 | ■ Forestry plantations mature, staged harvesting. |

A summary of the positive and negative impacts of the Project divided between construction and operation stages follows.

### 2.26.1 Construction Stage

Positive impacts generated during the construction stage include:

- increased real GRP to SEQ that peaks in 2009 at approximately $219 Million;
- increased aggregate employment in SEQ that peaks in 2009 at approximately 1745 jobs;
- direct employment opportunities for around 500-600 skilled and unskilled workers on a temporary or short-term basis (up to 3 years);
- increased demand via the construction workforce for local goods and services within the Mary Valley and surrounding regions of the Wide Bay and Sunshine Coast;
- training and upskilling of the existing workforce within the Mary Valley and the surrounding regions which will enhance their capacity to access subsequent employment opportunities;
- opportunities for suppliers of goods and services required for construction of the Project which is expected to benefit 600 businesses of which 240 are anticipated to be local;
- stimulate the Mary Valley economy and surrounding areas through land acquisition as equity previously held in land and other farm assets is made available through their sale; and
- competitive leaseback rates at $19.23 per week until June 2011 (Phase 1 rates) and 25% of market value until 2035 (Phase 2 rates).

Negative impacts to local industry and businesses actually commenced from Project announcement and include:

- loss of approximately 1.7% of the total amount of productive agricultural land in the Mary Valley (representing 4.05% of Queensland dairy production, 0.041% of beef, 0.15% of horticulture and 0.03% of other industries), equating to a gross economic impact of approximately $29 Million.
- total 100 businesses (approx. 60% agricultural and 40% other) required to relocate;
- closure of a proportion of those businesses; and

- indirect impacts to businesses that are reliant upon directly impacted businesses.

Mitigation strategies include:

- commence the Project as quickly as possible so that the lead-in impact period is as short as possible;
- business disturbance payment paid to directly affected businesses and commenced from 2006 that includes the future relocation costs of the business to a suitable new site, a personal disturbance payment to cover legal costs and minimal personal removal costs, and the stamp duty on the new property;
- Business Assistance Scheme (BAS) for businesses indirectly affected that assists the development and implementation of strategies to improve their ongoing viability. As at 27 July 2007 there were 44 applications to the BAS, of which seven were for exit assistance;
- Worker Assistance Program which provides access to training, job preparation, relocation and wage subsidy assistance for eligible workers who have lost their jobs as a result of the planning or implementation of the Project. As at 27 July 2007 there were eight applications for assistance from workers.
- Food and Fibre Futures Strategy;
- capacity building through assistance, research and development, subsidies, field trials, farm management education and training, and workshops;
- reducing knowledge gaps through feasibility studies and on farm trials;
- encouraging entrepreneurial skills through marketing, provision of technical advice and business and market development; and
- new industries via feasibility studies for infrastructure to allow provision of locally allocated water downstream of the Project.

### 2.26.2 Operation Stage Impacts

Positive impacts at the local level (macro level summarised in Section 1.10) during the operation stage includes:

- long-term flow-on benefits to businesses within the region that supplied goods and services for Project construction which resulted in increased capital expenditure and hence an improvement in the on-going viability and capacity of the businesses;
- positive benefits to local tourism operators that result from the Project inundation area providing for a wide range of recreational activities, including bed and breakfast, fishing, swimming and boating, hiking, camping and horse riding;
- planting of native timber plantations in land acquired for the Project which will:
  - make a significant contribution to the Government's policy objective of transitioning the native timber industry from State forests to plantations over a 25 year timeframe;
  - deliver carbon sequestration benefits that could off-set those emitted during dam construction;
  - establish permanent vegetation through environmental plantings for biodiversity and land management; and
  - contribute to the local economy, which is heavily and traditionally reliant on the timber industry;
- opportunities for schools and private outdoor education organisations to access a wide range of educational opportunities associated with the Project including:
  - Freshwater Species Conservation Centre (FSCC) and its incorporated Interpretive Centre;

  - aquatic environments of the dam and nearby rivers and streams;
  - refuge islands, turtle nest banks, fishway, and turtle ramp;
  - catchment management initiatives, timber plantations, and areas of natural forest; and
  - recreational areas around and within the dam;
- mitigation of adverse flood peaks and flood levels downstream of the Mary River Valley that have previously resulted in roads and property damage estimated in excess of $25 Million; and
- development of a multi-sport/recreational facility at Kandanga.

### 2.27 Hazard and Risk

An analysis of potential hazards and risks, adopting an "all hazards" approach identified hazardous activities. The preliminary risk assessment undertaken for the Project as part of the preliminary design (Sunwater, 2007) has used the relevant ANCOLD Guidelines on Assessment of the Consequences of Dam Failure (ANCOLD, 2000b) and Guidelines on Selection of Acceptable Flood Capacity for Dams (ANCOLD, 2000a) in estimating the Population At Risk (PAR) and the extent and severity of damages and loss caused by dam failure. The Guidelines on Risk Assessment (ANCOLD, 2003) has also been consulted. Also included are assessment of the health and safety of Project employees and the public.

The risk assessment has been undertaken in accordance with the 'Guidelines for Hazard Analysis' and Australian Standard AS/NZS 4360:2004 Risk Management. The assessment outlines the implications for the Project and the impact on the public and workforce. The risk assessment process includes a preliminary hazard analysis.

Where risks are identified, appropriate mitigation strategies are outlined and a subsequent analysis has been undertaken to identify any significant residual risks.

The hazard and risk assessment, together with mitigation measures, has identified Low to Moderate residual risks but no High or Extreme residual risks. Each risk will have further mitigation measures applied.

# 3. ENVIRONMENTAL MANAGEMENT AND SUSTAINABILITY

The mitigation of impact and realisation of beneficial outcomes identified in the environmental impact assessment process will require an effective management framework and implementation. Detailed EMPs will be prepared for the Project based on the draft EMP included in the EIS. Some aspects of the EMPs will need to be approved by the Queensland Government and others will need to be approved by QWI prior to the commencement of construction and operation of the Project. Existing laws, regulations, codes and the like determine the approval roles and responsibilities of both the Queensland Government and QWI.

EMPs are dynamic documents as they incorporate continuous improvement. Each plan will be updated to incorporate further information, approval conditions, and changes in environmental management procedures in the light of ongoing monitoring results, new techniques, and relevant legislative requirements.

The objectives of the draft EMP are those embodied in the Intergovernmental Agreement on the Environment (IGAE) and the Principals of Ecologically Sustainable Development (ESD). The core objectives are:

- enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
- provide for equity within and between generations; and
- protect biological diversity and maintain essential ecological processes and life support systems.

The Guiding Principles are:

- where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
- the global dimensions of environmental impacts should be recognised and considered; and
- decisions and actions should provide for community involvement regarding issues that affect them.

The sustainability principles for the Project, which have been outlined earlier, are embodied in the draft EMPs. It is anticipated that the principles of the draft EMP will form the basis for conditions imposed by the CG and subsequently, for the detailed management plans drawn up by the contractor and subsequent operator/s of the Project assets.

An important aspect of environmental management planning for the Project is significant focus and investment in effective community and agency consultation throughout the Project. Consistent, early and open communication which also provides input into the management of the Project will help empower people and allow them to maintain their patterns of life with less impact and disturbance than would be the case without such consultation and interaction.

### 3.1 Cumulative Impact

Cumulative impact assessment for the Project focussed on the principles of sustainability where, once mitigation measures and residual impacts were identified, sustainability principles and guidelines facilitated identification and assessment of additional mitigation measures and actions. The outcome of the first step in the process was a vision, goals and principles for the Project and the outcome of the second step was to identify proposed sustainability measures or projects and assess these against the sustainability principles.

Implementation of the Project would cause impacts, both negative and positive, at various social, economic and environmental scales. In recognising the potential impacts, QWI in conjunction with CSIRO Sustainable Ecosystems have developed a set of sustainability principles to inform and guide the project design and also develop a method to assess the benefits of any proposed mitigation measures and actions.

Current best-practice engineering design and construction techniques and "standard" mitigation measures were adopted as the basis of the Project where the focus is on minimising or avoiding potential negative impacts. The challenge for the Project was to identify potential positive impacts and the longer term implications of the Project. Both these elements are relevant to the goal of developing sustainable outcomes.

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 sustainability 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.

### 3.2 Sustainability

The outcome of the first stage of the process was to define the vision, goals, and a number of sustainability principles for the Project. These are as follows:

#### Vision

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

To plan, design and enable innovative projects that:

- promote the development of sustainable communities through opportunities generated by the Traveston Crossing Dam;
- encourage sustainable local enterprises that benefit from the development of the 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

*Sustainable Communities*

The "Bristol Accord" (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".

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 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

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.
- 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:

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.
- Principle 5. Encourage, facilitate, or support research and actions targeted at improving the environmental sustainability of the catchment, aquatic ecosystems, and/or native biodiversity.

*Sustainability Implementation*

The studies and assessment undertaken for the EIS identified a number of mitigation strategies with the aim to minimise or avoid negative impacts and enhance positive impacts. Through consultation with agencies, the Community Taskforce and local stakeholders, QWI has developed an initial set of projects which go beyond the recommended mitigation measures in order to achieve the vision, goals and design principles which have been established for the Project. Many of the projects contribute to a number of sustainability principles.

(A) Freshwater Species Conservation Centre

QWI and the Queensland Government have announced the development and funding of a Freshwater Species Conservation Centre on the shores of the Traveston Crossing Dam. The Centre, which will include breeding and rearing facilities, will develop and implement actions that ensure the survival and improve the status of the lungfish, Mary River cods, and Mary River turtle. The Centre will also include an interactive interpretative centre to contribute towards the knowledge and understanding of local community, visitors and school groups in regards to the conservation of freshwater species.

The Centre will also seek to contribute and work with the existing community funded Gerry Cook Fish Hatchery at Cooroy through provision of a new building and facilities and working co-operatively, focussing on the Mary River cod.

(B) Native Timber Plantations

Native timber plantations will 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. The potential benefits include:

- significant contribution to the governments policy objective of transitioning the native timber industry from State forests to plantations over a 25 year timeframe;
- deliver carbon sequestration benefits to offset those emitted during dam construction and operation;
- establish permanent vegetation through environment plantings for biodiversity and land management;
- contribute to the local economy which is heavily and traditionally reliant on the timber industry; and
- diversify the productive and economic use of land (agroforestry).

Assessments undertaken for the Project indicate the plantations will provide a major positive benefit and provide substantial carbon credits for the Project.

(C) Design for Turtles

In conjunction with the EPA and the Australian Freshwater Turtle Conservation and Research Association, QWI have incorporated a number of design elements into the Project specifically 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, and others, the objective is 'benign by design' and includes:

- fish way design which explicitly accounts for the needs of turtles;
- re-creation of turtle nesting banks to new locations on the edge of the dam and on specifically constructed refuge islands within the dam;
- protective measures of turtle nesting areas including isolation and fencing combined with monitoring;
- intake tower screen design which prevents turtles from entering the system;
- non destructive acoustic or electric barriers to keep turtles away from the spillway gates, thus preventing movement through the gates;
- barrier design that prevents turtles entering the downstream release areas where they might be injured by high flow velocities; and
- construction of a turtle ramp to facilitate the movement of turtles past the dam wall. This is a world first and will be supported by a catch and carry option to be decided in consultation with experts.

(D) Sustainable Riparian Farm Management

QWI, through the DPI&F, 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.

(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 maximises opportunities that arise from the dam. These include:

- a Memorandum Of Understanding and letters of support have been received from a number of organisations (Kandanga Bowls Club, Kandanga and District Amateur Swimming Club, Mary Valley Rangers Soccer Club, Kandanga Public Hall Association and Friends of Kandanga) regarding relocating to an area of town that will be above flood levels and form part of a multi-sport/recreational facility to cater for locals and the construction work force and continue to be a major hub for local activities well after construction ceases;
- master planning to include the sport and recreational facilities and to provide for additional area for housing and business area to maximise the opportunity to provide for an integrated, accessible, mixed residential, business, recreational and community facilities hub; and
- Kandanga is not sewered and whilst the assessment undertaken for the Project suggests this is not a significant issue for the dam, as a sustainability measure (precautionary, improvement, recycling, amenity, further development) QWI has undertaken to assess, plan and enable the sewering of Kandanga and improvement to water supply.

(F) Recreation and Tourism Planning

The 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.

(G) Educational Opportunities

Several schools have expressed interest in opportunities offered by the dam and associated activities and projects. The components of the Project, together with existing facilities including the Australian zoo, would offer a number of activities of interest in the one locality which will be a major attraction for educational and tourism alike. The range of opportunities includes:

- Freshwater Species Conservation Centre and its incorporated Interpretive 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.

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

(H) Mary Valley Rattler

To enhance this iconic feature, QWI proposes to enhance opportunities to access the facility by raising platforms at Amamoor, Kandanga and Imbil, to an appropriate height and design for use by elderly or mobility impaired persons. This will add the feature to a demographic which currently cannot enjoy full use. Also, QWI are undertaking structural inspections of the bridges crossed by

the train to assist operators in the long term. The Valley Rattler, together with the other additional attractions in the area, will become even more of a central feature than it is now.

(I) Local Industry Participation plan

QWI has instigated an Expression of Interest (EOI) process for local business to participate on the Project. This EOI will allow QWI 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. To date over 500 business have registered, more than 80% of them local.

(J) Apiculture

In 1995 to 1996, approximately 42% of the total apiary sites in SEQ were located in the Imbil and Gympie district with an average of 49% of these sites booked for use in these two districts (Winders, 2004). Their location adjacent to Traveston Crossing Dam provides an opportunity for all stakeholders to provide a small but, significant step towards supplementing the needs of the apiculture industry.

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 DPI&F in investing in further scientific investigation and has committed funding of $200,000 over a three year period to assist research into bee nutrition. As part of this, QWI are have commenced a study to investigate further the suitability of the areas surrounding Traveston Crossing Dam.

The CSIRO also further developed the assessment of sustainability and how the projects outlined above, and other major mitigation strategies identified in the EIS, align with the Sustainability Principles.

## 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 | ✓ | | ✓ | ✓ | | | | | | ✓ |

These sustainability alignments were an outcome of a workshop with QWI and the CSIRO and will be subject to further development.

# 4. CONCLUSIONS AND RECOMMENDATIONS

The Project forms a critical component of the multi-faceted strategy to provide for a secure and reliable water supply for SEQ, now and into the future. The Project provides the northern link of the SEQ Water Grid and is in a large catchment which experiences good rainfall levels thus providing for a very high yielding river system supplying a significant proportion of the prudent supply needs of SEQ.

Importantly, the assessment and studies undertaken for the Project indicate that negative impacts are able to be mitigated to a satisfactory level; that matters of environmental significance are not negatively impacted by the Project; there is significant beneficial impact in many instances; and additional proponent commitments will contribute significantly to sustainable outcomes for the Project.

## 4.1 Recommendation 1

Having regard for the benefits and the impacts of the Project presented in this EIS, it is a recommendation of the EIS that the Project proceed subject to:

a) developing and implementing detailed environmental management plans for the construction phase and the operational phase; and
b) developing and implementing a scheme of effective mitigation measures and proponent commitments such as those set out in **Attachment 3**.

In making the recommendation, the Coordinator-General is requested to:

1) assess the EIS;
2) recommend the Project proceed;
3) state conditions for the Project under section 39(1)(a) of the *State Development and Public Works Organisation Act 1971*; and
4) recommend under section 43 of the *State Development and Public Works Organisation Act 1971* requirements for inclusion in the designation of the designated Project area as 'community infrastructure' under section 2.6.8 of the *Integrated Planning Act 1997*, if required.

## 4.2 Recommendation 2

It is a further recommendation of this EIS to the Coordinator-General that:

1) necessary approvals and permits be sought for the Project including as required as listed in Chapter 3 of this EIS; and
2) QWI and the Queensland Government investigate measures to ensure suggested programs, budgets and resources be included in the relevant agency planning process to ensure ongoing provision of services to the local community.

# 5. LIST OF ABBREVIATIONS

| Term | Definition |
|---|---|
| µg | microgram (one Millionth of a gram) |
| 1D | One Dimensional |
| AAD | Average Annual Damages |
| AADT | Average Annual Daily Traffic |
| AATC | Average Annual Time of Closure |
| ABS | Australian Bureau of Statistics (Commonwealth) |
| ACH Act | *Aboriginal Cultural Heritage Act 2003* (Cth) |
| ADWG | Australian Drinking Water Guidelines |
| AEMSC | Australian Explosives Manufacturer Safety Committee |
| AEP | Annual Exceedance Probability |
| AGO | Australian Greenhouse Office |
| AHD | Australian Height Datum |
| ALARP | As Low As Reasonably Practical |
| ALG | Alliance Leadership Group |
| ALUM | Australian Landuse and Management system |
| AMA | Area Management Advice |
| AMTD | Adopted Middle Thread Distance |
| ANCOLD | Australian National Committee on Large Dams |
| ANFO | Ammonia Nitrate Fuel Oil |
| ANZECC | Australian and New Zealand Environment and Conservation Council |
| ARI | Average Recurrence Interval |
| ARMCANZ | Agriculture and Resource Management Council of Australia and New Zealand |
| AS | Australian Standard |
| ASC | Australian Soil Classification |
| ASS | Acid Sulphate Soils |
| AWA | Australian Water Association |
| AWQG | Australian Water Quality Guidelines |
| AWS | Automatic Weather Station |
| BA | Birds Australia |
| BAS | Business Assistance Scheme |
| BEMP | Best Environmental Management Practices |
| BHC | Bromohydrocarbon |
| BOD | Biological Oxygen Demand |
| BoM | Bureau of Meteorology (Commonwealth) |
| BP | Before Present |
| BPA | Biodiversity Planning Assessment |
| CAC | Community Advisory Committee |
| CAMBA | China-Australia Migratory Bird Agreement |
| CEMP | Construction Environmental Management Plan |
| CFT | Community Futures Taskforce |
| CG | Coordinator-General |
| CGE | Computable General Equilibrium Modelling |

| Term | Definition |
|---|---|
| CHCU | Cultural Heritage Coordinating Units |
| CHIMA | Cultural Heritage Investigation and Management Agreement |
| CHIMS | Cultural Heritage Investigation and Management Strategy |
| CHMP | Cultural Heritage Management Plan |
| CID | Community Infrastructure Designation |
| Creek | Creek |
| CLR | Contaminated Land Register |
| cm | Centimetre |
| CNCCS | Common Nature Conservation Class System |
| CO | Carbon monoxide |
| $CO_2$ | Carbon dioxide |
| $CO_2$-e | Carbon dioxide equivalents |
| COAG | Council of Australian Governments |
| CS | Culturally Significant |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| CW | Completely Weathered |
| DCDB | Digital Cadastre Database |
| DCL | Dam Crest Level |
| DCS | Distributed Control Systems |
| DDT | Dichloro-Diphenyl-Trichloroethane |
| DEM | Digital Elevation Model |
| DEO | Desired Environmental Outcomes |
| DEW | Department of Environment and Water (Commonwealth) |
| DG | Dangerous Goods |
| DIP | Department of Infrastructure and Planning |
| DLGSR | Department of Local Government, Sport and Recreation (Queensland) |
| DMR | Department of Main Roads (Queensland) |
| DME | Department of Mines and Energy |
| DNRW | Department of Natural Resources and Water (Queensland) |
| DO | Dissolved Oxygen |
| DoS | Degree of Saturation |
| DPI&F | Department of Primary Industries and Fisheries (Queensland) |
| DS | Downstream |
| DTRDI | Department of Tourism, Regional Development and Industry |
| E | Endangered under the *Nature Conservation Act 1992* (Qld) or *Environment Protection and Biodiversity Conservation Act 1999* (Cth) |
| EAP | Emergency Action Plan |
| EC | Electrical Conductivity |
| ECEC | Effective Cation Exchange Capacity |
| EES | Ecotone Environmental Services |
| ED | Evapotranspiration Depth |
| EFO | Environmental Flow Objective |
| EHMP | Ecosystem Health Monitoring Program |
| EIS | Environmental Impact Statement |

| Term | Definition |
|---|---|
| EL | Elevation Level |
| EMA | Environmental Management and Assessment |
| EMP | Environmental Management Plan |
| EMR | Environmental Management Register |
| EP Act | *Environmental Protection Act 1994* (Qld) |
| EPA | Environmental Protection Agency (Queensland) |
| EPBC Act | *Environment Protection and Biodiversity Conservation Act 1999* (Cth) |
| EPP (Air) 1997 | *Environmental Protection (Air) Policy 1997* |
| EPP (Noise) 1997 | *Environmental Protection (Noise) Policy 1997* |
| EPP (Waste) 1997 | *Environmental Protection (Waste) Policy 1997* |
| EPP (Water) 1997 | *Environmental Protection (Water) Policy 1997* |
| ERA | Environmentally Relevant Activity under the *Environmental Protection Act 1994* (Qld) |
| ERP | Emergency Response Plan |
| ESA | Equivalent Standard Axles |
| ESCP | Erosion and Sediment Control Plan |
| ESD | Ecologically Sustainable Development |
| ESP (air) | Electrostatic Precipitator |
| ESP (soil) | Exchangeable Sodium Percentage |
| ET | Evapotranspiration |
| EVR | Endangered, Vulnerable or Rare listed species under the *Nature Conservation Act 1992* (Qld) or the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) |
| EVs | Environmental Values |
| FIA | Failure Impact Assessment |
| FS | Field Surveys |
| FSL | Full Supply Level |
| FSV | Full Supply Volume |
| FTE | Full Time Equivalent |
| GDE | Groundwater Dependant Ecosystems |
| GDP | Ground Disturbance Permit |
| GEC | Grout Enriched Concrete |
| GQAL | Good Quality Agricultural Land |
| GRP | Gross Regional Product |
| GS | Gauge Station |
| GSQ | Geological Survey of Queensland |
| GWDB | Groundwater Database |
| H | Horizontal |
| Ha | Hectare |
| HACCP | Hazard and Critical Control Point |
| HAT | Highest Astronomical Tide |
| HAZOP | Hazard and Operability |
| HNFY | Historical No Failure Yield |
| HQ | Hazard Quotient |
| Hr | Hour |

| Term | Definition |
|---|---|
| IAS | Initial Advice Statement |
| ICHD | Indigenous Cultural Heritage Database |
| IDAS | Integrated Development Assessment System |
| IFHC | Incremental Flood Hazard Category |
| IGAE | Intergovernmental Agreement on the Environment |
| ILUA | Indigenous Land Use Agreement |
| IPA | *Integrated Planning Act 1997* (Qld) |
| IQQM | Integrated Quality Quantity Model |
| IROL | Interim Resource Operations Licence |
| IWSC | Irrigation and Water Supply Commission |
| JAMBA | Japan-Australia Migratory Bird Agreement |
| Kg | Kilograms |
| kL | Kilolitre |
| km | Kilometre |
| km² | Square kilometre |
| KRA | Key Resource Area |
| kV | Kilovolt |
| L | Litre |
| L/s | Litres per Second |
| LCU | Landscape Character Units |
| LGA | Local Government Area |
| LI | Landscape Institute |
| LNCS | Local Nature Conservation Strategy |
| LOS | Level of Service |
| LOTE | Language Other Than English |
| LPP | Land Purchasing Policy |
| LRRS | Local Road of Regional Significance |
| m | Metre |
| M | Species covered by migratory provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) |
| m³/s | metre cubed per second |
| MAF | Mean Annual Flow |
| MAR | Mean Annual Rainfall |
| MBcm | Million Cubic Metres |
| mBGL | Metres Below Ground Level |
| MCA | Multiple Criteria Analysis |
| MDE | Maximum Design Earthquake |
| Mg | Milligrams |
| ML | Megalitre |
| mm | Millimetre |
| MMBW | Melbourne and Metropolitan Board of Works |
| MNES | Matters of National Environmental Significance (see NES) |
| MOU | Memorandum of Understanding |
| MPN | Most Probable Number |

| Term | Definition |
|---|---|
| MRCCC | Mary River Catchment Coordinating Committee |
| MSDS | Material Safety Data Sheet |
| Mt (Air Quality) | Metatonnes |
| MWh | Megawatt Hours |
| NASCABD | National Strategy on Conservation of Australian Biological Diversity |
| NATA | National Association of Testing Authorities |
| NC Act | *Nature Conservation Act 1992* (Qld) |
| NEPM | National Environment Protection Measure |
| NL | Not Listed under the *Nature Conservation Act 1992* (Qld) or *Environment Protection and Biodiversity Conservation Act 1999* (Cth) |
| NOC | Not of Concern species under the *Vegetation Management Act 1999* (Qld) |
| NOX | Oxides of nitrogen |
| NPWS | National Parks and Wildlife Service |
| NS | Not Specified |
| NT Act | *Native Title Act 1993* (Cth) |
| NTRB | Native Title Representative Bodies |
| NWQMS | Australian National Water Quality Management Strategy |
| OBE | Operating Basis Earthquake |
| OC | Of Concern species under the *Vegetation Management Act 1999* (Qld) |
| Ocs | Organochlorine Pesticides |
| OEMP | Operational Environmental Management Plan |
| OESR | Office of Economic and Statistical Research |
| OPS | Organophosphorus Pesticides |
| OUM | Office of Urban Management (Queensland) |
| P | Primary survey sites |
| PAR | Population at Risk |
| PCB | Polychlorinated Biphenyl |
| PGA | Peak Ground Acceleration |
| PHA | Preliminary Hazard Analysis/Assessment |
| PIFU | Population Information and Forecasting Unit |
| PM | Particulate matter |
| PMF | Probable Maximum Flood |
| PPE | Personal Protection Equipment |
| PPV | Peak Particle Velocity |
| PR | Performance Requirements |
| PRW | Purified Recycled Water |
| PSI | Preliminary Site Investigation |
| QCS | Listed under the *Nature Conservation Act 1992* (Qld) |
| QA | Quality Assurance |
| QC | Quality Control |
| QDSM Guidelines | Queensland Dam Safety Management Guidelines |
| QH | Queensland Herbarium |
| QH Act | *Queensland Heritage Act 1992* (Qld) |
| QHC | Queensland Heritage Council |

| Term | Definition |
|---|---|
| QM | Queensland Museum |
| QMP | Quality Management Plan |
| QPWS | Queensland Parks and Wildlife Service |
| QT | Queensland Transport |
| QWI | Queensland Water Infrastructure Pty Ltd |
| QWQG | Queensland Water Quality Guidelines |
| R | Rare under the *Nature Conservation Act 1992* (Qld) or *Environment Protection and Biodiversity Conservation Act 1999* (Cth) |
| RBC | Rating Background Level |
| RCC | Roller Compacted Concrete |
| RE | Regional Ecosystem |
| REDD | Regional Ecosystem Description Database |
| REIQ | Real Estate Institute of Queensland |
| RL | Relief Level |
| RNE | Register of National Estate |
| ROL | Resource Operations Licence |
| ROP | Resource Operations Plan |
| ROPS | Rollover Protective Structures |
| RVMC | Regional Vegetation Management Code |
| S | Secondary survey sites |
| SCADA | Supervisory Control and Data Acquisition |
| SDPWO Act | *State Development and Public Works Organisation Act 1971* (Qld) |
| SEQ | South East Queensland |
| SEQIPP | South East Queensland Infrastructure Plan and Program |
| SEQLTS | Water for South East Queensland: A Long-term Solution (DNRW, 2006) |
| SEQROC | South East Queensland Regional Organisation of Councils |
| SEQRP | South East Queensland Regional Plan |
| SEQRWSS | South East Queensland Regional Water Supply Strategy |
| SEQTFRT | South East Queensland Threatened Frogs Recovery Team |
| SEQWC | South East Queensland Water Cooperation |
| SKM | Sinclair Knight Merz |
| SLA | Statistical Local Area |
| SME | Small and Medium Enterprises |
| SMP | Site Management Plan |
| SMS | Short Messaging Service |
| $SO_2$ | sulphur dioxide |
| SPP | State Planning Policy |
| SS | Suspended Solids |
| STP | Sewerage Treatment Plant |
| SWL | Standing Water Level |
| TAP | Technical Advisory Panel |
| TAPM | The Air Pollution Model |
| TBL | Triple Bottom Line |
| TDS | Total Dissolved Solids |

| Term | Definition |
|---|---|
| TOC | Total Outturn Cost |
| ToR | Terms of Reference as described in Part 4 of the *State Development and Public Works Organisation Act 1971* (Qld) |
| ToS | Time of Submergence |
| TPR | Third Party Reviewer |
| TQld | Tourism Queensland |
| TSP | Total Suspended Particulate Matter |
| TSS | Total Suspended Solids |
| UN | United Nations |
| URBS | Urban Runoff and Basin System |
| US | Upstream |
| USACE | United States Army Corps of Engineers |
| UXO | Unexploded Ordinance |
| V | Vertical |
| V (Ecology) | Vulnerable under the *Nature Conservation Act 1992* (Qld) or *Environment Protection and Biodiversity Conservation Act 1999* (Cth) |
| VMA | *Vegetation Management Act 1999* (Qld) |
| VPD | Vehicles Trips per Day |
| WASO | Water Allocation Security Objective |
| WBIRTP | Wide Bay-Burnett Integrated Regional Transport Plan |
| WHS | Water Harvesting Scheme |
| WMP | Waste Management Plan |
| WQO | Water Quality Objectives |
| WRP | Water Resource Plan i.e. *Water Resource (Mary Basin) Plan 2006* |
| WSI | Water Security Index |
| WSS | Water Supply Scheme |
| yBP | see Glossary “Coquina” |

# 6. GLOSSARY

| Term | Definition |
|---|---|
| Abiotic | Pertaining to physical and inorganic components of the environment; non-living. |
| Abutment | The part of a valley against which a dam is constructed. Right and left abutments are those on respective sides of an observer looking downstream. |
| Accretion | (a) The process of growth or enlargement by external accumulation.<br>(b) Sediment accumulation, not necessarily with cementation (opposite to erosion). |
| Acidic | Quality of being acid; having a pH of less than 7 (see pH). |
| Adopted Middle Thread Distance (AMDT) | The distance from the mouth of the watercourse or the confluence of the watercourse with the main watercourse measured along the middle of the watercourse. |
| Adsorbed | The process of attaching to the outside of a surface. |
| Allocated water | Water that a person or entity has been granted an entitlement to extract. |
| Allochthonous material | Organic matter that is derived from outside of the aquatic ecosystem, such as leaves of terrestrial vegetation that fall into the stream. |
| Alluvial (alluvium) | Weathered material transported and deposited by the movement of water. |
| Alluvial forests | Forests growing in alluvial soils, mainly sand and silt, that a river has carried in suspension and then deposited. |
| Alluvial plain | A plain formed by the deposition of alluvial material over a long period of time. |
| Amphidromous | Organisms which migrate between saltwater and freshwater environments however not for breeding purposes. |
| Anabat | A bat detector that can record the signals of bats for computer analysis. It converts the ultrasonic echolocation signals of bats into audible electronic signals which can be recorded and processed, to assist in identification of the species. |
| Anadromous | Diadromous species that spend the majority of their life in saltwater and migrate to freshwater to breed. |
| Anastomosing | Water spreading across the river bed as numerous small channels. |
| Animal | Any member, alive or dead, of the animal kingdom (other than a human being). |
| Annual Exceedance Probability (AEP) | The probability of a specified magnitude of a natural event being exceeded in any year. |
| Annual Proportional Flow Deviation | Annual proportional flow deviation is the statistical measure of changes to flow season and volume in the simulation period calculated using the formula in Technical Report 5 of "Fitzroy Basin Water Allocation and Management Planning Technical Reports" (DNRW, 1999) |
| Anoxic | Without or depleted of oxygen. |
| Anthropogenic | Effects, processes, objects or materials which do not occur in natural environments but are as a result of, or derived from human activities. |
| Aquatic macrophyte | Submerged, emergent or floating aquatic vegetation that is visible to the naked eye. |
| Aquiclude | A boundary layer that prevents soil water infiltration. |
| Aquifer | A water-bearing stratum of permeable rock, sand, or gravel, able to transmit substantial quantities of water. |
| Arboreal | Living in or among trees. |
| Australian Height Datum (AHD) | The datum used for determining elevations in Australia which uses a national network of bench marks and tide gauges, and has set mean seal level as zero elevation. |
| Average Recurrence Interval (ARI) | The average interval (in years) between the occurrence of a flow, discharge or rainfall greater than or equal to a specified amount. |
| B horizon | The second or subsurface zone of soil made of clay and oxidized materials and organic matter obtained from the A horizon by leaching. |
| Barrier beaches | Elongate sandy ridges slightly above high tide level, and running parallel to the shoreline – extended by long shore transport (Brennan, 2004). |

| Term | Definition |
|---|---|
| Benthic | Pertaining to the bottom of a body of water. |
| Biodiversity | Biodiversity is short for “biological diversity”. It describes the variety of life forms and their habitats that make up a region. Biodiversity includes the diversity of plant and animal species, the diversity of ecosystems formed by communities of these organisms, and the genetic diversity within and between species. |
| Biofilm | A thin layer of living cells, such as bacteria, protozoa and algae, which coat the surface of a living or non-living substrate. |
| Biogenic sediment | Sediment produced by the actions of living organisms. |
| Biotic | Pertaining to living organisms, and usually applied to the biological aspects of an organism’s environment. |
| Borrow pit | A small excavation providing earth to be used for construction material. |
| Bunding | An artificially created boundary, usually in the form of an embankment used to prevent sediment and substances from entering a water stream or storage facility. |
| CAMBA | CAMBA means the Agreement between the Government of Australia and the Government of the People’s Republic of China for the protection of Migratory Birds and their Environment signed in Canberra on 20 October 1986. |
| Carboniferous | The period of geological time extending from about 360 to 290 Million years ago. |
| Carboniferous period | The Carboniferous is a major division of the geologic timescale that extends from the end of the Devonian period, about 360 Million years ago (mya), to the beginning of the Permian period, about 290 mya. |
| Catadromous species | Diadromous species that spend the majority of their life in freshwater and migrate to saltwater to breed. |
| Cease to flow | The period where water ceases to flow. |
| Coastal plain | Any plain with its margins on the shore of the sea. Generally a flat featureless area of low relief which is usually underlain by sediments. |
| Colluvium | Loose bodies of sediment transported by gravity which have been deposited or built up towards the base of a low grade slope. |
| Common | The wildlife is common or abundant and is likely to survive in the wild. |
| Commonwealth Marine Area | The Commonwealth Marine Area is any part of the sea, including the waters, seabed, and airspace, within Australia's exclusive economic zone and/or over the continental shelf of Australia, that is not State or Northern Territory waters. |
| Community | An assemblage of interdependent populations of different species (plants and animals) interacting with one another, and living in a particular area. |
| Compensatory habitat | A vegetation offset to maintain the extent of remnant vegetation that will be loss as a result of the Project. |
| Conglomerate | Coarse sedimentary rock containing cemented rounded gravel or pebbles |
| Connectivity | Refers to the ease with which organisms move between particular landscape elements. |
| Controlled action | An action (including a project, development, undertaking, activity, or series of activities) that is likely to have a significant impact on a Matter of National Environmental Significance, as defined by the Commonwealth Minister for the Department of Environment and Water. If an action is controlled it is subject to a rigours assessment and approval process under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). |
| Coquina | A soft, whitish, coral like stone, formed of broken shells and corals, found in low, calcareous beach ridge sequences. Dated beach ridge sequences from the Burdekin area date from around 25000-30000 yBP (Hopley 1970). |
| Covenant | An agreement or contract between two parties (i.e. landholder and council). |
| Cracking clay | Clay soil from surface with large cracking patterns. Usually with gilgai surface features. |
| Critical storm duration | The critical storm duration is the duration of rainfall that will result in the highest peak flood levels at a particular location. |
| Crystobalitic | Form of silica. |

| Term | Definition |
|---|---|
| Cuspated | Points formed by the intersection of two arcs. |
| Dead storage | The volume in a water storage below the lowest operable level. |
| Dendritic | Having a form resembling a shrub or tree. |
| Denuded (denudation) | The removal of matter. Commonly used to describe the removal of vegetation, but also refers to the process of mass, or rapid, sediment removal. |
| Dermosols | Soils lacking strong texture contrast and having a structured B horizon. |
| Diadromous species | Organisms that move during their life cycle between freshwater and saltwater environments. |
| Dispersion | To distribute or suspend fine particles, such as clay, in or throughout a dispersion medium, such as water. |
| Duplex | Light surface texture of sand or clay loam abruptly overlying clay. |
| Easement | An access right held by a third party to enter upon and make use of land belonging to another for a specified purpose. |
| Ecology | The study of the interrelationships of organisms with and within their environment. |
| Ecosystem | A biophysical environment containing a community of organisms. |
| Edge effect | All changes at an ecosystem boundary and within adjacent ecosystems; the negative influence of a disturbed habitat edge on the interior conditions of a habitat, or on species that use the interior habitat. |
| Electrofishing | A fish sampling technique which uses electric fields and electric currents to capture fish by controlling fish movement and/or immobilising fish. |
| Embankment dam | Embankment dams are made mainly from natural materials. The two main types are earthfill dams and rockfill dams. Earthfill dams are made up mostly from compacted earth, while rockfill dams are made up mainly from dumped and compacted rockfill. The materials are usually excavated or quarried from nearby sites, preferably within the reservoir basin. |
| Embayment | Small bay between minor headlands. |
| Emerson test | A classification of soil aggregates based on their coherence in water. The conditions under which they slake, swell and disperse allow the different aggregates to be separated into eight classes. The test is particularly valuable in a soil conservation context as it grades soil aggregates according to their stability in water. |
| Endangered | A species is endangered if:<br>■ there have not been thorough searches conducted for the wildlife and the wildlife has not been seen in the wild over a period that is appropriate for the life cycle or form of the wildlife; or<br>■ the habitat or distribution of the wildlife has been reduced to an extent that the wildlife may be in danger of extinction; or<br>■ the population size of the wildlife has declined, or is likely to decline, to an extent that the wildlife may be in danger of extinction; or<br>■ the survival of the wildlife in the wild is unlikely if a threatening process continues. |
| Endangered Regional Ecosystem | A regional ecosystem is listed as endangered under the *Vegetation Management Act 1999* (Qld) if remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares. |
| Endemic | Restricted to a certain region or part of region. |
| Environment | The total of all the external conditions that act upon an organism. |
| Environmental flow | The flow of water that is required to maintain aquatic and riparian ecosystems in streams and rivers. |
| Environmental Flow Objective (EFO) | Performance indicators set out in the *Water Resource (Mary Basin) Plan 2006* for the measurement of the environmental performance of the Mary Basin. |
| Environmental quality | Human (individual or social) concepts of desirable ecological situations. |

| Term | Definition |
|---|---|
| Ephemeral | Transitory, short-lived. |
| Epilimnion | Upper waters of a thermally-stratified water body. The upper layer is characterised by warmer and lighter water. |
| Erosion | The process by which rocks are loosened, worn away and removed from parts of the Earth's surface.<br>Seven processes of erosion discussed separately; in practice they overlap and it is often difficult to isolate the net effects of any one process.<br>**Rainsplash erosion:** the detachment and removal of soil and debris by raindrop impact.<br>**Overland flow OR surface runoff:** water flowing over the surface before being concentrated into definite streams.<br>**Sheet erosion, sheet wash, or slope wash:** the combined effect of overland flow and rainsplash.<br>**Gully erosion:** the rapid development of gullies, usually in first- or second-order tributaries of streams, BUT also in situations unrelated to an integrated drainage system (e.g. highly dispersive soils)<br>**Mass Movement:** downhill movement of debris ***en masse*** rather than as individual particles. It can occur slowly (creep), or rapidly (rockfalls, slumps, landslides).<br>**Surface rock creep:** the movement of stones down sloping surfaces.<br>**Fluvial erosion:** the detachment and removal by streams of material in solution, suspension, or as bed load. Includes removal of debris supplied to the streams by slope wash, mass movement, and gullies. |
| Essential habitat | Vegetation in which a species of wildlife is known to occur that is listed as endangered, vulnerable, near threatened or rare under the *Nature Conservation Act 1992* (Qld). |
| Estuarine | The mouth region of a river that is affected by tides. |
| Euphotic zone | Surface layer of a body of water which receives enough sunlight for photosynthesis. |
| Eutrophication | Process during which water bodies become enriched with dissolved nutrients resulting in excessive growth of organisms, such as algae, and the subsequent depletion of oxygen. |
| Evaporation | The process that changes a liquid or a solid into a gas. In the tropical hydrological cycle, this involves the conversion to water vapour and the return to the atmosphere of the precipitation (rainfall) that has reached the earth's surface. |
| Evapotranspiration | The combined effect of evaporation and transpiration. |
| Exotic species | Introduced species not native or endemic to the area in question. |
| Ex-situ | Ex-situ means off site, i.e. protecting a species of plant or animal by removing part of the population from a threatened habitat and placing it in a new location. |
| Failure Impact Assessment (FIA) | An assessment carried out by a registered professional engineer who evaluates the number of people whose safety would be at risk if there was a dam failure. The assessment, if accepted by the chief executive of the Queensland Department of Natural Resources and Water, will result in the dam being given a failure impact rating according to the number of people at risk. |
| Fauna | The collective animals of a given region (see definition for 'animals'). |
| Feral | An introduced or domestic animal living in the wild. |
| Ferrosols | Soils lacking strong texture contrast and having high free iron in B horizon |
| Fishway flow | Flows that are released through a structure designed to allow fish passage up or down stream where a hydraulic structure such as a dam blocks the natural channel. Specific flows are necessary to attract particular species to use the fishway. |
| Flood plain | That portion of a river valley that is covered during periods of high flood water. |
| Flora | The collective plants growing in a geographic area (see definition for 'plants'). |
| Flora | See definition for 'plants' |

| Term | Definition |
|---|---|
| Flow duration curve | A cumulative plot showing the percent of time that given flow volumes are equalled or exceeded. |
| Flow regime | The variation in flow characteristics, such as volume, for a particular stream over time. |
| Fluvial | The river system. |
| Fragmentation | A process of landscape alteration in which natural areas are subdivided into smaller patches. |
| Full Supply Level (FLS) | The maximum normal operating water surface level of a reservoir. |
| Geomorphological Time Periods | **Proterozoic (2500-545 Million years ago)**<br>During the Proterozoic two mountainous blocks, the Mt Isa Inlier and the Georgetown massif (current area of the Einasleigh Uplands) were formed. Formation was a result of faulting, folding, thrusting of deposited marine and terrestrial sediments, extrusive volcanics and igneous intrusions. Widespread metamorphism was associated with igneous intrusions and the deforming tectonic activities (Brennan, 2004).<br>**Palaeozoic (545-251 Million years ago)**<br>Extensive erosion and planation was the major process occurring during this period. Weathered sediments were stripped from the two Proterozoic blocks and deposited within the Tasman geosyncline between these two divisions. North-west of the Proterozoic Mt Isa Inlier, a shallow sea transgressed from the south depositing carbonate-dominated marine sediments. These comprise the Barkly Tableland of the upper Nicholson and Settlement Catchments today. In the Einasleigh Uplands some extrusive volcanics accompanied erosion processes and resulted in the formation of the Newcastle and Croydon Ranges in the Norman and Gilbert Catchments. In the west, erosion continued to form an extensive plain that grew eastwards, and by the early Mesozoic, the whole of the Gulf region was reduced to a flat plain (Brennan, 2004).<br>**Mesozoic (251-65 Million years ago)**<br>The Proterozoic to Mesozoic cycle of erosion was terminated by earth movements that warped the flat plains. The result was the transgression (higher sea levels) of the sea into the Carpentaria and Eromanga Basins and the widespread deposition of Mesozoic sediments, namely sandstone, siltstone, mudstone, limestone, shale and conglomerate overlying the erosion surface of old, deformed Proterozoic rocks. By the end of the Mesozoic, the only extruding Palaeozoic rocks remained in the east (Einasleigh Uplands) (Brennan, 2004).<br>**Early-Mid Tertiary (65-34 Million years ago)**<br>During this period the Mesozoic plain was uplifted ad warped resulting in widespread erosion of the Mesozoic sediments. By the Mid-Tertiary most of the area was again reduced to a low relief plain that underwent laterisation (Brennan, 2004).<br>**Late Tertiary – Quaternary (34 Million years ago to present)**<br>Uplifting and warping increased slopes and initiated another period of erosion and planation. Streams adjusted to a new base level (increased sea levels) and the erosional surfaces extended inland forming the dissected river valleys seen today. At the upland margins of the Gulf Plains, the late Cretaceous rocks (end of the Mesozoic period) were removed, and within the steeper ranges rocks formed at end of the Palaeozoic period were eroded away. Accompanying widespread erosion was extensive deposition and the formation of new alluvial fans in the lower reaches of the Gulf Catchments (Brennan, 2004).<br>Along the coastline, down-warping lowered the laterised older Tertiary plain to wave action level (hence increased sea levels). This formed low cliffs and a marine terrace. Due to a low offshore gradient and wave action, and high loads of terrestrial sedimentation, constructional landforms were formed (e.g. barrier beaches and islands). A later drop in sea level and subsequent emergence of land led to the abandonment of barrier beaches that occur as parallel ridges around the Gulf of Carpentaria today, and the formation of a new lower, marine terrace (Brennan, 2004).<br>Some volcanic eruptions in the eastern block (Einasleigh Uplands) also occurred during this period, resulting in infilling of older valleys, particularly in the upper Flinders and Gilbert Catchments (Brennan, 2004). |

| Term | Definition |
|---|---|
| Geomorphology (geomorphological) | The form or shape of the landscape and the processes that modify and change it. |
| Gilgai | Melon hole, mound depression surface. |
| Global warming | The warming of the earth's atmosphere generally attributed to the burning of fossil fuels. Also referred to as "The Greenhouse Effect" - the capacity of the atmosphere to transmit short-wave energy (visible and ultra violet light) to the earth's surface, and to absorb and retain heat radiating from the surface. |
| Groundwater | Water found underground in porous rock or soil strata. |
| Habitat | The biophysical medium or media occupied (continuously, periodically or occasionally) by an organism or group of organisms. |
| Harp trap | A trap used to capture microchiropteran bats, consisting of metal poles connected by fishing wire. |
| Herpetofauna | Includes reptiles and amphibians. |
| Highest Astronomical Tide (HAT) | The highest tide level which can be predicted to occur under any combination of astronomical conditions. |
| Historical No Failure Yield (HNFY) | This is the maximum volume of water that can be supplied from the dam for every year of the simulation period. |
| Holocene | Refers to a geological period of time between the present and 10,000 years before present. |
| Holomixis | Complete mixing of the lake or water body, for example during winter when the epilimnion starts to cool. |
| Horizontal Layer Method | The layering process involved in Roller Compacted Concrete inevitably leads to the presence of a large number of horizontal joints between the strata, since in order to maintain the necessary compaction density by roller, the layers are typically only 0.3m thick (see "Roller Compacted Concrete"). |
| Hydraulic | Mechanical properties of liquids. |
| Hydraulic conductivity | A coefficient of proportionality describing the rate at which water can move through a permeable medium. |
| Hydraulic connectivity | Describes the connection of different aquifers within the same vicinity. |
| Hydraulic gradient | The change in total head with a change in distance in a given direction. |
| Hydrodynamics | The movements of water and other liquids. |
| Hypolimnion | Bottom layer of a thermally-stratified water body. This bottom layer is characterised by cold water which is usually low or lacking in oxygen. |
| Hyporheic | Hyporheic zone is where there is mixing of shallow groundwater and surface water in a region beneath and lateral to a stream bed. |
| Igneous rock | Rock produced under conditions involving intense heat, as rocks of volcanic origin or rocks crystallised from molten magma. |
| Intertidal | The area between high and low tide. |
| Inundation area | The area that will be flooded with water above the existing water level, from raising of the dam. |
| JAMBA | JAMBA means the Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment signed in Tokyo on 6 February 1974. |
| Kandosols | Soils lacking strong texture contrast and having a massive B horizon. |
| Kurosols | Soils with strong texture contrast and having pH <5.5 in B horizon. |
| Lacustrine habitat | Lake environment, pertaining to standing water bodies. |
| Laterisation | General term for a process that converts rock or soil to laterite. Laterite is a highly weathered sub-soil or material rich in secondary oxides of iron, aluminium, and is generally devoid of primary silicates such as quartz and kaolinite (Brennan, 2004). |
| Lentic habitat | Standing or still water habitats such as lakes and ponds. |

| Term | Definition |
|---|---|
| Lime | Calcium carbonate nodules. |
| Limnological process | Referring to the chemical, physical and biological properties of bodies of freshwater. |
| Listed species | A plant or animal included in a schedule of vulnerable, rare or endangered biota, such as the schedules in the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) or the *Nature Conservation (Wildlife) Regulation 2004* (Qld). |
| Littoral vegetation | Vegetation that occurs within the littoral zone. |
| Littoral zone | Region of shallow water near the shore of a body of water where light reaches the bottom. |
| Lotic habitat | Flowing water habitats such as rivers and streams. |
| Macroinvertebrate | Organisms without a backbone which are large enough to be seen with the naked eye. |
| Mass movement | The downslope movement of earth caused by gravity. Includes but is not limited to landslides, rock falls, debris avalanches, and creep. It does not however, include surface erosion by running water. |
| Matter of National Environmental Significance | The matters of national environmental significance include:<br>■ listed threatened species and communities<br>■ listed migratory species<br>■ Ramsar wetlands of international importance<br>■ the Commonwealth marine environment<br>■ World heritage properties<br>■ National heritage places<br>■ nuclear actions<br>as defined by the Commonwealth Minister for the Department of Environment and Water (see 'controlled action'). |
| Megachiropteran bats | Megachiropteran bats are larger than the microbats and feed on fruit, nectar and pollen, i.e. flying foxes. |
| Metalimnion | Middle layer of a thermally-stratified body of water. The metalimnion is the transition layer between the epilimnion and hypolimnion and is also referred to as the thermocline. |
| Metamorphic sediment / rock | Rock or sediment that has exhibited a change in structure or composition. |
| Metamorphism | Transformation of a pre-existing rock into a new rock by the action of heat (thermal metamorphism associated with igneous intrusions) or by severe compressional earth movements (regional metamorphism associated with folding, faulting etc). Changes occur to the texture, composition, physical or chemical structure of the original rock (Brennan, 2004). |
| Metamorphosed sedimentary rocks | Changed in form or nature, a metamorphic rock is created by heat and pressure such that the minerals, fabric, colour are changed, but not the composition. |
| Metasediment | Sediments or sedimentary rock which has been subjected to metamorphism. |
| Microchiropteran bats | Microchiropteran bats are relatively small mammals. These species are specially adapted for flight with wing membranes up to 25cm. They use both eye sight and echolocation for finding their way around at night and locating prey, being mostly insects. |
| Microhabitat | Within this habitat area there is a low availability of ground microhabitat including leaf litter, logs and branches. |
| Migratory species | A migratory species listed and protected under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). |

| Term | Definition |
|---|---|
| National heritage place | Under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth), a World Heritage property is either:<br>■ an Australian property on the World Heritage List kept under the World Heritage Convention; or<br>■ a property declared to be a World Heritage property by the Commonwealth Environment Minister. |
| Native species | A species that is indigenous to Australia or an external Territory, or periodically or occasionally visits. |
| Natural environment | The complex of atmospheric, geological, and biological characteristics found in an area in the absence of artefacts or influences of a well-developed technological human culture. |
| 'Not of Concern' regional ecosystem | A regional ecosystem is listed as 'Not of Concern' under the *Vegetation Management Act 1999* (Qld) if remnant vegetation is over 30 per cent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 hectares. |
| Nuclear action | A nuclear action is:<br>■ establishing or significantly modifying a nuclear installation;<br>■ transporting spent nuclear fuel or radioactive waste products arising from reprocessing;<br>■ establishing or significantly modifying a facility for storing radioactive waste products arising from reprocessing;<br>■ mining or milling uranium ores, excluding operations for recovering mineral sands or rare earths;<br>■ establishing or significantly modifying a large-scale disposal facility for radioactive waste. A decision about whether a disposal facility is large scale will depend on factors including:<br>– the activity of the radioisotopes to be disposed of,<br>– the half-life of the material,<br>– the form of the radioisotopes, and<br>– the quantity of isotopes handled;<br>■ de-commissioning or rehabilitating any facility or area in which an activity described above has been undertaken; or<br>■ any other type of action set out in the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) Regulations. |
| 'Of Concern' regional ecosystem | A regional ecosystem is listed as of concern under the *Vegetation Management Act 1999* (Qld) if remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion; or more than 30 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares. |
| Old growth forests | Forests that are both little disturbed and ecologically mature. |
| Opportunistic | When the conditions are ideal. |
| Overtopping | The process whereby the water level rises above the height of the dam wall. |
| Pelagic zone | The water column associated with the surface or middle depths of a water body, away from the bottom. |
| Permeability | The capacity of a material (rock) to transmit fluids (groundwater). |
| Permeable rock | Rock through which water can pass, either via:<br>(a) a network of pores between the grains; or<br>(b) interconnected joints, bedding planes and fissures (more correctly termed 'pervious rock'). |
| Permian | The period of geological time extending from about 285 to 250 Million years ago. |
| PET richness | Refers to the sum total of all taxa from the orders Plecoptera (the stoneflies), Ephemoptera (mayflies), and Tricoptera (caddisflies). |

| Term | Definition |
|---|---|
| pH | "power hydrogen". Negative logarithm of hydrogen-ion concentration; a numerical expression of acidity or alkalinity. |
| Piezometer | A small diameter water bore used to measure the hydraulic head of groundwater in aquifers. |
| Planation | Processes of erosion results in the formation of fundamentally, flat, even or level surfaces (Brennan, 2004). |
| Plant | A member, alive or dead, of the plant kingdom or of the fungus kingdom, and includes a part of a plant and plant reproductive material. |
| Pleistocene | The first part of the Quaternary period of geological time lasting from about 2 Million years to 10,000 years ago. |
| Population | Occurrence of a species or ecological community in a particular area. |
| Porosity | Is a measure of void spaces in various rock types. |
| Potadromous species | Organisms which complete their entire life cycle in fresh water. |
| Precambrian | The period of geological time extending from about 285 to 250 mya. |
| Precipitation | A collective term for the moisture, either liquid or solid, that falls on the earth from the atmosphere. In North Queensland this is usually in the form of rain. |
| Probable Maximum Flood (PMF) | The flood resulting from the worst flood-producing catchment conditions that can be realistically expected in the prevailing meteorological conditions. |
| Prograde (progradation) | The accumulation of sediments and the subsequent migration of a bank or coastline outwards from the land. |
| Propagation | The reproduction of plants. |
| Ramsar wetland | Under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth), a Ramsar wetland is either:<br>■ an Australian wetland on the List of Wetlands of International Importance kept under the Ramsar Convention; or<br>■ a wetland declared to be a Ramsar wetland by the Commonwealth Environment Minister. |
| Rare | An animal is rare / near threatened if:<br>■ the population size or distribution of the wildlife is small and may become smaller; or<br>■ the population size of the wildlife has declined, or is likely to decline, at a rate higher than the usual rate for population changes for the wildlife; or<br>■ the survival of the wildlife in the wild is affected to an extent that the wildlife is in danger of becoming vulnerable. |
| Recharge | The process involving the infiltration of water from the surface to groundwater. |
| Recovery plan | A recovery plan is a document stating the research and management actions necessary to stop the decline, support the recovery and enhance the chance of long-term survival in the wild, of a stated species or community of protected wildlife. |
| Regional ecosystems (RE) | Regional ecosystems were defined by Sattler and Williams (1999) as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. |
| Regrowth | A young, usually even-aged forest stand that has regenerated after disturbance. |
| Rehabilitation | Making the land useful again after a disturbance. It involves the recovery of ecosystem functions and processes in a degraded habitat. |
| Remnant vegetation | Small remaining areas of naturally occurring vegetation in a landscape that has been altered by human activity such as agriculture. These remnants were once part of a continuously vegetated landscape. |
| Rill erosion | The removal of soil by numerous small channels only several inches deep. Rills occur mainly on recently cultivated soils or recent cuts and fills. |

| Term | Definition |
|---|---|
| Riparian | Pertaining to, or situated on the bank of, a body of water, especially a watercourse such as a river. |
| Riverine | Pertaining to rivers. |
| Roller Compacted Concrete (RCC) | A zero slump concrete requiring no steel reinforcement and is compacted by vibratory rollers. In RCC dams, progressive layers of a relatively dry mix of concrete are laid, each being compacted down in turn by rollers, allowing dams to be built much faster and significantly cheaper than by traditional methods of construction. |
| Rudosols | Soils with negligible pedological organisation. |
| Salinity | The concentration of any salt. |
| Sediment | Any usually finely divided organic and / or mineral matter deposited by air or water in non-turbulent areas. |
| Sedimentation pond | An artificial retention basin designed to trap suspended sediments carried in overland water flow before discharge into a water storage facility. |
| Sheet erosion | Erosion of thin layers of earth-surface material, more or less evenly, from extended areas of gently sloping land by broad continuous sheets of running water, without the formation of rills, gullies, or other channelised flow. |
| Slaking | The partial breakdown of soil aggregates in water due to the swelling of clay and the expulsion of air from pore spaces. |
| Sloped Layer Method | This method involves building up multiple layers of concrete, in 0.3m thicknesses, laid successively to build up one single super-layer, sloped at an incline of between 1:10 and 1:20. |
| Sodic | Refers to the dominance of sodium on the exchange complex of the soil. High levels of sodium can cause moisture infiltration problems and the accompanying, generally high soil pH, can cause nutrient disorders. |
| Soil aggregation | The lumping together of soil particles into a coherent mass. |
| Soil profile | The physical and chemical features of the soil imagined or seen in vertical section from the surface to the point at which the characteristics of the parent rock are not modified by surface weathering or soil processes. |
| Species | A group of biological entities that (a) interbreed to produce fertile offspring; or (b) possess common characteristics derived from a common gene pool. |
| Species richness | A botanical term indicating a measure of the number of species of plants or animals occurring in a given area. |
| Spotter/catcher | An ecologist who is accredited by the Queensland Parks and Wildlife Service (QPWS) to capture and relocate fauna (mainly mammals) from trees prior to vegetation clearance. |
| Strata | Plural of stratum, strata refers to the process whereby material, whether natural or artificial, forms parallel layers upon one another. |
| Stress | The result or consequent state of a physical or chemical, or social, stimulus on an organism or system. |
| Sub-species | A geographically separate population of a species, being a population that is characterised by morphological or biological differences from other populations of that species. |
| Systematic | In a methodical and organised way. |
| Taxa | Taxonomic group of any rank (for example as species, genus, family, class, order). |
| Tenosols | Soils with weak pedological organisation. |
| Terrain | A tract of land and its physical features with emphasis on bedrock geology. |
| Terrestrial | Pertaining to land, the continents, and/or dry ground. Contrasts to aquatic. |
| Tertiary | The period of geological time extending from about 65 to 2 mya. |
| Thermocline | The zone of rapid vertical temperature change in a thermally-stratified body of water. |
| Threatened | A collective term for native plants and animals which are presumed extinct, endangered and vulnerable. |

| Term | Definition |
|---|---|
| Threatened species and ecological communities | Threatened species or ecological communities listed and protected under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). |
| Topography | Description or representation of natural or artificial features of the landscape; the description of any surface, but usually the earth's. |
| Translocation | The transfer of plants and animals from one part of their range to another. |
| Transpiration | The loss of water from plants, normally as vapour. |
| Ubiquitous | Having or seeming to have the ability to be everywhere at once. |
| Unallocated water | Water to which an entitlement to extract has not been granted. |
| Understorey | A general term for the plants of a community occurring at levels lower than the top stratum. |
| Vertosols | Soils with high clay content (>35%), cracks & slickensides. |
| Vulnerable | A species is vulnerable if:<br>■ its population is decreasing because of threatening processes, or<br>■ its population has been seriously depleted and its protection is not secured; or<br>■ its population, while abundant, is at risk because of threatening processes; or<br>■ its population is low or localised or depends on limited habitat that is at risk because of threatening processes. |
| Water Allocation Security Objective (WASO) | Means an objective that may be expressed as a performance indicator and is stated in a water resource plan for the protection of the probability of being able to obtain water in accordance with a water allocation. |
| Weathering | Changes in the coherence, texture and composition of rocks and minerals by either physical (mechanical) or chemical processes as a result of exposure at the Earth's surface. |
| Weed | A plant that is considered undesirable because it threatens the persistence of native plants. |
| Wetlands | Low-lying areas regularly inundated or permanently covered by shallow water. Usually important areas for birds and other wildlife. |
| Wildlife | An animal, plant or specimen derived from an animal or plant. |
| Wildlife corridor | A strip of habitat that facilitates fauna movement between otherwise isolated patches of habitat. |
| World Heritage property | Under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth), a World Heritage property is either:<br>■ an Australian property on the World Heritage List kept under the World Heritage Convention; or<br>■ a property declared to be a World Heritage property by the Commonwealth Environment Minister. |
| Zeolitic | Group of structures containing large internal cavities. |

# 7. ATTACHMENTS

**Attachment 1 – Key Approvals & Authorities**

Relevant State approvals will be able to be obtained progressively as construction of the Project proceeds. Under IDAS, some development applications can be consolidated into one application. Decisions about this will be made closer to the time the applications are to be made.

**Table 7.1 Key Approvals and Authorities**

| No. | Approval Source/Decision Maker | Relevant Aspect of Project |
|---|---|---|
| 1 | Approval as a controlled action (Environment Protection and Biodiversity Conservation Act 1999)<br>The Project has been declared a controlled action requiring an approval in relation to its likely impacts on the nominated matters of national environmental significance:<br>■ sections 12 and 15A (world heritage);<br>■ sections 16 and 17B (RAMSAR wetlands);<br>■ sections 18 and 18A (listed threatened species and communities); and<br>■ sections 20 and 20A (listed migratory species).<br>(Federal Minister responsible for the EPBC Act) | Any aspect of the Project which is likely to impact on the nominated matters of national environmental significance. |
| 2 | Community Infrastructure Designation (*Integrated Planning Act 1997*)<br>A Community Infrastructure Designation can be made in relation to a wide range of infrastructure facilities set out in Schedule 5 of IPA.<br>(IPA s.2.6.1 – 2.6.25)<br>(Any responsible State Minister) | Dam wall, reservoir and buffer areas.<br>Potentially to much of the infrastructure which needs to be relocated as part of the Project. |
| 3 | Resource Operations Licence (*Water Act 2000*)<br>The Resource Operations Licence represents the licence to operate the water infrastructure from time to time. An interim licence will be sought initially and a final upon completion of the Resource Operations Plan for the Mary Basin.<br>(Chief Executive responsible for the Water Act 2000) | Operation of the dam infrastructure. |
| 4 | Development permit (operational works) (Water Act 2000, Integrated Planning Act 1997)<br>Operational work of any kind and for all things constructed or installed either taking or interfering with water (other than using a water truck to pump water) under the *Water Act 2000* if the operations allow, under that Act –<br>■ taking or interfering with water from a watercourse, lake or spring (other than under the Water Act 2000 s.20(2), (3) or (5) or from a dam constructed on a watercourse).<br>(IPA Sch 8 Part 1 Tab 4-3)<br>(Chief Executive responsible for the Water Act 2000) | Works for construction of the dam.<br>Other works which interfere with water outside the construction zone. |
| 5 | Development permit (operational works) (Water Act 2000, Integrated Planning Act 1997)<br>Operational works that –<br>■ is the construction of a referrable dam as defined under the *Water Act 2000*.<br>(IPA Sch 8 Part 1 Tab 4-4(a))<br>(Chief Executive responsible for the Water Act 2000) | Works for construction of the dam. |
| 6 | Failure Impact Assessment (*Water Act 2000*)<br>(Section 480 ss *Water Act 2000*<br>(Chief Executive responsible for the Water Act 2000) | Works for construction of the dam. |

| No. | Approval Source/Decision Maker | Relevant Aspect of Project |
|---|---|---|
| 7 | Development permit (operational works) (Integrated Planning Act 1997, Vegetation Management Act 1999)<br>Operational works that is the clearing of native vegetation on land.<br>(Sch 8 Part 1 Tab 4-1A – 1G)<br>(Chief Executive responsible for the Vegetation Management Act 1999) | Land of relevant tenure to be cleared of native vegetation which is not subject to any exemptions listed in the relevant part of IPA Schedule 8. |
| 8 | Development permit (Water Act 2000, Integrated Planning Act 1997)<br>All aspects of development for removing quarry material from a watercourse or lake as defined under the *Water Act 2000* if an allocation notice is required under that Act.<br>(IPA Sch 8 Part 1 Tab 5-1)<br>(Chief Executive responsible for the Water Act 2000) | Any aspects where quarry material (stone, gravel, sand, rock, clay, earth, soil) is removed from the watercourse except if so removed as waste material. |
| 9 | Allocation notice for quarry material (*Water Act 2000*)<br>(Section 280 *Water Act 2000*).<br>(Chief Executive responsible for the Water Act 2000) | Any aspects where quarry material (stone, gravel, sand, rock, clay, earth, soil) is removed from the watercourse except if so removed as waste material. |
| 10 | Permit (Water Act 2000)<br>Permit to destroy vegetation, excavate or place fill in a watercourse, lake or spring.<br>(*Water Act 2000* s.266 and s.814).<br>(Chief Executive responsible for the Water Act 2000) | In the watercourse. |
| 11 | Licence to take or interfere with water (*Water Act 2000*)<br>A licence to take or interfere with the flow of water in a watercourse.<br>(Water Act 2000 s.206.)<br>(Chief Executive responsible for the Water Act 2000) | May apply to some elements of construction activities. The Resource Operations Licence will provide the relevant authority for operation of the dam. |
| 12 | Permit (Water Act 2000)<br>Permit to take water from a watercourse for a specified purpose where the activity has a foreseeable end date.<br>(Water Act 2000 s.237.)<br>(Chief Executive responsible for the Water Act 2000) | Likely to be required if water is required to be taken from the watercourse during construction. |
| 13 | Development permit (material change of use for environmentally relevant activity) (*Integrated Planning Act 1997, Environmental Protection Act 1994*)<br>Making a material change of use of premises for an environmentally relevant activity.<br>(IPA Sch 8 Part 1 Tab 2-1)<br>(Chief Executive responsible for the *Environmental Protection Act 1994*) | The activities following listed in Schedule 1 of the *Environmental Protection Regulation 1998*.<br>■ Storing fuel or chemicals at a construction site (ERA 37);<br>■ Dredging material (ERA 19);<br>■ Screening materials (ERA 22);<br>■ Quarry operations for extraction of rock, sand, clay or gravel (ERA 20);<br>■ Concrete batching (ERA 62); and<br>■ Regulated waste storage (ERA 84). |

| No. | Approval Source/Decision Maker | Relevant Aspect of Project |
|---|---|---|
| 14 | Registration Certificate ( Environmental Protection Act 1994)<br>Required for a person to be the registered operator carrying out an environmentally relevant activity as listed in Schedule 1 of the *Environmental Protection Regulation 1998*.<br>(Section 73D Environmental Protection Act 1994)<br>(Chief Executive responsible for the Environmental Protection Act 1994) | The activities listed for approval. |
| 15 | Development permit (operational works) (Integrated Planning Act 1997, Fisheries Act 1994)<br>For assessing operational works against the *Fisheries Act 1994* operational work that is the construction or raising of a waterway barrier works if it is not self-assessable development.<br>(IPA Sch 8 Part 1 Tab 4-6)<br>(Chief Executive responsible for the Fisheries Act 1994) | Works for construction of the dam and fishway. |
| 16 | Disposal Permit to remove Contaminated Land (*Environmental Protection Act 1994*)<br>To remove and treat or dispose of contaminated soil from land on the Environmental Management Register or Contaminated Land Register.<br>(EPA s.424)<br>(Chief Executive responsible for the Environmental Protection Act 1994) | Where land on either register, required for the Project, needs to be remediated for the purposes of the Project and removal and disposal of the contaminated soil is involved. |

**Table 7.2 Other Approvals**

| No. | Approval Source/Decision Maker | Relevant Aspect of Project |
|---|---|---|
| 1 | Development permit for building works<br>(*Integrated Planning Act 1997,* Sch 8, Part 1, Table 1, Item 1)<br>(Relevant local government) | Any works which meet the definition of "building works". |
| 2 | Licence for storage of flammable and combustible liquids above specified limits<br>(Dangerous Goods Safety and Management Act 2001; Dangerous Goods Safety and Management Regulation 2001)<br>(Relevant local government) | If trigger limits for storage quantities are met by any activity. |
| 3 | Authorities for possession, storage and use of explosives<br>(Explosives Act 1999; Explosives Regulation 2003)<br>(Chief Inspector under the Explosives Act 1999) | If defined explosives are used during construction. |
| 4 | Permit to light fires<br>(Fire and Rescue Service Act 1990; Fire and Rescue Service Regulation 2001)<br>(Commissioner of the Fire and Rescue Service) | Burning of cleared vegetation or other waste during construction. |
| 5 | Permit to take or interfere with listed species<br>(*Nature Conservation Act 1992*; Regulations made under that Act)<br>(Chief Executive responsible for the Nature Conservation Act 1992) | Where relevant listed species are identified as being affected by the Project. |

| No. | Approval Source/Decision Maker | Relevant Aspect of Project |
|---|---|---|
| 6 | Self assessable development<br>(These self assessable developments will not involve approvals, but if triggered will require relevant codes to be complied with.)<br>For assessing road works on a local government road under the *Transport Planning and Coordination Act 1994* s.8C; operational works that are road works on a local government road.<br>(IPA Sch 8 Part 2 Tab 4-5) | Road works on local roads involving passenger transport routes. |
| 7 | Permits or approvals under Council by-laws or local laws<br>(Relevant local authority) | Road works on local roads. |

**Attachment 2 – Present Value Cost Estimates for Alternative SEQ Supply Portfolios, 2007 - 2056**

**Present Value Cost Estimates for alternative SEQ supply portfolios, 2007 – 2056**

| | Traveston Crossing Dam Portfolio $M | Desalination Portfolio $M | Mary River Dams Portfolio $M | NSW Dam + Wyaralong Portfolio $M | Smaller Dams Portfolio $M |
|---|---|---|---|---|---|
| Total SEQ Portfolio Capex | 7,364 | 7,173 | 8,087 | 7,684 | 7,898 |
| Total SEQ Portfolio Operating Fixed | 1,589 | 1,887 | 1,827 | 1,747 | 1,963 |
| Total SEQ Portfolio Operating Variable | 737 | 949 | 817 | 910 | 839 |
| Total SEQ Portfolio Cost (PV 2007-'56) | $9,690 | $10,008 | $10,731 | $10,341 | $10,700 |
| Difference in Total Cost of Portfolio compared to TCD Portfolio | Benchmark | +$318M (greater cost than TCD) | +$1,040M (greater cost than TCD) | +$651M (greater cost than TCD) | +$1,009M (greater cost than TCD) |
| Ranking | 1st | 2nd | 5th | 3rd | 4th |

**Attachment 3 – Proponent Commitments**

| Proponent Commitments |
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| **General** |
| ■ The Proponent will construct Traveston Crossing Dam Stage 1 in accordance with the Environmental Management System developed for the Project; |
| ■ The proponent will implement operating procedures as stated in a Resources Operations Plan. |
| ■ In conjunction with relevant government agencies, emergency services and other relevant local government and community representatives, the proponent will develop an optimised flood management plan which balanced the needs of both upstream and downstream stakeholders and the environment. |
| ■ The proponent will undertake the Project in accordance with a EMP which incorporates the elements of the draft EMP included in this EIS and also including improvements, and particular aspects relating to finalisation of design, construction timetables and the like |
| **Land** |
| **Topography, Geomorphology, Geology and Soils** |
| ■ Prepare and implement a Topsoil Management Plan for the inundation area and borrow/spoil areas outside of the inundation area (i.e. down stream of dam wall) to assist with re-establishment of the area and ongoing stability. |
| ■ Rehabilitate any borrow area outside of the inundation area as site works are completed, incorporating a selection of indigenous and fast growing plant species endemic to the area. |
| ■ Maintain existing vegetation within the flood margins of FSL where required to stabilise the soil, reduce raindrop impact erosion and runoff velocities to minimise erosion. |
| ■ Prior to any construction works commencing on site, undertake an erosion risk assessment to identify flow paths, suitable stockpile locations, soil cover type, and soil stability. |
| ■ Prepare and implement erosion and sediment control plans in accordance with the Erosion and Sediment Control: Engineering Guidelines for Queensland Construction Sites (Witheridge and Walker, 1996). |
| ■ Monitor geomorphic assessment sites to assess bed erosion / deposition and changes in bed substrate and ensure that environmental flow rules are working in terms of habitat maintenance. |
| ■ Develop and implement riparian management plans and manage overgrowth of stabilising vegetation on selected bars. |
| ■ Review sand / gravel extraction within the upstream sections of the inundation area, including the option of extraction during lower water levels to alleviate any adverse impact of deposition and ameliorate the impact of any reduction in sediment extraction downstream of the dam due to the Project. |
| ■ Utilise extracted sediment to supplement sands eroded from the artificial ‘beaches’ constructed on islands created within the proposed inundation area. |

| Proponent Commitments |
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| **Land Contamination** |
| ▪ Sites listed on the EMR will undergo a staged PSI assessment process with subsequent investigative/remediation activities based on the PSI assessment outcomes in accordance with EPA requirements. |
| ▪ High and Medium potential risk sites will initially be inspected by an experienced and qualified contaminated land professional (i.e. minimum 10 years professional experience). If the inspection identifies actual notifiable activities or signs of contamination, these properties will also be subject to the PSI investigation process. |
| ▪ In co ordination with the relevant Council as the responsible authority, provide for assessment and remediation of septic tanks considered as a risk to water quality of the storage. |
| ▪ Obtain an approval and a disposal permit by the EPA (Contaminated Land Unit) for the management, removal or disposal of any contaminated soil, in accordance with the Environmental Protection Act 1994. |
| ▪ Develop a management plan to ensure a proactive approach to identifying unexpected contamination as construction works are undertaken. |
| ▪ All required contaminated land investigations, remediation and/ or site management works will be completed prior to inundation. |
| ▪ Prepare and implement procedures for the remediation of contaminated soil spills that may occur during transport. |
| ▪ Prepare a management plan to ensure that all material brought to the site meets the requirements of: |
| – National Environmental Protection (Assessment & Site Contamination) Measure; and |
| – Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland (1998). |
| ▪ Fuel, oil and chemicals will be stored in accordance with Australian Standard 1940B-1993, the Storage and Handling of Flammable and Combustible Liquids, and the Dangerous Goods Act 1975 and the Pesticides Act 1999. |
| ▪ Chemical storage will comply with Australian Standards and Material Safety Data Sheets (MSDS) requirements. MSDS for products kept on site will be readily available to employees and contractors. |
| **Visual Amenity** |
| ▪ Prepare and implement a Landscape Design and Management Plan for the design and construction of the dam wall, associated embankments, spillway and visually exposed infrastructure. This plan is to address: |
| ▪ architectural or sculptural design, form and colour of the exposed downstream face of the impoundment wall; |
| ▪ landforming and landscape treatment of spoil placement adjacent to the downstream face of the wall to reduce the apparent height of the wall and provide a suitable foundation for screen planting and other uses. Spoil is to be placed in a form consistent with local topography and landscape to avoid simply enlarging the engineering bulk of the impoundment structures; |
| ▪ landscape design of the spillway including the proposed treatment of the cut rock face on the eastern side to avoid visual exposure of this rock face; |
| ▪ protection and management of native vegetation within the dam wall construction area footprint particularly immediately downstream riparian vegetation and remnant native forest and bushland vegetation above the spillway; and |
| ▪ management of night lighting to ensure lights are focussed on the areas and to limit extraneous light where necessary. |

| Proponent Commitments |
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| ▪ Landscape Assessment and Design Plans should be prepared for all road upgrading, new roads and local access arrangements identifying significant visual impact issues and proposed landscape treatments |
| ▪ Prepare and implement a Landscape Masterplan(s) for the inundation area prior to construction dealing particularly with:<br>▪ the management of existing vegetation within the FSL;<br>▪ the design and management of the FSL edge treatment to avoid erosion and protect steeper slopes and future “banks”; and<br>▪ manage water level fluctuations and provide for the establishment of pioneer riparian plantings consistent with existing vegetation<br>▪ provide for a staged clearance of vegetation which retains fringe elements of vegetation to minimise the visual impact of clearance of the inundation area. These fringe elements can be cleared as a last stage in the clearing activity.<br>▪ The Master plan will provide for the staged inundation of the water body and take into account the views of adjoining landholders. Specific Landscape Masterplans should be prepared for urban or tourist areas addressing the effects of the inundated areas and also associated infrastructure such as roads. Particular attention should be given to the early establishment of suitable vegetation and the creation of special areas suitable for water based recreation and enjoyment. |
| ▪ Lighting of the site to conform with the Australian standards AS1158 Road lighting and AS 4282 Control of the obtrusive effects of outdoor lighting. |
| **Infrastructure** |
| ▪ Utility infrastructure relocations will be undertaken by the relevant utility and will be paid for, after agreement on reasonable and directly relevant costs, by QWI. |
| ▪ QWI will liaise with the relevant local Council and State government agency prior to the design and construction of the new local road relocations/realignments and intersection ugrades |
| ▪ All utilities will mange their infrastructure relocation activities via an EMP which embodies the principles of the Project EMP. |
| ▪ QWI will control the use of land within the leaseback areas in addition to existing local government planning scheme restrictions, to protect water quality of the storage and the river system and also protect the structure of the banks and streams. It is intended that the following activities be prohibited on land included within the buffer area:<br>▪ Permanent structures excluding fencing;<br>▪ Cropping and other intensive agricultural land uses;<br>▪ Quarrying, mining or excavating;<br>▪ Recreational use of trail bikes or 4WD vehicles off formed roads;<br>▪ Industry (including extractive activities);<br>▪ Spraying and other activities which may impact on water quality; and<br>▪ Incompatible land uses within the separation distances of the quarry. |
| ▪ Investigate the feasibility for flexible housing types within the construction accommodation camp to cater for both single workers and workers with families |

| Proponent Commitments |
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| ▪ Consult with Mary Valley Heritage Railway Committee and Kandanga, Imbil and Amamoor station committees regarding station/platform improvements including improving access for people with impaired mobility |
| ▪ Mitigate the flooding of Kandanga Cemetery in a Q100 flood event. A grassed verge will be the benchmark option to provide immunity to the Kandanga Cemetery for floods up to and including the 1 in 100 AEP event however, QWI will work with relevant community members and OUM/ CFT, and will consider alternative mitigation measures. |
| ▪ Upgrades, relocation and/or realignment of roads, bridges, access and intersections as described in detail in the Description of Project will be undertaken as a Project cost. |
| ▪ QWI will contribute to the brought forward costs for the realignment of the Bruce Highway which accounts for the possible Stage 2 considerations. |
| ▪ QWI will undertake and implement the obligations and agreements contained in the MOU executed by QWI to facilitate the relocation and upgrade of the Bowls Club, sports and community facilities in Kandanga. |
| **Water Resources and Water Quality** |
| ▪ The design and management of the construction process will ensure the normal flow in the Mary River is maintained. |
| ▪ QWI will make a submission to DNRW for a Resource Operation License (ROL) under the ROP. |
| ▪ The dam will comply with all WASOs for supplemented and unsupplemented allocations. Existing user entitlements will not be impacted by development of the dam and system reliability will be maintained. |
| ▪ A Soil and Water Management Plan complying with erosion and sediment control guidelines will be prepared and implemented. Key sediment runoff control initiatives will include the following: |
| ▪ The construction area footprint will be restricted as much as practical to minimising areas of disturbance and much of the construction will be carried out in the proposed inundation area; |
| ▪ Key phase of the construction sequence will be timed to coincide with lower rainfall periods as much as is practical; |
| ▪ Directional bunds and grades will be used to direct runoff water to appropriately-sized sediment retention ponds; |
| ▪ The water detained in sediment ponds is to be reused on the construction site where possible, or progressively released back into the river under a water quality management plan; |
| ▪ Stockpiled top soil will be kept at a practical distance from the waterway and will be protected by bunded and lined enclosures; |
| ▪ Boom and floating silt fencing will be installed during the spillway tie-in and coffer dam construction phases to restrict any turbid plumes; |
| ▪ The coffer dam will have scour protection installed to minimise sediment mobilisation; |
| ▪ The bulk of the construction facilities will be located on farmland where most of the vegetation has already been cleared (minimising the need for further vegetation clearing); |
| ▪ Vegetation on banks or steep slopes will be cut just above base height to maintain the root mass; |

| Proponent Commitments |
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| ▪ Vegetation clearing will be staged so that only the area required for construction works is initially cleared then the remainder will be cleared progressively and as late as possible in the construction sequence; and |
| ▪ The construction footprint area will be progressively reshaped and re-vegetated with native species as work phases are completed. |
| ▪ Bore drilling, construction and development methods will be in accordance with the Minimum Construction Requirements for Water Bores in Australia (Land and Water Committee, 2003). The final bore construction details will be designed by a supervising hydrogeologist as each borehole is drilled, to ensure target yields are obtained for the localised ground conditions encountered. |
| ▪ Ensure groundwater monitoring program is developed prior to construction to monitor groundwater levels as part of geotechnical program. |
| ▪ Emergency response procedures will be developed, with chemical spill response kits will be issued at all construction sites and staff trained in their use. |
| ▪ Former agricultural land directly abutting the inundation owned by QWI will be re-vegetated to minimise nutrient run-off. |
| **Terrestrial Environments** |
| ▪ Millable timber or timber suited to other commercial purposes will be salvaged and large woody debris suitable as aquatic or terrestrial habitat will be saved for placement in critical locations. As much of the remaining suitable material will be mulched for use in rehabilitation and landscaping. |
| ▪ A Vegetation Clearance Management Plan will be developed for the Project to prevent excessive clearing and impact to vegetation. Strategies include: |
| ▪ limit the clearing of riparian zones to within 1.5m of the FSL; |
| ▪ identify areas within the inundation area that are to be cleared and/or retained on Construction Drawings; |
| ▪ boundaries of areas to be retained to be clearly marked by tape and/or pegs and conform to limits on drawings; |
| ▪ avoid impact on vegetation outside the inundation area by clearly identifying the FSL boundary, and directing contractors to avoid these areas; |
| ▪ minimise clearing of vegetation within the road corridors; and |
| ▪ contractor to monitor vegetation clearing to ensure only approved areas are cleared. |
| ▪ On completion of construction, progressive rehabilitation of the construction site in areas that will not be inundated will be undertaken, by replacement of topsoil, contouring, re-vegetation with local native species, and mulching as soon as possible after disturbance. |
| ▪ Restrict clearing to within approximately 1.5 m of the FSL in riparian zones along upstream reaches of the tributaries. |
| ▪ Develop a Vegetation Management Offsets (VMO) to mitigate impacts to significant regional ecosystems and vegetation communities. The VMO will seek to comply with the guidelines detailed in the Queensland's 'Policy for Vegetation Management Offsets' (DNRW, 2006). The restoration of vegetation connectivity and generation of buffers for existing remnant vegetation will be sought wherever possible as an additional component of the offset strategy. This requires focus on key areas where rehabilitation and management will provide the greatest ecological enhancements through increasing connectivity or providing buffers to high conservation value vegetation including significant RE's and riparian vegetation. |
| ▪ A landscaping and re-vegetation plan will be implemented after construction of the Project and will involve targeted re-vegetation of riparian areas along Belli Creek and Happy Jack Creek, and road sides, planting around the banks of the dam and within the proposed island refuges with groundwater tolerant species. Local native species will be used |

| Proponent Commitments |
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| ■ A translocation plan will be developed for slender milkvine prior to construction works. Suitable translocation sites be identified within the study area (above the FSL), and propagated and/or removed individuals of slender milkvine be planted at several sites. These sites will be subject to active management to reduce the threat of weeds and fire in particular. Pilot propagation and planting trials will be initiated at the commencement of the Project to determine the translocation potential of the slender milkvine. It is proposed to monitor flora at the translocation sites to determine the success of the translocation and management actions. |
| ■ To offset the loss of likely EVR flora species, a qualified botanist will be on-site prior to any vegetation clearing works within remnant vegetation communities, to inspect the area for EVR flora. |
| ■ A weed management plan, will be prepared prior to the commencement of any construction of clearing activities. Management measures include: |
| ■ Use of wash-down facilities for vehicles and equipment entering and leaving the construction site and those areas proposed for vegetation clearance. |
| ■ All machinery, equipment and vehicles shall be certified as “clean” prior to entering the construction site by trained personnel in accordance with DNRW practices. |
| ■ Avoid the removal of vegetation, which is not salvaged for timber resource, from the vegetation clearance areas. |
| ■ Weeds not to be used as mulch for landscape, disposed of to Council’s landfill or burnt to prevent reseeding. |
| ■ Soil and landscaping material brought onto the site must be from a source that is clean and weed free. |
| ■ Management methods for declared weeds must be consistent with recommendations in DNRW Pest Fact sheets. |
| ■ The monitoring of re-vegetated areas to identify new infestations and eradicate any declared weeds found. |
| ■ Weed monitoring to ensure that new weed species are not introduced into the immediate area of the dam catchment and eradicate any declared weeds. |
| ■ Identify areas for frog rehabilitation upstream of the FSL along Belli Creek, Happy Jack Creek and other tributaries to provide habitat for Southern Barred Frog and other local frog species. These areas will be re-vegetated and restricted from cattle grazing (in negotiation with landowners) to encourage utilisation by local frog species. Habitat management for Southern Barred Frog has been conducted to date on a property along Happy Jack Creek. The facilitation and extension of habitat upstream, in co ordination with appropriate stakeholders, will be undertaken as part of the Project |
| ■ To offset the loss of habitat for fauna, the following will be undertaken as part of the Project as detailed in the EIS:<br>■ island refuges throughout the dam<br>■ re-vegetation of riparian areas along Belli Creek and Happy Jack Creek for local frog species<br>■ re-vegetation of construction site areas and around the edges of the dam<br>■ provision of vegetation management offsets in areas where vegetation connectivity can be enhanced and buffers for existing remnant vegetation generated<br>■ salvage habitat logs, branches and other shelters from vegetation clearing to create habitat for small mammals and reptiles<br>■ retain dead (stag) trees within the inundation area as potential roosting sites. |

| Proponent Commitments |
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| ▪ A Queensland Parks and Wildlife Service (QPWS) accredited spotter/catcher will be on-site immediately prior to vegetation clearance to inspect habitat trees (i.e. trees with hollows, fissures or with substantial food resource, mature trees or stag trees) to determine the presence of fauna and to implement a relocation plan for any fauna found. This spotter/catcher must also be present during vegetation clearing to relocate any native fauna. Clearing will be undertaken using a staged approach to encourage fauna to migrate out of the area. The process of identifying habitat trees, removing hollows, flushing out fauna and caring of injured fauna will be included in a Terrestrial Fauna EMP. |
| ▪ Management measures that will be employed during the operation of the Project to minimise impacts on native fauna include: |
| ▪ Monitor populations of the Southern Barred Frog and Tusked Frog in rehabilitated riparian habitats to assess long-term population trends and disturbance responses. |
| ▪ Monitor translocation sites to determine the success of the translocation and management actions. |
| ▪ Management of vegetation offset and re-vegetation areas. |
| ▪ Erect nesting boxes on trees in re-vegetated areas to provide habitat for arboreal mammals and nesting birds. |
| ▪ Ongoing weed and pest animal control, including active management to remove feral animals or rescue native fauna from the island refuges should they become trapped. |
| ▪ Establish contact details and communication with of local wildlife care and veterinary surgeons to enhance the effective emergency processes and management of injured native fauna. Establish contacts for local wildlife care and veterinary surgeons for the rescue and care of injured native fauna. |
| ▪ Implement speed limits and wildlife signage on local roads to minimise road mortality. |
| ▪ Detailed design of bridges should avoid where possible the construction of supporting structures in the stream and riparian habitats. |
| ▪ Installation of fauna crossings on the Bruce Highway, such as land bridges, under passes or rope ladders. These structures must include exclusion fencing to direct fauna to utilise the crossing structures. |
| ▪ Ongoing feral and pest animal control will be implemented during the operation of the dam. |
| ▪ During construction, measures will be implemented to assist in the control of mosquitoes, for example preventing the accumulation of water in containers, tanks and trenches etc and screening of sediment ponds. |

| Proponent Commitments |
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| **Aquatic Environments** |
| ■ Prepare and implement a program to monitor and control declared and aggressive aquatic weeds, such as Salvina and Water Hyacinth including those found in tributaries that will become inundated by the dam. This program will include a survey to determine the distribution and abundance of declared weeds within the Project area (including the inundation zone). |
| ■ Retention of vegetation and re-vegetating selected areas of the fringe of the dam and on islands within the dam (i.e. areas within 1.5 m of FSL) with native species tolerant of periodic inundation, which are known as good sources of large woody debris, and will provide food for aquatic species (certain *Melaleuca*, *Waterhousia* and *Eucalyptus*); |
| ■ QWI will introduce snag habitat into the storage which will involve the placement of hollow snags and piles of logs in areas identified as most potentially suitable for cod and other species, such as turtles. Compensatory snag habitat and re-vegetation will be undertaken in other parts of the catchment (particularly where Mary River cod are known to occur but where current habitat values are sub-optimal). |
| ■ QWI will introduce artificial surfaces to act as suitable shelter habitat for fish (this may include rocks or large diameter water pipes), particularly for the Mary River cod and the lungfish. |
| ■ QWI will develop and install a state of the art fish transfer mechanism on the dam and a turtle ramp system in conjunction with the DPI&F and EPA and other leading experts. In addition to this, QWI proposed to use physical translocation of specimens of the species of interest, or restocking of juveniles derived from brood stock from a different location for population maintenance and negating the possibility for genetic isolation. QWI will regularly monitor of the efficacy of the fish transfer mechanism and turtle ramp to ensure their objectives are achieved |
| ■ Create turtle habitat and nesting sites at strategic points around the dam perimeter and on islands within the dam |
| ■ Control access to nesting sites by feral animals (such as foxes, dogs) and cattle to reduce the taking or trampling of eggs. |
| ■ Prepare and implement a program to identify operational activities that could aid in the management of habitat diversity. |
| ■ QWI will support catchment management works with links to the impacts of the dam, such as cod habitat rehabilitation, through a number of funding mechanisms. |
| ■ QWI will develop and establish a Freshwater Species Conservation Centre. The $35M cost of the Centre over a 10 year period will be funded as part of the Project. |
| ■ QWI will contribute through funding improvements to fish hatchery facilities at Noosa and District Hatchery Association |
| **Air Quality/Greenhouse Gas** |
| ■ QWI will contribute, as part of the Project, towards the establishment of a native hardwood timber plantation to offset carbon emissions. |
| ■ Air quality will be managed as set out in the EMPs. |
| ■ Establish a dust concentration and deposition monitoring network to assist with the quantification of background air pollutant levels (PM10 and dust deposition) at a number of representative receiver locations adjacent to the site. The monitoring will be continued throughout the duration of construction, as required. |
| ■ Prepare and implement a detailed air quality and meteorological monitoring plan as part of the construction Air Quality Management plan including a mechanism to indicate where additional mitigation measures are required for air quality management. This may include on site visual monitoring by the site environmental officers as well as a complaints trigger. |

| Proponent Commitments |
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| **Noise and Vibration** |
| ■ Noise and vibration will be managed as set out in the EMPs |
| ■ Construction activities will be carried out in accordance with the construction noise control guidelines described in Australian Standard AS 2436-1981 Guide to noise control on construction, maintenance and demolition sites (Standards Australia, 1981). |
| ■ Prior to the commencement of site works, QWI will inform the community of the upcoming activities and likely duration. The construction programme would continue to be developed in consultation with the local community to schedule noisier activities (such as blasting) during least sensitive times of the day (refer *Community Notification* and *Complaints* Procedure below). |
| **Waste** |
| ■ Waste will be managed as set out in the EMPs. |
| ■ Prepare and implement site-specific Waste Management Plan prior to commissioning of the dam addressing issues such as location and methods of storage, transport and disposal. |
| ■ Identify and implement measures for avoiding waste generation, reducing waste generation and reusing waste generated on site. |
| ■ Enter purchase agreements to include the requirement for suppliers to take back packaging, where practicable. |
| ■ Ensure the transport of regulated wastes, contaminated soils or other materials is conducted by licensed contractors for disposal at licensed facilities, in accordance with requirements of Part 2 of the Environmental Protection Regulation 1998. |
| **Transport and Access Arrangements** |
| ■ Road, access and intersection realignments and/or relocations, upgrades will generally be in accordance with the details provided in the EIS. Where improvements and opportunities for better outcomes can be derived these will be identified and through consultation appropriate modifications made to the planned road and access designs. |
| ■ Prepare a traffic management plan for all elements of the works to included measures to minimise the adverse effects on the road network. The plan should: |
| ■ provide a detailed schedule of construction works for roadworks prior to construction works commencing which also addresses safety and convenience for all road users; |
| ■ detail the heavy vehicle operation to minimise the adverse effect on road users and the community; |
| ■ analyse the capacity of intersections and road links along the haulage routes in order to identify and mitigate against any operational impacts; |
| ■ monitor construction conditions; |
| ■ Investigate the feasibility for a bus service for construction employees. |
| ■ Maintain one lane open during roadworks for emergency vehicles. |
| ■ Provide on-site parking for employees and visitors to the site during construction. |

| Proponent Commitments |
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| ▪ Provide bus facilities (pull in bays) to support school, community and tourism purposes during construction and for the longer term. The facilities will be part of the negotiations between QWI and the appropriate representatives and be undertaken as part of the Project. |
| ▪ All road upgrades and relocations will ensure local and regional accessibility including individual property access is maintained. |
| ▪ Ensure all construction employees and contractors are aware and comply with the Traffic Management Plan for the Project |
| ▪ Consult with Queensland Police, Queensland Ambulance, Queensland Fire and Rescue Service and Queensland Transport regarding road safety management for the Mary Valley during construction. Integrate consultation inputs into road planning and access arrangements. |
| ▪ Each haulage contractor will be required to prepare a Road Use Management Plan (RUMP), which addresses the following key items associated with the haulage of materials: |
| ▪ Providing signage and delineation past the work site, including any diversion routes. |
| ▪ Notify the local communities about proposed changes to local traffic access due to construction activities and provide clear signage of changed traffic conditions. |
| ▪ Provide adequate on-site parking to accommodate the employees' vehicles and instruct the commuting employees to use the provided parking facilities in order to avoid traffic disruption due to road side parking. |
| ▪ Provide buses for transportation of construction workforce, where necessary. |
| ▪ Maintain at least one lane open for traffic on roads near the construction site. |
| **Cultural Heritage** |
| ▪ All site operations are to be carried out in accordance with the Cultural Heritage Investigation and Management Strategy (CHIMS) as agreed between QWI and the Aboriginal Parties for the area. |
| ▪ QWI is committed to a process that affords the native title parties the opportunity to identify the nature and scale of the cultural heritage issues to be managed, and then develop and implement the necessary management processes. This process is located in the ILUA that has been agreed between QWI and the native title parties. |
| ▪ QWI and the native title parties have specified the implementation of a management process that embodies culturally appropriate mechanisms for the management of their cultural heritage, in conjunction with an ILUA that provides recompense for impact upon native title interests. |
| ▪ In the event that any indigenous items are uncovered during the course of the construction of the Traveston Crossing Dam Project, work in the immediate area should cease and the finds immediately be reported to the Cultural Heritage Coordination Unit, DNRW on (07) 3238 3838 and QWI Cultural Heritage Senior Project Officer. |
| ▪ Conduct cultural heritage awareness training for all on-site personnel identifying areas and items of cultural heritage significance. |

| Proponent Commitments |
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| **Social & Economic** |
| ■ Develop, as part of the Project, an information and interpretive centre as part of facility development to enhance recreational access and values at, and around the Traveston Crossing Dam. |
| ■ Actively facilitate the implementation of the MOU executed with sporting and community organisations in Kandanga. |
| ■ Facilitate and participate in the development of melliferous tree plantations |
| ■ Facilitate and provide support to land use and infrastructure planning studies to investigate the impacts and opportunities of the Project on existing land uses and infrastructure and participate in local and State government long-term land use planning and infrastructure programming for the Project area and surrounds |
| ■ Partner with Tourism Queensland and local tourism bodies to develop visitor attraction program |
| ■ In co operation with the Rural Fire Brigade, enhance the base and training facilities at Kandanga. |
| ■ Prepare and implement a communication program to targeted residents in the immediate vicinity of pending works and the wider community as part of a Project Communications Plan, including: |
| ■ regular construction updates; |
| ■ advice on blasting and construction schedules; |
| ■ the results of monitoring required by the EMP; |
| ■ Maintaining existing commitments with the Friends of Kandanga Information Centre and facilitate identification of suitable premises for ongoing occupancy post construction of the Project |
| ■ Prepare and implement a complaint responses system including promotion and provision of phone contact with construction management staff during hours of construction, and a follow up procedure which notifies complainants within 24 hours of the intended response to the issue raised. |
| ■ Effective promotion, PR and advertising towards the end of the construction period indicating when it will be opened to the public and what facilities will be available. |
| ■ Facilitate the planning, funding and development of the recreational planning initiatives outlined in the EIS to enhance the area's future capacity to provide for the recreational needs of locals and tourists, including recreation and opportunities as part of the Project. |
| ■ Facilitate planning for sewering and improved reticulated water supply for Kandanga township. |
| ■ Continue to operate the 1800 number along with mail, web based feedback forms and site visitation throughout the Project. |
| ■ Prepare an annual activity report which outlines the environmental, social and economic objectives of the Project, including sustainability, and progress against these for distribution within the regional community |
| ■ Undertake consultation to develop mitigation strategies (early and ongoing), community engagement strategies, environmental management measures, and monitoring processes including community involvement. |
| ■ In designing, planning and siting the construction accommodation camp, ensure the contractor considers its potential future use (e.g. affordable housing, recreational use, functional open space). |

| Proponent Commitments |
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| ■ Maintain Traveston Crossing Dam Business Capabilities Working Group to help local business prepare for the opportunities that would be available to them during the construction phase (e.g. acquiring necessary licences, permits, skills etc). |
| ■ Coordinate with the Industry Capability Network (Qld), a not-for-profit group assisting in the development of a Local Industry Participation Plan. |
| ■ Continue to promote a Local Business Opportunity Register, so that local businesses can register their interest in and preparedness for participating in construction works for a diverse range of goods and services. |
| ■ QWI commit to meet reasonable costs incurred by landowners in agreeing to a sale, including: |
| ■ Reasonable fees for legal, valuation, financial planning and accounting advice regarding the sale; |
| ■ An allowance for Stamp duty incurred on the purchase of another property (calculated based on the amount of Stamp duty for the sold property); and |
| ■ A lump sum amount for disturbance and general expenses to allow the landowner to relocate as agreed between QWI and the landowner. |
| ■ Facilitate strategies proposed by DPI&F to identify future scenarios and opportunities for stimulating agricultural development in the region under the Flood and Fire Strategy such that the current level of dairy production, for example, is retained once the Project is operational. |
| ■ Encourage the recruitment of a local workforce, where possible, to maximise the potential employment opportunities available to the local community and encourage the development of partnerships with local training providers regarding the timely provision of suitable training opportunities. |
| ■ Ensure contracts with suppliers, service providers and contractors maximise local industry participation where appropriate skills are available. Work will be packaged and presented to enhance opportunities for capable and competitive local suppliers. Details on business opportunities in the surrounding regions will be provided prior to the release of these packages, and tenders will be advertised locally. |
| ■ Continue the Business disturbance payment scheme for directly affected businesses in accordance with the QWI guidelines and policies. |
| **Hazard and Risk** |
| ■ Hazards and risks will be managed as set out in the EMPs |
| ■ Undertake storage and transport of materials according to relevant Australian standards, guidelines and legislation, including: |
| ■ AS4452 The Storage and Handling of Toxic Substances; |
| ■ AS1940 The Storage and Handling of Flammable and Combustible Liquids; |
| ■ AS3780 The Storage and handling of Corrosive Substances; |
| ■ Dangerous Goods Safety Management Act 2001; and |
| ■ Local council requirements. |
| ■ Licensed transporters operating in compliance with the Australian Dangerous Goods Code will undertake the transport of dangerous goods to the construction site. The transport of ammonium nitrate will be undertaken in compliance with the requirements of AS 1678.5.1.002-1998: Emergency procedure guide - Transport - Ammonium nitrate. |

| Proponent Commitments |
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| ■ A specialist explosives company will provide the ammonium nitrate, emulsion, detonators and boosters to be used during blasting operations. The Contractor's personnel will be licensed and trained in the transport, handling, mixing and use of explosive materials. |
| ■ All waste fuels/oils/grease/chemicals will be collected by licensed contractor for recycling, treatment or disposal. |
| ■ A safety risk assessment will be undertaken of the Project to identify areas of high risk to public safety and appropriate risk management mitigation measure sput in place. |
| ■ Prepare and implement a safety management system in accordance with Australian Standards AS 4801 and AS4804. |
| ■ MSDS's will be readily available for all employees and contractors and personnel made aware of the environmental and safety requirements of these materials. |
| ■ Maintenance of list by Site EHS Officer that gives full details of any hazardous materials, oils, chemicals and petroleum products used on site. |
| ■ Emergency spill kits containing absorbent materials, neutralising chemicals and other spill containment equipment will be strategically located around the site and on board equipment and in vehicles for the types of spills likely to be encountered. |
| ■ All personnel provided with Environmental Awareness training during induction sessions and taught spill control and containment procedures. |
| ■ Signs erected on roadways within the catchment stating that the route is within a drinking water catchment and that all spills are to be reported to the nearest emergency services, with contact details for emergency providers listed on the sign. |
| ■ An Emergency Action Plan (EAP) or Dam Safety Emergency Plan must be developed and should include the following: |
| ■ identification of emergency conditions which could endanger the integrity of the dam; |
| ■ dam operation procedures to follow in the event that such emergency conditions are identified; |
| ■ warning systems for downstream communities; |
| ■ notification listing or flowchart – identifying responsibility for notification, the order of notification and who is to be notified; |
| ■ roles and responsibilities – of the dam owner, operator and dam personnel; |
| ■ area map – showing the access routes to the storage during fair and adverse weather conditions, including distance and travel times; |
| ■ a drawing of the storage catchment area; |
| ■ emergency events and actions list; |
| ■ description of typical problems, problem characteristics and when/ what to check for during inspections; |
| ■ a dam failure inundation map – this should identify: downstream inhabited areas subject to danger, inundated areas, a narrative description of areas affected by dam break; and |
| ■ any other charts, rating tables, considered by the dam owners as necessary. |
| ■ Prepare and implement spill response measures in accordance with the Emergency Management Response Plan. |

| Proponent Commitments |
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| ■ An Operations and Maintenance manual will be prepared for the dam. This should include procedures for the following: |
| ■ operating the dam under normal conditions; |
| ■ coordination with other flow regulating structures within the catchment; |
| ■ maintaining environmental flows; |
| ■ coordinating with emergency response and counter disaster agencies; |
| ■ flood warning; |
| ■ maintaining the dam, associated structures and associated equipment in accordance with the designer's operating criteria; |
| ■ a program for surveillance and monitoring of the dam and all associated structures and equipment to allow for early detection of faults and deficiencies; |
| ■ recording and reporting of routine and non-routine surveillance; |
| ■ remedial action in the event of faults or deficiencies being identified by surveillance; and |
| ■ periodic review, at regular intervals or when changes or other circumstances dictate. |
| ■ The manual must be written such that persons unfamiliar with the dam can operate it properly. This is particularly important in an emergency situation. |
| ■ Construction workers operating vehicles on-site will be trained and licensed, so that these vehicles are driven in a safe and appropriate manner. |
| ■ Speed control (signage), driving to conditions, and prescribed driving etiquette on the site will be used. |
| ■ All vehicles will be fitted with radios for two-way communication. |
| ■ Adequate night lighting through the provision of lighting towers and vehicle headlights will be provided to ensure night operating and driving conditions are safe. |
| ■ Blasting operations will comply with the Explosive Act 1999. |
| ■ PPE for construction sites will be mandatory. |
| ■ Specific and detailed standard operating procedures implemented that deal with high voltage. |
| ■ Consult with Qld Police and DES to address construction and operation planning issues (e.g. emergency response scenarios). |
| ■ Monitor changes to the hydrological regime to ensure impact of dam on flooding extent and frequency and commensurate impact on maintenance of floodplain water bodies is minimised. |
| ■ All construction and operational activities undertaken will be managed in accordance with a Project environmental management plan. |

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