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1 PROJECT AND PROCESSES — OVERVIEW

1.1 The Project

The Wyaralong Dam Project (the Project) involves the construction of a dam and associated infrastructure on Teviot Brook, a tributary of the Logan River in South-East Queensland (SEQ) to provide for future urban water supplies for SEQ. The location of the dam is approximately 14.2 km north-west of Beaudesert and 51 km south-west of Brisbane.

The Queensland Government approved the location of the Wyaralong Dam (**Figure 1-1**) to provide for reliable future urban water supplies for SEQ on the 26 August 1991.

When completed, the dam will deliver an additional system yield of 21,000 ML/annum of water when operated with Cedar Grove Weir. At its proposed Full Supply Level (FSL) of 63.6 m Australian Height Datum (AHD), the dam will inundate 26 km of Teviot Brook and cover an area of approximately 1230 ha.

Figure 1.1: Regional Locality

1.2 The Proponent

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

QWI is committed to effective environmental management and 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 specialised consultants with expertise in delivering sound environmental and technical advice for water infrastructure projects. Curricula Vitae of the senior management team are included in **Appendix D**, supported by a list of consultants commissioned by QWI to assist in the preparation of the EIS and the preliminary design.

The proponent is committed to ensuring the development and implementation of an appropriate EMP in accordance with QWI's Environmental Policy , the Draft EMP and the commitments made in the EIS.

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

1.3 Background to the Project

The provision of reliable, high quality water supplies is essential for the sustainable economic growth and quality of life of any region. However, in SEQ the compound effects of a booming population, and the worst drought in more than 100 years has led to many areas suffering a significant reduction in the security of their water supply. As water levels in major storages continue to fall, Level 5 water restrictions have been put in place and Level 6 restrictions are being proposed in order to maintain supplies until supplementary measures are implemented.

SEQ now faces a situation where urban and industrial demands for water are forecast to increase. Water usage is about 480,000 ML/annum under non-drought conditions but the prudent take from existing sources of supply is approximately 440,000 ML/a. Further, in accordance with the high series population projection/high water savings scenario adopted by the State Government, SEQ will require an additional prudent take of 210,000 ML/a by 2026 and 490,000 ML/a by 2051 (MWH, 2007).

Projected urban water demands for the SEQ region have been estimated under a 'no water savings' or 'business as usual' scenario and three 'water savings' scenarios. The water savings scenarios - low, medium and high - all include supplying power stations with recycled water.

These scenarios also include increasing the use of rainwater tanks in residential areas and increasing the use of recycled water in new residential and non-residential developments (State of Queensland, 2007). The high water savings scenario has been adopted as the basis for water supply planning (State of Queensland, 2007). The choice of the 'best' scenario implies that water demands in SEQ may be appreciably higher than is assumed in this document if the savings targets are not met. With unfettered use, demand in 2051 could reach over 1,000,000 ML/a, though high savings demand management reduces this by 21%.

As SEQ already has a shortfall of prudent yield supply, against these projections, and with the long lead time for development of water supply infrastructure, the requirements to 2026 need to be facilitated now.

Of major economic and social importance to Queensland and Australia, SEQ requires significant quantities of additional highly reliable water supplies to maintain forecast growth to 2026. Without the provision of extra water for SEQ, this anticipated growth will not be possible. Consequently, failure to provide adequate water into the future will have serious impacts not only on the economy of the State, but on all Queenslanders and, in particular, families and young job seekers.

It has been estimated that the SEQ gross regional product could double by 2020 if sufficient water is available. Conversely, the cumulative impact of not providing additional water for the period to 2020 is estimated to produce a loss of between $57 billion and $111 billion to the regional economy (depending on assumptions - ACIL Tasman 2006). The $57 billion loss assumption is based on constraining water availability to 530,000 ML/a with associated impacts on population and industry growth applying from 2010. The $111 billion loss makes similar assumptions applying from 2006.

A multi-faceted strategy has been developed to identify both short term and long term measures to meet the need for a secure supply of reliable water in SEQ. Short term measures that provide for additional supply infrastructure will, when combined with other initiatives that include (but are not limited to) groundwater development, water harvesting and recycling, provide an additional prudent take of 261,000 ML/a. This is sufficient to meet the region's demand for water to the year 2026 (MWH, 2007) and possibly beyond. Early components of the strategy that are being implemented include 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 Wyaralong Dam Project (including Cedar Grove Weir) represents 8% of the anticipated total yield of current proposed supply initiatives in SEQ by 2015 (**Figure 1.2**).

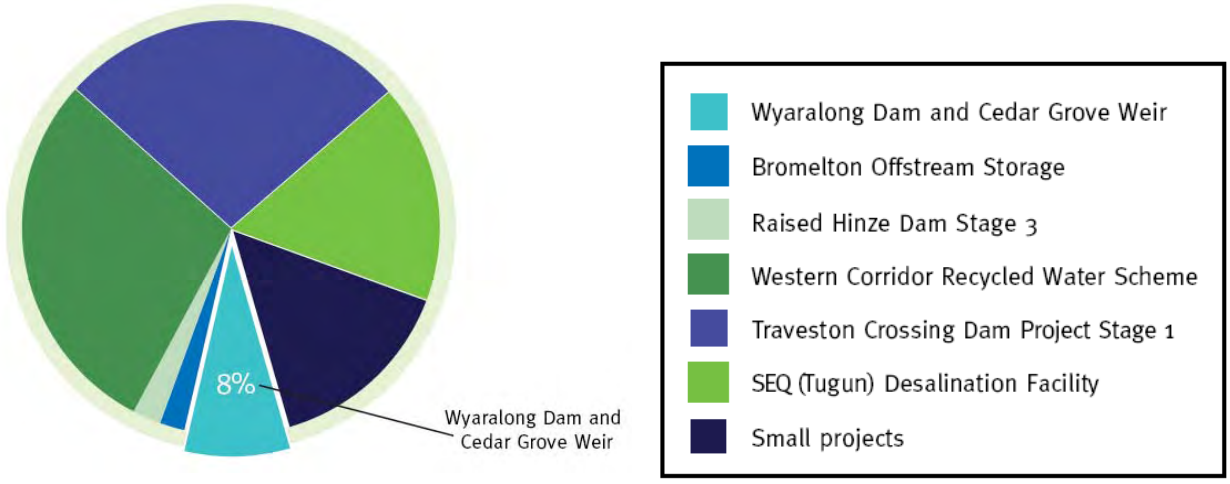


Figure 1.2: Anticipated Yield of Proposed Supply Alternatives

1.4 Project Objectives

The objectives of the Project are:

- contribute to the development of long-term reliable water supplies for SEQ by providing water supplies to the SEQ Water Grid
- develop long-term reliable potable supplies for the local region particularly the Brisbane, Beaudesert, Logan and Gold Coast Local Government Areas (QWI and WBM, 2006)
- provide sustainable water supplies for local industry and agriculture
- conform with the environmental and water allocation objectives of the Water Resource (Logan Basin) Plan 2007 (WRP) (DNRW 2007).

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:

> *"Promote sustainable regional development and enable communities to adapt to life in the changing rural landscapes of the Logan 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 Wyaralong Dam
- encourage sustainable local enterprises that benefit from the development of Wyaralong Dam
- 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 16 and 17B (Ramsar Wetlands)
- Sections 18 and 18A (Listed Threatened Species and Communities)
- 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
- 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 have 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 13 December 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 13 January 2007 to 26 February 2007 and a final ToR was issued on 5 May 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 or 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
- 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
- that the application for development approval must be refused.

It is likely that QWI will seek a community infrastructure designation (CID) under Chapter 2, Part 6 of the IP Act for aspects of the Project including:

- water cycle management infrastructure
- communication network facilities
- local and state controlled roads
- miscellaneous transport infrastructure
- operating works under the *Electricity Act 1994*
- storage and works depots and the like including administrative facilities associated with the provision or maintenance of community infrastructure.

The EIS assessment procedure under the SDPWO Act will satisfy the environmental assessment and community consultation requirements for the making of a CID if written notice of the proposed designation is given to the owners of land and the local governments affected by the CID. Landowners and local governments must be given at least 15 business days to make a submission about the proposed CID. It is proposed that a public notification of the EIS will include notification to landowners and the relevant local governments to fulfil these requirements.

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 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 cannot 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
- 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 number of submissions were made during the preparation of the ToR, including from community groups, affected residents living within and surrounding the Project and government agencies. A further opportunity for submissions regarding the EIS is available to any person during the EIS public notification period.

A public notice has been advertised in relevant newspapers circulating in the local area, the State and nationally stating:

- where a copy of this EIS is available for inspection
- where a copy of this EIS may be obtained at a stated reasonable cost

- that submissions may be made to the CG about this EIS
- 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, need not be in any particular form but must 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. The submission must be signed by each person who made the submission. Submissions must be addressed to the CG at the address stated below or as otherwise notified in the public notice:

THE COORDINATOR-GENERAL
Project Manager
SEQ Infrastructure (Water) – Wyaralong Dam
Department of Infrastructure and Planning
PO Box 15009 City East QLD 4002 Australia

Tel: 1800 996 829

Fax: +61 7 3237 7530

Email: wyaralongdam@infrastructure.qld.gov.au

Persons or groups with special communication needs, who wish to comment on the EIS, should contact the EIS Project Manager on 1800 996 829 to discuss making alternative arrangements.

A submission made as outlined above will be a properly made submission which must be considered by the CG in preparing his report evaluating the EIS. The CG may accept a written submission which is not a properly made submission. 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 IPA which is for a material change of use or requires impact assessment, s 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 approval. Any person who wishes to make a submission about any such development approval should therefore make a submission about the EIS in order to gain standing for any appeal (where third party appeal rights apply) regarding any such development approval.

1.8 Consultation Process

An extensive consultation program has been undertaken for the period 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.

1.8.1 Objectives

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
- provide easy and accessible ways for stakeholders to participate in the consultation process
- inform the EIS Project Team.

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.

1.8.2 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.

1.8.3 Consultation Phases and Activities

Specific communication activities to facilitate effective two-way communication included a community Information Day and ongoing engagement with key community groups and Government Representatives. In addition, two Project newsletters have been distributed to more than 14,000 stakeholders through letterbox delivery and insertion in local newspapers.

Stakeholders were 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:

- all-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
- website
- information day and information day report
- static display/s
- corporate presentations to community organisations
- dissemination of community feedback and comments to the EIS Project team
- local business opportunities register.

1.8.4 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
- phase 5 – project operation.

1.8.5 Consultation Results to Date

During the period the EIS was being prepared, a total of seven feedback forms were received by QWI during the consultation process. The outcomes of the engagement process also included identification of the issues raised. Issues raised were considered in the EIS.

1.8.5.1 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: Response to Issues Raised

Issue	Action/Strategy
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.
Water Resources	Feedback provided by stakeholders was taken into consideration for the EIS – Chapter 6. Water Resources and Water Quality.
EIS Process	The Project has been declared a 'significant Project' requiring an EIS to be completed in accordance with the SDPWO Act. The objectives of the EIS are to ensure that all potential environmental, social and economic impacts of the Project are identified and to develop actions to mitigate adverse impacts and enhance positive impacts. 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.
Economic Cost and Economic Impact – Future Planning	Feedback provided by stakeholders was taken into consideration for the EIS – Chapter 15. Social and Economic Environment and Chapter 2. Rationale & Alternatives.
Consultation Process for the EIS	QWI undertook a comprehensive consultation program to engage stakeholders in the Project. The Consultation Report outlines initiatives undertaken.
Land Use – Existing/Operational Infrastructure/Recreational	Feedback provided by stakeholders taken into consideration in EIS – Chapter 5. Land.
Opposition in General/Project General	QWI provided a number of forums for those opposed to the Project to have their say. A detailed summary is provided in the Consultation Report. Points raised were generally included within 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, Chapter 15. Social and Economic Environment.
Support General	Feedback provided by stakeholders was taken into consideration for the EIS – Chapter 6. Water Resources and Water Quality and Chapter 15. Social and Economic Environment and Chapter 2. Rationale & Alternatives
Water Resources - Access	Feedback provided by stakeholders was taken into consideration for the EIS – Chapter 6. Water Resources and Water Quality

1.9 Sustainability

QWI commissioned CSIRO Sustainable Ecosystems to develop guidelines and principles to ensure development, for projects 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. This resulted in a focus on the enhancement of positive outcomes at a local and sub-regional scale by assisting the community of the Logan River Catchment 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.

1.9.1 Vision for the Logan River Catchment

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

1.9.2 Goals for Sustainability

To plan, design and enable innovative projects that:

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

1.10 Alternative Options Considered

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 the latter initiatives do not provide the savings necessary or the worst-case reality of climate change eventuates (in case of increased climatic variability or another significant drought).

The Government has available a number of options to increase supply, these include: sources from groundwater, desalination, recycling of wastewater, a water grid, and additional surface water sources. The current mix of projects (which is being planned or under construction) requires that additional water be sourced from surface water as it will be uneconomical or too risky to increase reliance on other non-surface water options.

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

Water efficiencies achieved through rainwater tanks and groundwater cannot provide an appreciable portion of the required supply and the former cannot do so efficiently with the necessary level of security, nor at a reasonable cost.

Desalination is included in the Government's strategy with a target to supply over 21% of 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 (such as recreational facilities) other than water supply.

Recycling, at the highest level of any major city in Australia, is already being undertaken as a priority component of the strategy. Under current water restrictions per capita use of water is the lowest for any equivalent population at about 140 L/day.

Surface water supply relies upon tried and proven technology. It can be supplied at reasonable cost, and as the volume is available, it is therefore justified, prudent and feasible that a shortfall in water can be addressed via surface water supply.

1.10.1 Surface Water Supply Alternatives

A range of alternative surface water supply options were assessed, including the Glendower Dam on the Albert River, Tilleys Bridge Dam on the Logan River, and dam options in northern New South Wales, along with water harvesting. Wyaralong Dam, operating in conjunction with Cedar Grove Weir, is the preferred alternative because it is a well known alternative, previously adopted in 1991, and land purchases have been ongoing since that time. Also, Wyaralong Dam:

- is the best remaining dam site south of Brisbane, where opportunities have suffered urban encroachment
- is geographically appropriate, being central to the area to be serviced and the nearest site to the already approved offtake point
- is on a significant tributary of the Logan River, so avoids the major environmental impacts of the main channel

- development on the tributary allows the less intrusive delivery of an appropriately sized offstream storage on the main channel (Bromelton Offstream Storage)
- is in a significantly developed, cleared and impacted area
- has potentially less environmental impact than alternatives
- has less social impact than the only viable local alternative
- is cost efficient
- development timeframe is optimal by coordinating development with Cedar Grove Weir and Bromelton Offstream Storage.

1.10.2 Economic Assessment of Alternatives

An economic cost evaluation of the Wyaralong Dam (Marsden Jacob Associates, 2007) reviewed alternative supply portfolios that will need to deliver a similar prudent take to be comparable to the Government's policy. Each of the alternatives examined are couched in terms of substituting Wyaralong Dam in the supply portfolio for an alternative supply module. Three alternatives are examined:

- a modular desalination plant
- Glendower Dam
- Clarence River Dam.

The key findings of the portfolio modelling are:

- Glendower Dam option is not economically viable. The overall cost of the SEQ water supply portfolio increases by $360 million if Wyaralong Dam is replaced in the portfolio with Glendower. This cost increment is due to much higher capital development costs for Glendower
- due to very high water transport costs (i.e., pipeline and pumping costs), the Clarence River Dam represents an extremely high cost option. If Wyaralong Dam was substituted with Clarence River Dam in the SEQ regional water supply portfolio, then the present value of future supply costs increases by $1,667 million. Hence, Clarence River Dam is clearly not an economically viable supply option
- the cost for the supply portfolio inclusive of Wyaralong Dam is in the order of $935 million lower than the case whereby Wyaralong Dam is substituted in the portfolio with a single desalination module (120 ML/day capacity)
- environmental impacts of desalination would need to be examined in detail in an EIS for potential desalination plants. Key concerns are the brine trail in marine waters produced by the desalination process and the large loss in visual and recreational amenity on coastal areas where the desalination plant is located.

Sensitivity analysis is applied to test for the impact on the economic modelling results of changes in key parameters. Importantly, under all of the above scenarios, Wyaralong Dam has a clear cost advantage over the three supply alternatives examined.

This confirms that the results from the economic modelling conducted for this study are robust, as Wyaralong Dam is the least-cost supply option under a wide range of scenarios with respect to changes in the key model parameters.

1.10.3 Cost and Benefits of the Project

The directly attributable Project construction costs (capital costs) for which QWI are responsible are estimated at approximately $285 million. This number includes dam construction, roads, land purchase, mitigation measures, risk and contingency. Inclusion of additional items, such as connection pipelines to the Southern Regional Interconnector, pumping stations and treatment plant, raises the Project construction costs to $333 million.

The operational and maintenance costs for the Project alone is estimated to be $0.5 Million per year. Inclusion of water treatment and pipeline operational costs raises the Project operational cost to $16.8 million per year at full capacity.

The Project benefits are significant and will accrue at the local, regional, state and national levels. At the State level, the provision of 18,000 ML/a of water from Wyaralong Dam (attributable amount when operated with Cedar Grove Weir) will be pivotal in underpinning and supporting continued population and economic growth in Queensland. In conjunction with proposed and existing supply sources including dams, recycled water and desalination, together with demand management, the Project will be an important component of a diversified supply base to ensure water supply reliability well into the future.

Real Gross Regional Product in Queensland is expected to increase in the construction period by approximately $42 million in 2009. This will continue to rise during operation due to the ongoing supply of water from the Project. In 2013, when the Project is modelled as providing full take, real GRP increases by approximately $75 million.

Aggregate employment in SEQ will increase through the injection of capital required for construction, and from the provision of water the Project will yield. In 2009 during the construction period, aggregate employment is expected to peak at approximately 300 jobs. This level is maintained in the longer term as the Project provides full take. In 2013, aggregate employment is anticipated to increase by approximately 302 jobs.

At the National level, it is anticipated that the discounted national welfare benefit will be in the order of $745 million, driven by additional investment in the construction period that stimulates short-run employment. The operational phase of the dam reduces the scarcity of water in SEQ. This in turn raises national employment and income.

At the local level, the benefits of the Project are also significant. The injection of $333 million 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 force will have flow on effects from the income they spend in the local economy. Other benefits include tourism and recreation activities which, while not quantified, are expected. The benefits accruing from upgrading of roads have also not been quantified.

The Project will create costs for the local community. The most significant will be the loss of approximately $0.76 million to $1.1 million in gross agricultural output. There will also be disruption to one local business which will be required to relocate. Strategies have been implemented to assist the local community, including discounted leaseback rates to property owners, payments for disturbance, relocation and the stamp duty on a new property should they choose to relocate (though present indications are that most landowners will remain on their properties), business adjustment schemes, and the implementation of economic development programs.

With the presence of the construction workforce and commencement of construction itself, any negative impacts to local businesses will subside as flow on effects from demand for their goods and services and spending by the construction workforce takes effect. Negative impacts will be further reduced through the assistance being offered by the State Government and the various economic development programs being implemented. A summary of the economic benefits and costs of the Project are presented below in **Table 1.2**.

Table 1.2: Summary of Project Benefits and Costs

Benefits	Location of benefit	Costs	Location of cost
Increased National Welfare of $745 million	National	Project Cost $333 million[1]	State
Avoided cost of $359 million for next best alternative (desalination)	State, Regional	Operational Cost $0.5 million per annum[2]	State
Increased GRP of $42 million (2009)	State, Regional	Agricultural gross output loss $0.76 - $1.1million	Local
Increased GRP of $75 million (2013)	State, regional	Temporary disruption through relocation of 1 local non-agricultural business	Local
Increased aggregate employment 300 (2009)	State, Regional, Local	Disruption of flora and fauna during construction and filling of the Project, until mitigation measures in place and habitat stabilises	Local
Increased aggregate employment 302 (2013)	State, Regional, Local	Community disruption through project planning and implementation – 9 property part purchases and 2 whole purchases by 2011	Local
Avoided employment losses of approximately 6,600 jobs and $1.2 billion to the SEQ economy through more secure provision of water (based on 15% reduction in supply if the Project does not proceed)	State, Regional, Local		
Additional recreational facilities, including on water (canoe trails), and on the land to the north (horse, walking and mountain bike trails)	Regional, Local		

1. Directly attributable Project costs only.
2. Project operation and maintenance costs only.

1.10.4 Do Nothing Option

Notification of a water supply emergency under the Water Regulation 2002 highlights the seriousness of the current water shortage in SEQ and the inadequacy of the existing water supply system. There have been economic impacts in some sectors already and impacts on household and recreational activities.

Existing water supplies cannot support existing demands. Predicted levels of population growth will be unsustainable and economic growth will be unachievable unless SEQ obtains significant additional highly reliable water supplies. Existing supplies cannot support future demand even taking into account high potential savings from demand reduction strategies and recycling opportunities.

Failure to secure adequate supplies will curtail economic growth and result in social disruption. Job opportunities for young people entering the workforce would be curtailed, population growth through migration will become unsustainable and there will be significant changes to recreational opportunities and domestic arrangements.

Water supply security with the Wyaralong Dam in place will create certainty and encourage flow on investment into Queensland. This will raise capital stocks as the increased supply of water as a consequence of the Project makes SEQ more conducive to investment. An assessment into the short term impacts of a conservative 15% reduction in water supply to the SEQ economy concluded that GRP would decrease by some $1.2 billion and approximately 6,600 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 2007).

Wyaralong Dam forms an integral part of the overall water supply strategy for SEQ. It is essential that this dam be constructed to ensure the success of a multi dimensional program aimed at addressing a range of uncertainties including rainfall patterns, and population growth rates in the economic and social consequences if the SEQ economy stalling because of inadequate water supplies.

The "do-nothing" option is not considered a realistic option.

1.11 Project Description

The dam wall is approximately 22 km east-north-east of Boonah while the upstream limit of storage is approximately 7.5 km north-east of Boonah. When completed the dam will be the second storage in the Logan River catchment (after Maroon Dam) that will not drown out in high flows. The dam's 546 km^2 catchment area represents about 15% of the Logan River catchment and the area upstream of the two storages will total about 670 km^2 or 18% of the whole catchment.

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

- construction, operation and maintenance of a new dam on Teviot Brook, at 14.8 km AMTD, upstream of the confluence with the Logan River
- construction of an access road to the dam site
- realignment of sections of the Beaudesert–Boonah Road
- relocation of local government roads
- relocation of local power and telecommunications infrastructure
- relocation of other impacted local infrastructure including private infrastructure.

Operation of the Water Storage involves management of land inundated by the water at Full Supply Level (FSL) and also additional land comprising:

- a buffer area aimed at protecting water quality, bank stability, addressing safety matters, to exclude activities with a high risk of adverse impacts on water quality and/or dam operations, and allow for revegetation and control of access, and/or
- a flood margin 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 for floods up to 1% AEP (Annual Exceedence Probability; in this case the 1 in 100 year event) – the significance of this risk and the impact of extra flooding diminishes further upstream from the dam wall.

The Operational Area of the dam includes the area of inundation, dam wall, embankments, spillway, dam access road, relocated Beaudesert – Boonah Road, associated infrastructure and facilities and buffer and flood margin areas. The entire Operational Area was included in the impact assessment process and is shown in the Proposed Project Designation Area (**Figure 1.3**).

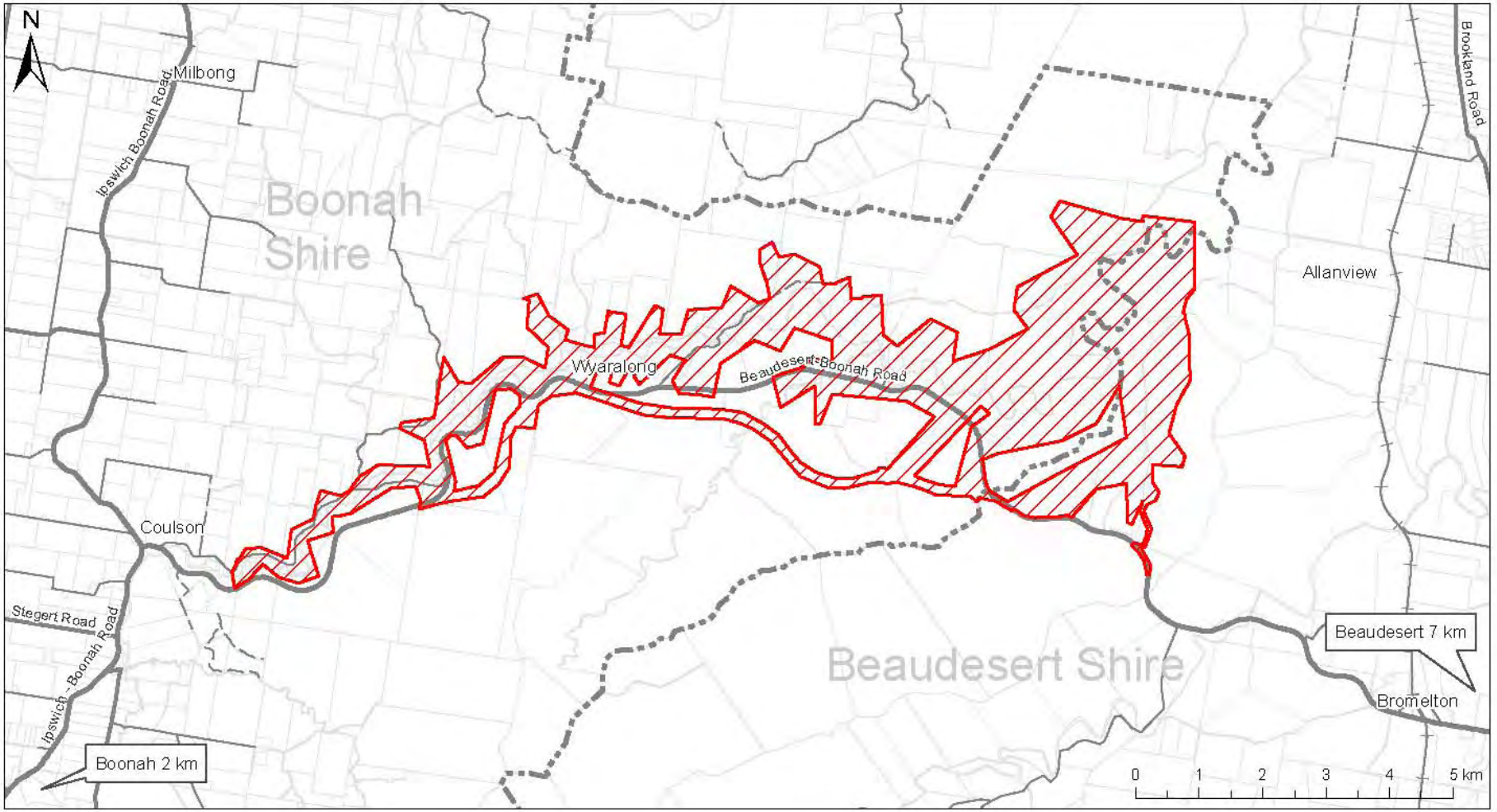


Figure 1.3: Project Designation Area

Project Parameters

Site and geotechnical investigations have found that the Wyaralong Dam site is suitable for construction of a number of dam types. Solid rock foundations have been found on both abutments and below the stream channel. These will support the following dam structures:

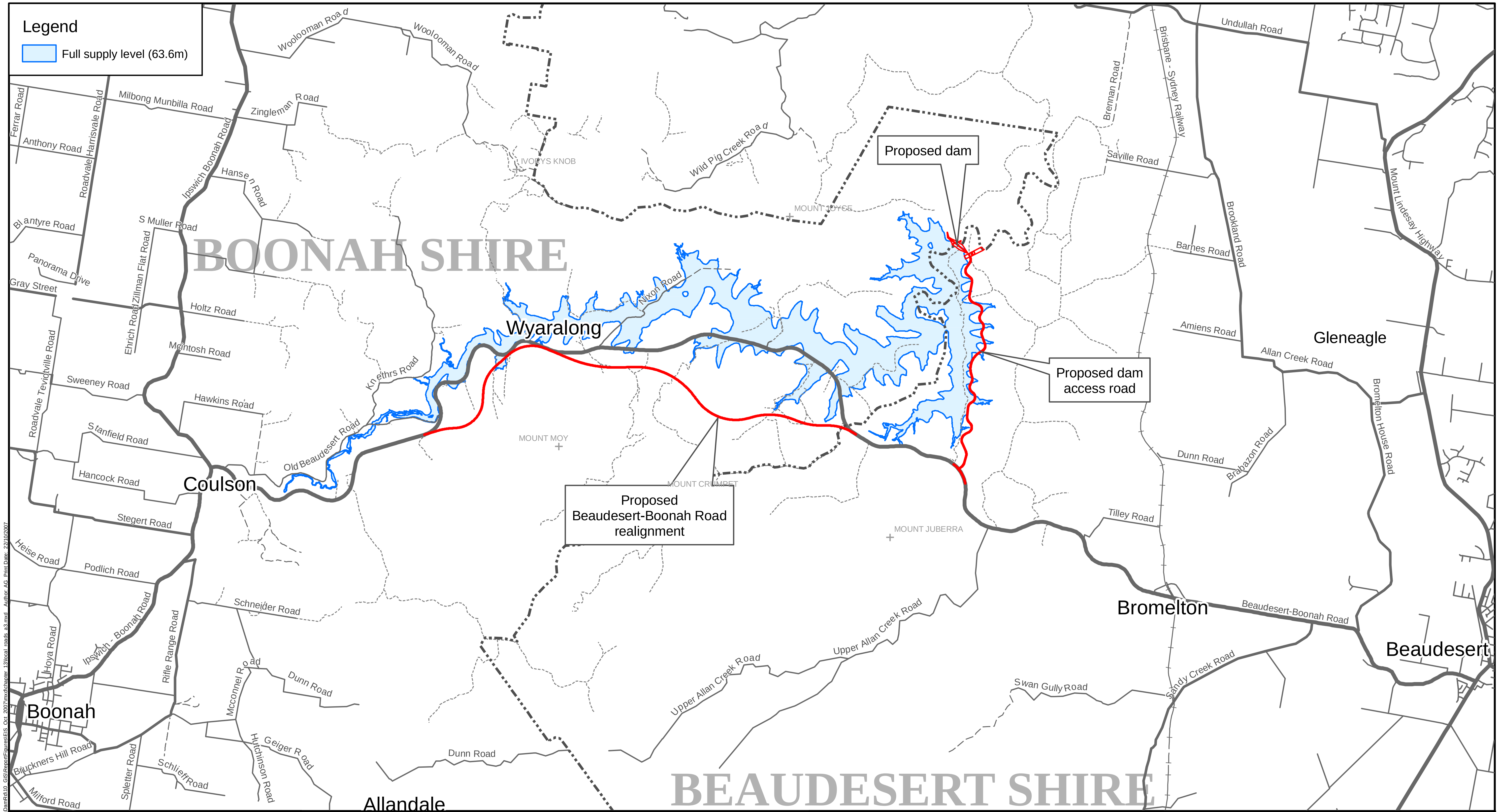
- earth and rockfill (E&R) embankment
- concrete-faced rockfill (CFR) embankment
- roller compacted concrete (RCC) dam.

A summary of the features of the three types of dams is presented below in **Table 1.3**.

Table 1.3: Principal Features for E&R, CFR and RCC Dam Options (SunWater, 2007d)

Feature	Description
Reservoir	
FSL	63.6 m AHD
Maximum depth at FSL (existing stream channel at upstream toe of embankment)	Approximately 27.6 m
Maximum design flood level (PMF)	73.49 m AHD
Reservoir capacity at FSL	103,000 ML
Reservoir area at FSL	1,230 ha
Stream inundated at FSL (Teviot Brook)	Approximately 26 km
Stream inundated at FSL (named tributaries)	Approximately 7.8 km
Average reservoir depth at FSL (volume in m^3 divided by area in m^2)	Approximately 8.5 m
Prudent Take (operated with Cedar Grove Weir)	21,000 ML/year
Main dam embankment	
Maximum wall height above lowest foundation level E&R and CFR options	Approximately 48 m
Maximum wall height above lowest foundation level RCC option	Approximately 47 m
Nominal crest elevation E&R and CFR options	74.0 m AHD
Nominal crest elevation RCC option	72.5 m AHD
Nominal deepest foundation excavation level	Approximately 25.5 m AHD
Wall length at crest elevation	Approximately 500 m
Orientation	North-west to south-east across stream flowing approximately west to east
Outlet works	
Minimum operating level	40 m AHD
Residual storage at minimum operating level (dead storage)	260 ML
Outlet conduit invert level	37 m AHD
Regulated flow design capacity	Up to 165 ML/day down to reservoir level 42 m AHD and storage volume 800 ML
Centreline level of outlet regulating valves	38 m AHD
Maximum storage level for conduit and valve design	72.5 m AHD
Emergency drawdown	FSL to 10% of storage by volume in 100 days (commonly adopted criteria in modern dam design)

Road infrastructure required to be realigned or relocated as part of the Project are shown in **Figure 1.4.**



Notes:
1. Roads, SunWater 2000, QT 2003, BSC 2007
2. Coordinate system - MGA94 Zone 56
3. Level Datum Australian Height Datum (AHD)

N

0 0.5 1 2 3 4 5 6
Kilometres

October 2007

QUEENSLAND WATER INFRASTRUCTURE PTY LTD
PARSONS BRINCKERHOFF
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Figure 1-4
Wyaralong Dam EIS
Road network in the local area

A summary of the features of the significant components of the road infrastructure is presented below in **Table 1.4**.

Table 1.4: Significant Components of Road Infrastructure

Feature	Description
Beaudesert-Boonah Road realignment	
Location	Leaves the existing road at approximate chainage 15.6 and runs to the south-west of the existing road to rejoin it at approximate chainage 27.5 km
Length	Approximately 10.6 km (replacing 11.9 km of road)
Design speed	100 kph
Sealed pavement width	11 m
Pavement design life	20 years from opening
Flood immunity (dam and transverse waterways)	1 in 100 year AEP with dam
Cut	Approximately 700,000 m^3 (solid)
Fill	Approximately 630,000 m^3 (solid)
Dam access road	
Location	Leaves the Beaudesert-Boonah Road at approximate chainage 13.2 km from Mount Lindesay Highway
Length	Approximately 5.5 km
Design speed	80 kph
Sealed width	9 m
Cut	Approximately 230,000 m^3 (solid)
Fill	Approximately 280,000 m^3 (solid)
Flood immunity (dam and transverse waterways)	1 in 100 year AEP with dam

1.11.1 Pre-Storage Activities

Pre-storage activities include land purchase, vegetation clearing, resource recovery and stockpiling and decontamination. As the vast majority of the inundation area is unimproved agricultural pasture, this will be left undisturbed; only trees and shrubs will be cleared (cut off near ground level) to FSL within the inundation area. This applies with the exception of the riparian zone of tributaries and the main channel (which will be cleared to within 1.5 m of FSL or where significant vegetation is near FSL, such as on the northern side of the storage). In this case vegetation will be left in place as it may survive, depending on inundation frequency and duration.

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.

1.11.2 Construction/Materials

Materials investigations have been undertaken around the site (**Table 1.5**). Indications to date are that there is sufficient clay and sandstone of a suitable quality for use as core material and rockfill in an E&R dam and sufficient sandstone of suitable quality for use as rockfill in a CFR dam. The sandstone is not sufficiently durable for use in RCC, conventional concrete or for use as rip rap.

Table 1.5: Indicative Quantities of Materials Required

Dam Option	Quantity materials to be imported	Quantity materials to be sourced on site
E&R Dam	2,900 tonnes and 180,000 m^3 (or total approximately 380,000 tonnes at 2.1 tonnes/m^3)	930,000 m^3
CFR Dam	6,300 tonnes and 175,000 m^3 (or approximately 375,000 tonnes at 2.1 tonnes/m3)	500,000 m^3
RCC Dam	56,000 tonnes and 215,000 m^3 (or approximately 510,000 tonnes at 2.1 tonnes/m^3)	Nil

1.11.3 Construction Timetable/Hours of Operation

The construction period is approximately 2–3 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 and spillway. An exception would be the placement of the RCC which will be carried out on a two-shift basis to expedite construction, which at particular stages will include night work.

1.11.4 Workforce and Accommodation

The total workforce across all aspects of the Project, including the dam, road works, infrastructure relocation and support services, is estimated at up to 300 people. A typical construction site workforce on the dam component of the Project would be approximately 150 people during the peak construction period. Multiple shift operations would increase this number.

In addition, there would be a requirement for from 20 to 30 professional staff on-site, including engineers, environmental officers, clerical staff, supervisors, foremen, soil testers and support staff.

Crib rooms will be provided on-site and toilet and shower facilities will be provided in demountable buildings. Grey water will be re-used where feasible and toilet waste will go to pump-out facilities, or on-site septic disposal systems will be established (subject to discussion with Beaudesert Shire Council). Cleaning and domestic staff will be employed to maintain these areas.

It is unlikely that there will be sufficient accommodation in Beaudesert and Boonah to meet the needs of the dam construction workforce in addition to that needed for the road construction and infrastructure relocation. Personnel may choose to travel daily from local towns, Logan, Ipswich, Brisbane and the Gold Coast, but it is most likely that temporary construction accommodation will be needed for the Project.

Potential sites would be at Beaudesert or Boonah with direct access to existing infrastructure and within easy driving distance to the site. The location selected will take into account the possibility of shift work operations requiring vehicle movements outside normal hours. The accommodation will be subject to a separate assessment and approval process.

1.11.5 Operations

Administration of Wyaralong Dam operations is likely to be integrated with that for the BOS and Cedar Grove Weir nearby.

Staffing of Wyaralong Dam and the associated water supply works downstream will require four full time officers. Staff would include a storage operator and three assistants. Since this is an un-gated structure it will not be necessary for staff to reside at the dam.

1.11.6 Management of Extractions and Releases

Diversion of water from Wyaralong Dam will be through Cedar Grove Weir. Regulated releases will be made through the dam outlet works. Flows will pass down the natural channel of Teviot Brook to Cedar Grove Weir on the Logan River.

The outlet structure will enable the operator to select the depth from which discharges are drawn through the multi-level inlet tower to ensure that water of the most appropriate quality is released. Factors considered in selecting the depth will include water temperature, nutrient levels and oxygen content. Water will be released through cone dispersion valves which will assist re-oxygenation.

The Cedar Grove Weir structure is about 18 km downstream and its upstream limit of storage is at about 2.8 km on Teviot Brook resulting in about 12 km of regulated stream flow between the Wyaralong Dam outlet and Cedar Grove Weir pool when the weir is full.

Water will be pumped from Cedar Grove Weir and treated as required before connecting to the SEQ Water Grid. A site has been selected for a water treatment plant and pump station adjacent to the weir and a preliminary pipeline route to link in to the SEQ Water Grid has been identified. The site is essentially cleared and is the site of the former Beaudesert water treatment works. The pipeline route will follow existing road easements for the majority of its length. These works will be the subject of a separate approval process.

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 Project will cause various social, economic and environmental impacts. The majority of the direct negative impacts of the Project will be felt in the local area, while the majority of the positive impacts (relating to water supply security and flow-on economic benefits) will be felt at local, regional, state and national levels, largely outside the area of negative impact.

While the cumulative impacts of the Project suggest that these impacts will be both negative and positive, the issues highlighted as being most significant are those which are positive - associated with socio economic conditions, and those which are negative - associated with flora and fauna, and landholders. All other negative impacts can successfully be mitigated through appropriate design and management.

The flora and fauna impacts associated with the habitat loss and fragmentation, particularly of the major north-south movement corridor, are the most relevant. These are impacts that cannot be totally directly mitigated and will result in some habitat loss and fragmentation. Proposed mitigation strategies for these impacts include vegetation offsets, designation of a conservation area of well vegetated land on the northern side of the dam, designation of fauna movement corridors to the east and west of the dam and selective revegetation of riparian zones upstream and downstream of the dam.

2.3 State and Local Government Requirements

The Project, or part thereof, is provided for in State, regional and local planning strategies and objectives.

The Project is exempt from assessment against the provisions of the Beaudesert Shire and Boonah Shire planning schemes, however, the Project is in accordance with the Schemes and is specifically provided for in both.

The Project complies with relevant State Planning Policies (SPP) including the SPP 1/92: Development and the Conservation of Agricultural Land, SPP 1/03: Mitigating the Adverse Impacts of Flood, Bushfire and Landslide, and SPP 2/07: Protection of Extractive Resources.

As a beneficial outcome of the Project, QWI has incorporated through negotiated lease agreements on land they own, additional land use controls to implement effective catchment measures and protect the water quality of the storage.

2.4 Land Use and Tenure

2.4.1 Land Tenure

The majority of land within the inundation area is held under Freehold title. Two parcels also had Profit à Prendre interests (a proprietary right to take the produce or output of the soil from the land of another person). The Profits à Prendre interests have recently been extinguished. This property is also subject to recent subdivision approval.

Several mining tenement interests have been identified in the proximity of the Project area but are not impacted.

There is a registered native title claim (Tribunal file no. QC03/15 and Federal Court No. QUD6014/03) in the name of the Jagera People over land on the northern side of Teviot Brook. The registered claim includes the site of the dam wall and the northern extent of the inundation area from the mid-point of Teviot Brook.

There is no registered native title claim, nor any determined native title holders, for the area to the south of Teviot Brook. Meetings held as a result of the advertisements placed by QWI have identified members of a negotiating team for the area south of Teviot Brook. These people are commonly, but loosely, referred to as the Mununjali People.

2.4.2 Land Use

The Project will result in a change in land use of approximately 2,304 ha including 1,230 ha of predominantly grazing land to use for water storage, 932 ha for a buffer area, 106 ha for the realignment of the Beaudesert-Boonah Road and 36 ha for the dam access road. These changes in land use will result in the loss of grazing land, including 741 ha of land classified as Good Quality Agricultural Land (GQAL). As a proportion within the catchment, the loss of grazing land and GQAL is low and it is not considered to adversely affect the availability of adequate rural land in the catchment nor affect the ongoing rural activities in the balance of the catchment.

A further 1279 ha of land will potentially be included in the northern conversation area, and 1545 ha to the west and east of the dam used for wildlife corridors.

The Project will require the purchase of 2 properties, partial areas of a further 17 properties (8 of which are currently owned by the State Government), and may also necessitate the acquisition of other interests in land in the Project area including:

- a mining lease
- other lease interests.

A process, set out in QWI's Land Purchasing Policy provides for land purchases based on market valuations and also seeks to minimise the potential adverse effects of the land purchase process on landowners.

Concept plans have been developed for recreational facilities around the shoreline to enhance the lake's amenity and attraction for the local community and visitors to the region. This will provide the opportunity to promote the new lake as a tourist destination in this already popular area.

2.4.3 Land Use Controls in Buffer Area

As part of the Land Purchasing Policy, lease agreements on land owned by QWI and within the buffer area, incorporate a number of additional land use 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.

2.4.4 Environmental Land Use Changes

QWI will liaise with landowners with respect to the proposed conservation area and fauna corridors with the aim of enhancing and managing those areas for their intended environmental purposes but also maintaining utility of the land for the landowner.

2.5 Infrastructure

Construction and operation the Project will result in the inundation or isolation of the following transport, power and telecommunications infrastructure:

- approximately 11 km of the Beaudesert-Boonah Road
- four Council-controlled local access roads
- approximately 5.4 km of power supply infrastructure, including 11 kV and lower voltage transmission lines
- approximately 11 km of fibre optic cable and a further 11.5 km of copper cable telecommunications infrastructure.

Privately owned infrastructure including access roads, fences, farm dams, sheds, cattle yards and other farm related infrastructure will also be inundated by the storage at FSL or will be severed by the realignment of the Beaudesert-Boonah Road.

Generally, existing infrastructure that is affected by the Project will be relocated, replaced or removed, depending on the requirements of property owners, infrastructure providers, and other stakeholders, and the outcome of the property purchase process.

The options for changes to existing infrastructure will, in consultation with property owners, utilities and other stakeholders, continue to be investigated as part of the design and property purchase process for the Project. The replacement or relocation of infrastructure will minimise disruption of services to the community, and will be designed to provide for the continuation of current land uses by landholders who retain unaffected parts of their properties.

The planning and development of any new infrastructure may be subject to separate assessment and approval requirements.

2.6 Topography and Geomorphology

There is a fault line along Crows Creek. This fault line does not extend to the dam site and there are no signs that it has been active in recent geological periods.

There are also overhanging root mats that provide appreciable erosion protection for the stream banks most of the way through the reservoir and downstream.

Sediment volumes in the Logan River have increased over time and are greater now than in pre-European times. However, the dam will trap bedload sediments and a significant proportion of suspended sediments entering it (though the estimated volume is insignificant in terms of storage volume and design life, i.e. 0.015% per year). The trapping of sediment will have benefits at the whole-of-catchment level (though any changes will be slow), particularly in the estuary.

Management strategies to mitigate topography or geomorphology changes include:

- managing erosion and water flows in and around construction areas
- reshaping disturbed areas using flow control, rock protection and vegetation, as appropriate, before permanent rehabilitation
- maintaining and enhancing vegetation in the catchment particularly in the immediate vicinity of the dam, and in downstream areas of riparian vegetation
- designing the spillway and other outfalls to minimise downstream flow impacts
- minimising sand extraction downstream in Teviot Brook unless monitoring shows that sand deposits are increasing.

Five significant islands, ranging in size from 0.3 ha to 14 ha, will be created when the dam is at FSL. At least two of these will be developed to provide wildlife habitats and protection from feral animals.

2.7 Soils and Geology

The rocks underlying the area are sufficiently impermeable to allow aquifers to develop in the overlying alluvium, and the risk of seepage losses from the reservoir should be low, as testing at the dam site indicates low permeability.

Sandstone at the spillway site for the E&R and CFR dam options is suitable for use as rockfill in these structures but not suitable for use in the RCC option or concrete. There are also clay materials in the reservoir area in the vicinity of the dam that are suitable for use as core materials in an E&R dam.

Erosion during and after construction can be controlled through measures such as:

- managing potential run-on so that flows are dispersed over the area
- avoiding flow concentration
- shaping landforms to provide slopes similar to or lower than those of the surrounding landscape;
- adequate soil material to support plant growth and planting
- using rock walls where slopes acceptable for re-vegetation cannot be achieved because bare rock is a natural feature of the landscape
- choosing species appropriate to the area and the soil conditions for re-vegetation
- monitoring and maintaining vigorous riparian vegetation downstream of the dam
- monitoring and maintaining rehabilitation works.

Salt movement from the soils and landscapes in and around the reservoir area is not an appreciable threat to water quality in the reservoir.

2.8 Landscape Character and Visual Amenity

Generally, the Project will have a low visual impact on the landscape, as visibility of the dam wall and realigned Beaudesert-Boonah Road will be relatively limited, with few nearby viewpoints.

The most significant change to scenic quality will be the new water body (lake) in place of grazing paddocks and bushland. As a compatible and familiar feature of many rural landscapes, the water body will not appear out of place in the context of the existing landscape and the final form of the will have a natural configuration due to the relatively narrow and elongated topography and ebbs around its valley's sides. The new water body is considered a beneficial landscape outcome.

2.9 Land Contamination

Potential contaminant sources include those typical of agricultural areas related to livestock dips, spray races and engine workshops. Potentially contaminated sites were identified within the Project area and within 200 m of the FSL.

A search of the EMR and CLR revealed 22 lots with the potential for the presence of unexploded ordnance (UXO). Other parts of the Project area, which had been used for training areas and bombing ranges during World War II, were also identified as having potential for UXO, including part of the Beaudesert-Boonah Road.

Remediation and validation will be completed before dam construction proceeds. Once appropriate remediation is completed and a final site assessment is undertaken to validate effectiveness, there will be negligible risk to human health or water quality. Remediation of the contaminated land and UXO hazards will deliver a positive outcome.

2.10 Hydrology

Teviot Brook is the major left bank tributary of the Logan River and is an intermittent stream, naturally ceasing to flow approximately 10% of the time with 25 periods of no flow in the historic record. Floods pass through the system quickly, for example the largest recorded flood in 1991 passed the Overflow gauge in approximately two days. Mean annual flow in the Brook pre-development is approximately 45,000 ML/a.

Water allocations (unsupplemented) from Teviot Brook total 3,734 ML/a. There is currently no supplemented supply on Teviot Brook. This extraction has impacted the low flow regime, extending the duration of low flow periods and dry spells. The existing extraction of water has not significantly impacted on the distribution of flows throughout the year, with largest flows experienced in late summer and relatively small flows in late winter/spring.

In the future development case, the mean annual flows are reduced by 21% compared to the existing case. Downstream of Cedar Grove Weir, there will be little change in the distribution of flows throughout the year. However between Wyaralong Dam and Cedar Grove Weir, flows in the summer and autumn months will be significantly reduced whilst flows in spring are significantly increased.

A comparison of the environmental flow outputs against the Environmental Flow Objectives (EFOs) specified in the Water Resource Plan (WRP) for the existing operations and future development found that:

- both met the mandatory EFOs specified by the WRP
- the proposed future development case met the (non mandatory) target upper bound monthly 50% daily EFOs for one month of the year, compared to the existing operations case which met this target four months of the year
- both the proposed future development (s301d2) case and the existing operations (s151c) case did not meet the (non mandatory) target upper bound monthly 90% daily EFOs for any months of the year.

A statistical analysis found that all cases met the mandatory Water Allocation Security Objectives (WASOs) and target upper bound optional WASOs specified in the WRP.

One downstream wetland is mapped as RE 12.3.3, blue gum woodland on alluvial plains. Other wetlands identified from various sources have no conservation status at State or Federal level, tended to be heavily grazed and appear to rely more on local catchment runoff or groundwater than on infrequent inundation during flood events. There is unlikely to be any impact on the frequency of inundation of these wetlands.

Peak flow rates during flood events downstream of the dam were found to reduce for all floods modelled. The greatest reductions (around 25 to 30%) occurred immediately downstream of the dam, with small reductions (around 5 to 10%) occurring downstream of the confluence with the Albert River.

Modelling of Pre dam and Post-dam flood levels, based on the assumption that the reservoir was at full supply level (FSL) prior to the flood event indicated negligible change in levels for the 1 in 2 and 1 in 5 AEP events and no difference in flood level for the 1 in 100 AEP event. Reduction in flood levels would be greater with lower storage levels in the dam.

2.11 Groundwater

The dam, its foundations and its grout curtain will locally prevent downstream groundwater movement. Recharge of alluvial aquifers from regulated flows in Teviot Brook will compensate for truncation of aquifers by the dam wall.

The majority of construction impact will occur in the area of the dam wall. Alluvium will be removed and groundwater inflow will be contained. Potential local impacts could occur immediately downstream of the dam wall with water level decline in shallow groundwater and surface water.

Inundation of the reservoir will saturate materials down to bedrock, including the sandstone and the surrounding alluvium. Very little use is currently made of local groundwater resources. Monitoring of groundwater/surface water interaction will be undertaken as part of the Project.

2.12 Surface Water Quality

Water quality in Teviot Brook tends to be poor, with elevated nutrient levels, low dissolved oxygen content and elevated conductivity in certain areas and particularly during no flow or low periods. The latter is related to the underlying geology of one subcatchment while the former is a result of land clearing, land use history, riparian zone clearing, direct access by cattle to the water and sewage effluent disposal from Boonah.

The quality of water stored in the dam is likely to better than water currently in the Brook, more often than not.

The reservoir is likely to thermally stratify to some extent, as this is common with dams in SEQ. Impacts on water quality downstream will be managed by selective withdrawal through the multi-level offtake and re-oxygenation through release via cone dispersion valves.

Mitigation measures including catchment management upstream and facilitating the upgrade of the Boonah sewage treatment works, will improve in-reservoir and release water quality. The ongoing efficacy of these measures will be monitored to inform and upgrade modelling to refine reservoir management.

The sediment load to the downstream waters will be reduced as a result of capture by the dam. Sediment delivery is currently elevated as a result of catchment erosion and sediment carries pollutants, particularly nutrients. The reduction in sediment load is a beneficial outcome of the dam.

Operation of the dam is likely to have only a small but generally positive impact on the estuarine receiving waters. Reducing waste water treatment plant pollutant loads from the large plants near the coast and improved catchment management generally will have a much greater benefit to the estuary than any mitigation measure related to the dam.

2.13 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
- providing for rapid draw-down of the storage in the event of a dam safety emergency.

Climate and natural hazards such as storms, bushfires and earthquakes are critical considerations for the design and operation of the Project. Based on mean annual and monthly data, nett storage loss for the Wyaralong Dam reservoir, including evaporation and seepage and allowing for rainfall falling on the reservoir, has been estimated at 574 mm/annum.

Cyclones and thunderstorms represent hazards, principally through resultant flooding, particularly during construction. During operation flooding may also occur, but spillway capacity will be sufficient to safely pass the PMF for the site. Lightning strikes, damage to buildings, strikes by airborne objects during such events also pose potential but not critical hazards and appropriate mitigation and emergency measures will be put in place.

The Project involves areas with both medium and low bushfire hazard, but bushfire is not considered a hazard of major significance in the design of the dam.

By world standards the overall risk of earthquakes in SEQ is low - earthquake hazard mapping by Geoscience Australia places the Project area in a zone of intermediate hazard. The dam design will take account of the outcomes of a failure impact assessment, earthquake hazard, the Queensland Dam Safety guidelines and the appropriate Australian National Committee on Large Dams (ANCOLD) guidelines.

2.14 Terrestrial Environments

The Project lies across a regional north to south habitat corridor while Teviot Brook forms an east to west link. The majority of the Project area (76%) is cleared, though there is a millable timber resource of approximately 34,000 m^3 in the reservoir area. Other parts of the area are degraded as a result of land use and weed invasion. There are number of wetlands downstream of the Project area, including the Carbrook Wetlands, but they are highly reliant on local runoff for water supplies and are not likely to be impacted by the Project.

2.14.1 Flora

Six Regional Ecosystems covering 227.4 ha have been mapped in the Project area and will be directly impacted. Of these, two are classed as 'Endangered' (40.8 ha), one is classed as 'Of Concern' (3.3 ha) and three are classed as 'Not of Concern' (183.3 ha).

Approximately 300 flora species were recorded during the field survey but no species listed under the EPBC Act or the Nature Conservation Act 1992 (EVR species) were found. Of the exotic flora species encountered eight are listed pests under the Land Protection (Land and Stock Route Management) Act 2002. Seven flora taxa of significance (endangered, vulnerable or rare), though not encountered, are considered to have the potential to occur in the Project area based on the suitability of identified habitats. Their presence though is unlikely.

The edge effects from the reservoir area will present a need for regular management, primarily with regard to the control of weeds. Riparian vegetation communities downstream of the dam wall will be affected by alterations in stream morphology and available water, and will require monitoring and the implementation of management actions (as required) to ensure that the vegetation retains its current ecological function within the local landscape, and as part of a regional corridor.

2.14.2 Fauna

Fauna surveys encountered 37 species of mammal (more than half were microbats), 116 species of bird, 21 species of reptile and 17 species of frog. The survey found one mammal (Grey Headed Flying Fox) listed under the EPBC Act, two mammals (Koala and Echidna) and one bird (Powerful Owl) listed under the NC Act and five migratory birds listed under the EPBC Act. A range of regionally or locally significant species were also recorded. There are a number of other fauna species of conservation significance that were not encountered but may occur in the area though the likelihood is generally low.

2.14.3 Mitigation Strategies

The Project's impacts will be addressed through strategies including:

- planning construction work and operation of the Project to minimise the area disturbed
- retention of riparian zones within 1.5m vertical of FSL
- rehabilitating adjacent terrestrial habitats to provide new habitats to compensate for those lost and to maintain or improve connectivity of wildlife movement corridors
- the proposed restoration of lands to the east and west of the reservoir area that will re-establish the regional wildlife corridor
- facilitation of fauna movement through the Beaudesert-Boonah Road corridor south of the impoundment area

- restoration, enhancement or offset of Endangered and Of Concern Regional Ecosystems in accordance with the Vegetation Management Act
- the protection of the large area of relatively intact habitat to the north of the reservoir area
- the establishment of constructed wetlands to serve as refuges when dam water levels fall.

The presence of the dam will represent a permanent water source that will attract species adapted to lakes and impoundments.

Once appropriate mitigation measures and management plans are implemented, the scale and duration of the construction and operational phase impacts of the Project on terrestrial ecosystems are predicted to be minor and short-term.

2.15 Aquatic Environments

2.15.1 Existing Environment

The Logan Basin area contains a range of freshwater and estuarine habitats, which have varying levels of ecological significance to aquatic flora and fauna. Flow and habitat connectivity in Teviot Brook is intermittent and the reach is comprised of primarily pool and glide habitat with little or no riffle. Therefore, freshwater riverine or wetland habitats, including waterways within the storage area and downstream of the dam, are not thought to represent critical foraging or refuge habitats for threatened or protected freshwater flora and fauna.

Aquatic macrophytes are poorly represented throughout much of the Project area and downstream, particularly in Teviot Brook. Few exotic aquatic flora but several exotic fish species are present within the Project area.

A diverse and relatively abundant macro-invertebrate community occurs in the locality. Species present in upper freshwater areas (Teviot Brook) are likely to be tolerant of variable and sporadic flow conditions.

Up to 40 freshwater fish species are known to occur in the catchment, with the gudgeons (Eleotrididae) being the most diverse family. A number of freshwater fish species typically conduct movements or migrations at various life stages. Three species of freshwater turtle were recorded during EIS surveys. Although the estuarine fish community is not particularly rich on a regional scale, the Logan River estuary does support important fisheries.

Ramsar and nationally important estuarine floodplain wetlands are located over 70 km downstream of the Project area. However, freshwater floodplain wetlands are generally ephemeral and degraded with low aquatic habitat values.

No EVR species of aquatic plant were encountered in the Project area though two may occur. No EVR macroinvertebrates, fish or turtles were encountered or expected in the Project area.

2.15.2 Potential Impacts

The intermittent stream habitats within the water storage area will be converted to deep water lentic (lake) habitat. This will result in a large increase in littoral edge habitat, and changes in aquatic flora and fauna community structure within the water storage area, summarised as:

- a greater abundance of aquatic macrophytes associated with increased habitat availability
- altered macro-invertebrate community composition favouring species that prefer ponded or slow flowing waters, as well as increased abundances in shallow areas, associated with an increase in habitat availability and greater macrophyte abundances
- limitations on fish species with migration-dependent reproductive requirements but an increase in fish abundance in shallower waters due to increased habitat availability.

The stream reach extending from the dam wall to Logan River will have an altered flow regime. This will result in localised changes in aquatic fauna and aquatic flora communities summarised as:

- fewer and shorter dry periods and a greater occurrence of low flows (1–3 ML/d) will support a greater diversity and/or abundance of emergent and submergent macrophytes
- moderate flows in spring during dam releases will disadvantage a number of fish and turtle species that require zero to low flows at this time for successful reproduction
- the seasonal changes to the flow regime would also be expected to affect some macro-invertebrate species.

Little detectable change is expected in the estuary because beneficial sediment and water quality changes will be masked by other catchment influences. In relation to areas and species of conservation significance, impacts to aquatic macrophyte, freshwater fish and marine fauna species of conservation significance are highly unlikely to occur as a result of the Project and no detectable or measurable impacts to the aquatic ecology of Ramsar listed wetlands are expected to occur.

2.15.3 Mitigation

Within the reservoir, the following mitigation measures are proposed:

- protection of the northern bank as a conservation area
- retention of riparian zones within 1.5 m vertical of FSL
- selective replanting of riparian zones, particularly in tributaries
- retention of instream timber to provide aquatic habitats
- relocation of sand bars around FSL to provide nesting habitat for turtles
- creation of habitat islands as refuges from feral species
- creation of small weir structures within selected embayments to provide aquatic refugia during periods of draw-down
- control of spot outbreaks of pest aquatic plants on a continuous basis
- consult agencies and experts during detailed design to address turtle issues
- stocking with native fish to promote not only fishing opportunities, but potentially also assisting in the management of exotic fish species and possibly increasing biodiversity values. Fish stocking would be considered in collaboration with DPI should that department consider it appropriate
- ongoing best catchment management practices to reduce nutrient loads into the storage and the spread of exotic species from external sources such as farm dams is a broader issue that will need to be addressed outside of the planning and operation of this Project.

In the riverine and estuarine reaches downstream of storage area, the following measures are suggested (some are appropriately included in the Project design):

- use of cone dispersion valves to increase aeration and oxygenation of discharges
- use of the multi-level offtake to manage the water quality of releases
- riparian zone re-establishment immediately downstream of the dam wall and support for catchment activities that protect and enhance the riparian zone and riverine environment
- monitor and appropriately manage aquatic vegetation response (that is, not allowing excessive growth)
- the development of an appropriate fish transfer strategy, (together with the development of operational release rules), represents the key strategy for promoting fish (and other fauna) movements through the system
- further optimisation of the flow regime through monitoring and adaptive management, including targeting of environmental releases during summer, coincident with inflows.

2.16 Matters of National Environmental Significance

The Project constituted a 'controlled action' under s 75 of the EPBC Act, due to the likely potential impacts on Matters of National Environmental Significance (MNES). The controlling provisions (or protected matters) for the Project under the EPBC Act are:

- Ramsar wetlands: ss 16 and 17B
- Listed threatened species and communities: ss 18 and 18A
- Listed Migratory Species: ss 20 and 20A.

Moreton Bay Ramsar wetland has values based on supporting vulnerable, endangered and critically endangered species. It supports populations of species that are important for regional biodiversity and supports species at a critical stage of their life cycles.

The Project is not likely to substantially affect these processes or the values of the Ramsar site due to the minor impact of the dam on important components of the flow regime of the Logan River at the estuary.

There is one EPBC listed threatened species that will be affected by the Project – the Grey-headed Flying-fox. The listing of the Grey-headed Flying-fox under the EPBC Act is primarily designed to protect camps and for controlling agricultural endeavours where the animal is considered a pest species. No camps of the species were recorded within the study area during the field investigations, and the animals recorded from the riparian habitat were not present in very high numbers. Any minor impacts from the Project can be offset with respect to provision of roosting and feeding habitat by re-establishment of north-south wildlife corridor and rehabilitation or restoration of comparable habitat in the local area.

Native populations of a cod, *Maccullochella* sp., possibly Mary River Cod (*Maccullochella peelii marienis*), were recorded in the Logan/Albert catchments prior to the 1940s. This species is thought to be extinct in the catchment, and its identity remains unknown (Pusey et al. 2004). The Mary River Cod has been introduced into Maroon Dam, on the Logan River (not the Teviot Brook sub-catchment), and will not be impacted.

There are no Commonwealth threatened communities present within the direct or indirect impact area.

Listed migratory species have been identified in the vicinity of the dam. The habitats that these species use elsewhere in the Logan catchment are not directly impacted by the Project and the migratory species will continue to occupy and visit these areas once the dam is completed. The Project will likely result in an overall positive impact in the long term via provision of the water body including the refuge weirs, habitat enhancement through the revegetation of dam edges, the protection of aquatic plants, and management of pests and weeds.

Wetlands in the upper estuary are predicted to experience a slightly lower flood regime and this has the potential to impact on listed migratory birds. Impact is regarded as unlikely because Logan River flood flows are not a primary source of freshwater. For example the Carbrook Wetlands last received flood flow from the Logan River in 1974.

In summary, there will be no impact on listed threatened species, no negative impact on migratory species and no substantial impact on the Moreton Bay Ramsar wetland.

2.17 Air Quality

The main sources of emissions during construction are expected to be caused by the operation of heavy machinery moving material around the site, dust emissions from storage piles, and blasting.

The existing status of the local air shed has not been classified to date.

Impacts from the construction of the Project are not expected to degrade the existing environment nor detract from the existing local ambient air quality of the nearest potentially affected receptors. No significant cumulative effects are predicted to result from the proposed works, regardless of which of the three dam construction methods is undertaken.

Adoption of the recommended management practices and development of a detailed dust management plan (incorporating corrective actions and dust suppression procedures) should further reduce the potential for local air shed impacts.

A greenhouse gas inventory, including energy requirements and greenhouse gas emissions was also undertaken. Specific measures were recommended to reduce greenhouse gas emissions. It is expected that energy/greenhouse efficient operations will be adopted wherever possible.

2.17.1 Greenhouse Gas Assessment

Calculated greenhouse gas emissions from the majority of construction sources and indirect sources are not significant.

Ongoing emissions of greenhouse gases will be minimised by adopting the following measures:

- beneficial reuse of cleared vegetation
- restricting vegetation clearance to the inundation area
- where vegetation is cleared, avoid on site burning
- foe areas inundated for the majority of the time, clearing carbon rich topsoil for beneficial use in other locations
- replant vegetation.

QWI has committed to significant planting of native timber. Sufficient land has been identified to offset the greenhouse cost of the Project.

2.18 Noise and Vibration

Noise will be created by the movement of heavy machinery and construction works associated with the dam, dam access roads and the new alignment of Beaudesert-Boonah Road. Mitigation measures, such as restricting works to the standard working hours and other mitigation measures will ensure noise criteria are met.

Vibration caused by the construction of the dam and its required infrastructure is not expected to be noticeable at sensitive receivers and is predicted to comply with the set criteria. Vibration during dam operation will be negligible.

A detailed construction noise and vibration management plan will be developed prior to works commencing. Overall, predicted noise levels at all receiver locations comply with the criteria for construction of the dam wall, adopted from the Department of Main Roads Draft Code of Practice for long-term construction projects.

During operation noise sources associated with the dam will include the spillway, the dispersion valve, pumps and road traffic. It is predicted that noise during operation will meet legislative guidelines.

2.19 Waste Generation and Management

All phases of the Project, including the mobilisation stage (decontamination and removal of existing farm waste), construction (roads and dam infrastructure), and operational phases (road and dam maintenance, staff amenities) will generate waste.

While the waste produced during the construction works will be of short duration, a smaller volume of waste will continue to be produced as part of the operation and maintenance of the dam and its infrastructure (mainly office and domestic waste, wastewater, etc).

The waste that is generated will be managed and disposed of appropriately by qualified contractors in accordance with its waste classification. For example, regulated wastes (e.g. hydrocarbon wastes, solvents, asbestos, contaminated soil) will be tracked and recorded.

All wastes will be managed with preference for reuse of resources in other areas of the Project. For example: wastewater from road runoff during road construction will be directed to sediment ponds, which will be maintained, with water collected and re-used where possible; wastewater from ablutions will be suitably treated for reuse on site (e.g. toilet flushing or other uses if appropriately treated); cleared vegetation will be recycled where possible e.g. millable timber may be sold, or if appropriate, chipped for reuse in rehabilitation and stabilisation of exposed areas during the construction and construction site rehabilitation. Excess excavated material generated by the Project will be disposed of within the reservoir area.

2.20 Traffic and Access Arrangements

The dam will inundate sections of both State and council-controlled roads in the immediate vicinity of the dam site.

An 11.9 m section of the Beaudesert-Boonah Road is to be relocated and several Council-controlled roads will also be impacted, though some will not be replaced or alternatives provided as they service properties within the dam catchment reserve that will be purchased. Alternative arrangements will be discussed with local stakeholders and Council where access to properties is still required.

Traffic volumes will increase during dam construction. Over the construction period, a maximum of approximately 30,000 trucks will be required to transport material to the three construction sites: the dam, the access road to the dam site, and the Beaudesert-Boonah Road realignment. The environmental impacts likely to be caused by materials and equipment haulage into this Project (such as noise, vibration, air quality and amenity) are considered to be short term and relatively minor.

The main traffic usage during operation of the Project is likely to be for recreational use on weekends. Operators will live in the local area, and long term operations will result in limited traffic. From time to time traffic volumes will increase slightly when heavy equipment and associated materials required for dam and access road maintenance are required to travel to the site.

The operational impacts of the Project on traffic and access in the area will be largely positive. The road works undertaken in association with the dam will be carried out to higher standards than the present. Safety on the roads will also be significantly improved. The new road alignment's shortened length, combined with higher roadwork standards, could reduce overall crash rate in the area by up to 30%. This is a significant beneficial outcome of the Project.

Impact on emergency service access is expected to be negligible during the construction phase, as the existing Beaudesert-Boonah Road will remain open until the new road is completed. Once completed, the new road will improve travel times and safety.

2.21 Cultural Heritage

2.21.1 Indigenous Cultural Heritage

QWI has entered into two Indigenous Land Use Agreements (ILUAs) with Aboriginal Parties for the area. One of these is with the Jagera People whose native title claim area falls north of the Teviot Brook. The other is with the Mununjali People for the area south of Teviot Brook although there are no native title claims for this area. Upon registration, the Indigenous Land Use Agreements will ensure compliance with the duty of care requirements of the ACHA.

A comprehensive and systematic Indigenous cultural heritage survey of the Project area will be undertaken on registration of the ILUAs. QWI is committed to a process that affords the Aboriginal 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.

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
- Stage 3: Post-construction heritage management measures.

2.21.2 Non-Indigenous Cultural Heritage

Registers held by State and Commonwealth agencies hold no registered listings for the Project area or its immediate surrounds and local authorities were not able to provide data.

None of the locations identified through research as potential historically significant places fell within the Project area. Nevertheless, there are a number of places in or adjacent to the Project area that hold significance for locals, or provide links to past activities.

'The Overflow' homestead on Lot 1 RP160951 is historic from the perspective that members of royalty and other VIPs have stayed there. It is also a fine example of double story Victorian-era timber home. The property was owned by the Joyce family for four generations before being sold in 2005.

'Wyaralong' was originally an outstation of the vast 'Dugandan Station' first settled by the McDonald family in the mid 1850s. It was purchased in 1906 by Colin Philp, son of Queensland Premier Sir Robert Philp (Premier 1899 to 1903 and 1907 to 1908). The homestead was built about this time. It comprises an interesting complex of single story buildings joined by walkways.

Neither of the homesteads will be affected by the Project.

2.22 Social and Economic

2.22.1 Social

The Project will provide a range of positive social benefits to the local Project area and the surrounding region, as well as some localised negative social impacts.

During construction of the Project there may be some negative impacts, particularly to directly impacted property owners. The project will require the purchase of two complete properties and part of a further nine properties in addition to the eight which are already owned by Queensland Government. The loss of property may result in changes to property use and management, uncertainty and concern to property owners. There may also be some negative short-term impacts such as road diversions or changes, dust or noise, stemming from construction activities, but with careful management these impacts will be minimal.

Construction of the Project will result primarily in positive impacts. A large workforce will be required during the construction phase and this will provide a range of benefits to the local community through an increase in business activity through use of local services and facilities as well as employment and training opportunities.

Impacts during the operational stage of the Project will be largely positive, with the completed dam expected to provide benefits by improving the supply and reliability of water to the region. Any negative impacts during operation of the Project will be mainly associated with changes to directly affected properties.

2.22.2 Economic

The Project will generate both positive and negative economic impacts. The positive impacts are significant and will accrue at the local, regional, state and national levels. Water supply security will create certainty and encourage flow-on investment into Queensland.

At the local level, the provision of new infrastructure plus the injection of approximately $333 million will create a significant stimulus to regional economies, particularly businesses and the tourism industry. The injection of capital for construction, up-skilling of labour, and increased capacity and capability of local businesses that provided goods and services for the construction of the Project should ensure longer lasting benefits to the local community into the future.

Negative impacts at the local level will result from the loss of grazing area and relocation of one non-pastoral business located adjacent to the Project inundation area and to those subsequent businesses dependant on them. However, with the appropriate mitigation, these impacts will occur predominantly in the transition period while business relocation is undertaken and re-establishment is completed.

2.23 Hazard and Risk

A hazard identification and risk assessment of construction, operation and eventual decommissioning of the dam was undertaken generally in accordance with Australian Standard AS/NZS 4360 – 2004: Risk Management. A range of hazards were identified, and while some of these were high risk, only one was found likely to occur. This risk, relating to the risk of death or injury from project-related traffic, has a high level of residual risk after the application of mitigation measures. This traffic-related risk requires ongoing attention from construction contractors during the project to ensure that adequate controls are being applied.

The impact relating to the possibility of the dam failing was assessed as high because of the catastrophic nature of resulting impacts should it occur. However, the probability of such an event has been assessed as extremely small based on the nature of the site and the requirement to follow the ANCOLD and Queensland guidelines for the safety of large dams in their design, construction and operation.

Adherence to the guidelines and statutory requirements as described above will ensure that the risk posed by the dam is well within all guideline values for the downstream population. Other risks will be adequately managed by implementation of the mitigation measures identified in a qualitative risk assessment.

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 environmental management plans (EMPs) will be prepared for the Project based on the draft EMP included in this EIS. The proponent is committed to ensuring the development and implementation of an appropriate EMP in accordance with this document, QWI's Environmental Policy and the commitments made in this 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.

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 to:

- 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
- 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
- decisions and actions should provide for community involvement regarding issues that affect them.

The sustainability principles for the Project 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.

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 studies and assessment undertaken for the EIS identified a number of mitigation strategies to minimise or avoid negative impacts and enhance positive impacts. Through consultation with agencies, the Community Futures 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. Native Vegetation Corridors

The provision of native vegetation corridors at the eastern and western ends of the dam will improve interconnectedness of existing regional corridors and provide habitat for fauna in close proximity to the dam.

Through a targeted planting strategy, the corridors will be developed with native species and link into the vegetated conservation areas to the north of the dam reservoir.

This will allow coexistence with existing landholders and property management arrangements that will allow ongoing access to the revegetated area, once established.

B. Boonah Shire Sewage Treatment Plant

The Boonah Sewage Treatment Plant (STP) constructed in the 1960s is located approximately 9 km upstream from the dam site. In 2005, an upgrade to the STP was carried out to comply with current Environmental Protection Agency standards. The STP is currently licensed by the Environmental Protection Agency to discharge effluent in to the Teviot Brook at the same location.

Water quality modelling during the EIS preparation identified that the water being discharged is of a suitable standard that it would be unlikely to impact on the dam's water quality. However, in order to add greater certainty and avoid the prospect of potential spill risks, QWI has been in discussion with Boonah Shire Council to facilitate the upgrade of the STP.

C. Teviot Brook Riparian Zone Rehabilitation

The degradation of Teviot Brook upstream and downstream of the proposed Wyaralong Dam impoundment has mainly been attributed to the introduction of exotic species and clearing for agricultural purposes. These impacts have changed the riparian vegetation structure resulting in adverse water quality and erosion of the stream banks.

Boonah Shire Council has provided financial support to the Boonah Shire Rivers Improvement Trust (BSRIT), since its inception in 1975 to manage the streams within the Shire. Recently, in conjunction with the SEQ Catchments, the BSRIT has undertaken the Woody Weed Management Program. This program focuses mainly on the eradication of the species known as Chinese Celtis. This woody weed colonises the stream bank and makes it difficult for native species to survive.

The main issue to be addressed with this project is the removal of the exotic species to allow natural regeneration where possible and plantings of replacement species in target areas. The re-establishment of native species is to be addressed, resulting in improved water quality of stream flow into the ponded area of the Project.

QWI, in conjunction with Boonah Shire and BSRIT, and SEQ Catchments, will develop a plan to augment existing activities for the treatment of the woody weeds in Teviot Brook. This joint approach will aim to identify a program to which QWI will contribute.

D. Local Township Engagement

With a major infrastructure project, comes the opportunity for the indirect benefit to local township facilities and services support. Facilities such as the potential construction camp can present opportunities for a local town to work in partnership with the construction contractor, with the view to the camp facilitating a local facility that may not otherwise had been developed. There is scope for the construction camp to provide longer term facilities for a caravan park or other visitor accommodation.

Other opportunities exist for the local schools and sporting clubs to benefit from additional participation by the workforce, bolstering numbers and providing scope for additional revenues to enhance facilities.

Service clubs and projects of other volunteer organisations can also benefit from the Project, through volunteer work by the contractors, there staff and sponsorships.

QWI will be encouraging community engagements activities by contractors to ensure the major revenue injection by the project provides a lasting positive legacy for the local townships and communities.

E. Recreation and Tourism Planning

The dam offers significant opportunities for recreation and tourism. As part of the EIS process QWI has developed conceptual plans and has also identified the type of activities that are most likely to be popular and will have minimal conflict with dam operation. The plan includes provision of core recreational facilities around the dam, zoning of the dam for particular forms of recreation (boating, canoeing, picnicking, nature conservation), potential location for camping and caravanning facilities, and horse-riding and mountain-biking trails. Detailed planning is a critical consideration because, for example, while it is important to maximise recreational opportunities, it is also important to protect the natural habitat and water quality within the storage.

QWl has consulted with various stakeholders including those from the equestrian, bushwalking, mountain bike riding and canoeing communities and organisations. QWI is also working closely with the Queensland Outdoor Recreation Federation (QORF). QWI proposes to establish a Tourism Partnership with local and regional tourism organisations, in order to plan and implement visitor attraction programs, both during and on completion of construction.

F. Educational Opportunities

The region already boasts a number of schools and private outdoor education organisations that have existing outdoor and environmental education programs. Several of these have expressed interest in opportunities offered by the dam itself and by associated planning activities. It is anticipated that State Schools will take advantage of existing Education Department initiatives in environment and sustainability, and that private organisations will seek linkages to the Project and may seek funding to expand their operations through existing mechanisms or linkages with QWI.

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.

G. Local Industry Participation Plan

While Queensland has mandatory policies regarding utilisation of local services for Government projects, through review of the experience in the construction of Paradise Dam, QWI has developed a process to maximise this opportunity. Most important is the lead-in time needed to recognise the opportunities and align the training needs of the workforce to those opportunities. Since commencing an Expression of Interest process QWI has received over 250 responses from local businesses; this is a very significant response given the number of local businesses that could potentially benefit. A contractual component of the alliance agreement for construction of the dam will see this process achieve its maximum potential local benefit.

QWI has, in partnership, established the Wyaralong Dam Business Capability Working Group, which consists of:

- Queensland Water Infrastructure Pty Ltd
- Industry Capability Network
- Bremer Institute of TAFE
- Department of Department of Tourism, Regional Development and Industry
- Department of Employment and Industrial Relations

This Group is facilitating training and business planning to allow businesses to prepare for supply opportunities that will emerge as part of the Project.

3.1.1 Sustainability Outcomes

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

Table 3.1: Sustainable Communities

Principles	Projects and Activities						
	A	B	C	D	E	F	G
Principle 1. Ensuring that the communities of the Logan River catchment also benefit from the natural resources utilised in South East Queensland	✓	✓	✓	✓	✓	✓	✓
Principle 2. Designing and developing options for 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			✓		✓	✓	✓

Table 3.2: Sustainable Local Enterprises

Principles	Projects and Activities						
	A	B	C	D	E	F	G
Principle 1. Create employment opportunities during construction and operation of Wyaralong 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 Wyaralong Dam			✓	✓	✓	✓	✓

Table 3.3: Ecologically Sustainable Catchments

Principles	Projects and Activities						
	A	B	C	D	E	F	G
Principle 1. Encourage and facilitate whole of catchment restoration of riparian vegetation 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 species 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	✓	✓	✓			✓	

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

A range of alternatives to the Project, including the option of not building the dam, building other dams, recycling and desalination, alternative surface water supply options (including the Glendower Dam on the Albert River, Tilleys Bridge Dam on the Logan River, and dam options in northern New South Wales), along with water harvesting has been undertaken.

Based on the above assessment, a cost benefit analysis, and environmental and social considerations, Wyaralong Dam has been identified as the preferred alternative and the least-cost supply option under a wide range of scenarios.

A 'do nothing' option was found an unrealistic option.

The Project will cause various social, economic and environmental impacts. The majority of the direct negative impacts of the Project will be felt in the local area, while the majority of the positive impacts (relating to water supply security and flow-on economic benefits) will be felt at local, regional, state and national levels.

The Project benefits are significant. At the National level, the discounted national welfare benefit will be in the order of $745 million; real GRP in SEQ is expected to increase in the construction period by approximately $42 million in the operational period by approximately $75 million. At the local level, the injection of $333 million for project construction will have significant flow on benefits for the local community. Aggregate employment in SEQ will increase during the construction period, with approximately 348 jobs and due to the increased reliability of water supply by approximately 302 jobs.

Other benefits include tourism, recreation activities, and upgrade of infrastructure, including roads.

The Project is situated across a regional north to south habitat corridor while Teviot Brook forms an east to west link. The majority of the Project area (76%) is cleared, though there is a millable timber resource of approximately 34,000 m^3 in the reservoir area. Other parts of the area are degraded as a result of land use and weed invasion. There are number of wetlands downstream of the Project area, including the Carbrook Wetlands, but they are highly reliant on local runoff for water supplies and are not likely to be impacted by the Project.

The Project will result in a change in land use of approximately 2,304 ha including 1,230 ha of predominantly grazing land to use for water storage, 932 ha for a buffer area, 106 ha for the realignment of the Beaudesert-Boonah Road and 36 ha for the dam access road. These changes in land use will result in the loss of grazing land, including 741 ha of land classified as Good Quality Agricultural Land (GQAL). As a proportion within the catchment, the loss of grazing land and GQAL is low and it is not considered to adversely affect the availability of adequate rural land in the catchment nor affect the ongoing rural activities in the balance of the catchment.

The Project will require the purchase of two whole properties, partial areas of a further 17 properties (eight of which are currently owned by the State Government), and may also necessitate the acquisition of other interests in land in the Project area. The QWI's Land Purchasing Policy provides for land purchases based on market valuations and also seeks to minimise the potential adverse effects of the land purchase process on landowners.

The Project will have a low visual impact on the landscape, as visibility of the dam wall and realigned Beaudesert-Boonah Road will be relatively limited, with few nearby viewpoints. Together with potential recreational facilities around the shoreline to enhance the lake's amenity and attraction the new water body is considered a beneficial landscape outcome.

Operation of the dam is likely to have only a small but generally positive impact on the estuarine receiving waters. The capture of sediment load and reduction of sediment to the downstream waters together with effective catchment management upstream and upgrade of the Boonah sewage treatment works which will improve in-reservoir and release water quality is a beneficial outcome of the dam.

The flora and fauna impacts are associated with the habitat loss and fragmentation. Once appropriate mitigation measures and management plans are implemented, the scale and duration of the construction and operational phase impacts of the Project on terrestrial ecosystems are predicted to be minor and short-term.

In relation to areas and species of conservation significance, impacts to aquatic macrophyte, freshwater fish and marine fauna species of conservation significance are highly unlikely to occur as a result of the Project and no detectable or measurable impacts to the aquatic ecology of Ramsar listed wetlands are expected to occur. Further, the assessment found there will be no impact on listed threatened species, no negative impact on migratory species and no substantial impact on the Moreton Bay Ramsar wetland.

The environmental impacts likely to be caused by materials and equipment haulage into this Project (such as noise, vibration, air quality and amenity) are considered to be short term and relatively minor.

The operational impacts of the Project on traffic and access in the area will be largely positive. The road works undertaken in association with the dam will be carried out to higher standards than the present. Safety on the roads will also be significantly improved. The new road alignment's shortened length, combined with higher roadwork standards, could reduce overall crash rate in the area by up to 30%. This is a significant beneficial outcome of the Project.

Impact on emergency service access is expected to be negligible and once the new road is completed, travel times and safety will improve from existing conditions.

Indigenous Land Use Agreements (ILUAs) with the Jagera People whose native title claim area falls north of the Teviot Brook and the Mununjali People for the area south of Teviot Brook have been signed. Upon registration, the Indigenous Land Use Agreements will ensure compliance with the duty of care requirements of the ACHA.

None of the locations identified through research as potential historically significant places fell within the Project area. The historical 'The Overflow' homestead and the 'Wyaralong' homestead will not be affected by the Project.

The greenhouse cost of the Project will be offset through QWI commitment to significant planting of native timber. Sufficient land has been identified for this purpose.

A hazard identification and risk assessment of construction, operation and eventual decommissioning of the dam and only one risk was found likely to occur. This risk, relating to the risk of death or injury from project-related traffic, has a high level of residual risk after the application of mitigation measures. This traffic-related risk requires ongoing attention from construction contractors during the project to ensure that adequate controls are being applied.

The mitigation of impact and realisation of beneficial outcomes identified in the environmental impact assessment process has been incorporated into a draft environmental management plan (EMPs).

Cumulative impact assessment for the Project has indicated 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 and objectives of the Project will be achieved through the mitigation measures and a number of sustainability projects including the provision of native vegetation corridors, facilitating the upgrade of the Boonah Sewage Treatment Plant, rehabilitation of Teviot Brook Riparian Zone, local township engagement, recreation and tourism planning, educational opportunities and the Local Industry Participation Plan.

Given the strong need for the Project, the level of benefits of the Project, and the strong commitment to mitigation and sustainability measures which will offset any negative impacts, the Project should proceed.

4.2 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

b) developing and implementing a scheme of effective mitigation measures and proponent commitments such as those set out in **Attachment 2**.

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

1. evaluate 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.

4.3 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

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.

GLOSSARY

Term	Definition
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.
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.
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.
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)
Aquatic macrophyte	Submerged, emergent or floating aquatic vegetation that is visible to the naked eye.
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.
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.
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.
Cease to flow	The period where water ceases to flow.
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.
Connectivity	Refers to the ease with which organisms move between particular landscape elements.

Term	Definition
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).
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.
Dead storage	The volume in a water storage below the lowest operable level.
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.
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.
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.
Endangered	A species is endangered if: • 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 • the habitat or distribution of the wildlife has been reduced to an extent that the wildlife may be in danger of extinction; or • 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 • 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 (Logan Basin) Plan 2007* for the measurement of the environmental performance of the Logan Basin.
Environmental quality	Human (individual or social) concepts of desirable ecological situations.
Ephemeral	Transitory, short-lived.

Term	Definition
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. Seven processes of erosion discussed separately; in practice they overlap and it is often difficult to isolate the net effects of any one process. **Rainsplash erosion:** the detachment and removal of soil and debris by raindrop impact. **Overland flow OR surface runoff:** water flowing over the surface before being concentrated into definite streams. **Sheet erosion, sheet wash, or slope wash:** the combined effect of overland flow and rainsplash. **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 (eg highly dispersive soils) **Mass Movement:** downhill movement of debris ***en masse*** rather than as individual particles. It can occur slowly (creep), or rapidly (rockfalls, slumps, landslides). **Surface rock creep:** the movement of stones down sloping surfaces. **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.
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').
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.

Term	Definition
Fragmentation	A process of landscape alteration in which natural areas are subdivided into smaller patches.
Full Supply Level (FSL)	The maximum normal operating water surface level of a reservoir.
Geomorphology (geomorphological)	The form or shape of the landscape and the processes that modify and change it.
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.
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.
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.
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 zone	Region of shallow water near the shore of a body of water where light reaches the bottom.

Term	Definition
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: • listed threatened species and communities • listed migratory species • Ramsar wetlands of international importance • the Commonwealth marine environment • World heritage properties • National heritage places • nuclear actions • 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).
National heritage place	Under the Environment Protection and Biodiversity Conservation Act 1999 (Cth), a World Heritage property is either: • an Australian property on the World Heritage List kept under the World Heritage Convention • 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.

Term	Definition
'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% of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 h.
Nuclear action	A nuclear action is: • establishing or significantly modifying a nuclear installation • transporting spent nuclear fuel or radioactive waste products arising from reprocessing • establishing or significantly modifying a facility for storing radioactive waste products arising from reprocessing • mining or milling uranium ores, excluding operations for recovering mineral sands or rare earths • 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: – the activity of the radioisotopes to be disposed of – the half-life of the material – the form of the radioisotopes – the quantity of isotopes handled – de-commissioning or rehabilitating any facility or area in which an activity described above has been undertaken – 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% of its pre-clearing extent remains and the remnant extent is less than 10,000 ha.
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: (a) a network of pores between the grains (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.
pH	"power hydrogen". Negative logarithm of hydrogen-ion concentration; a numerical expression of acidity or alkalinity.
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.
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.

Term	Definition
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: • an Australian wetland on the List of Wetlands of International Importance kept under the Ramsar Convention; or • a wetland declared to be a Ramsar wetland by the Commonwealth Environment Minister.
Rare	An animal is rare/near threatened if: • the population size or distribution of the wildlife is small and may become smaller • 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 • 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.
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.
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.

Term	Definition
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 0.3 m 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).
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.
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.
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.

Term	Definition
Vulnerable	A species is vulnerable if: • its population is decreasing because of threatening processes • its population has been seriously depleted and its protection is not secured • its population, while abundant, is at risk because of threatening processes • 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: • an Australian property on the World Heritage List kept under the World Heritage Convention • a property declared to be a World Heritage property by the Commonwealth Environment Minister.
Zeolitic	Group of structures containing large internal cavities.

Attachment 1

No.	Approval Source/Decision Maker	Relevant Aspect of Project
1	Approval as a controlled action (Environment Protection and Biodiversity Conservation Act 1999) 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: • sections 16 and 17B (Ramsar wetlands) • sections 18 and 18A (listed threatened species and communities) • sections 20 and 20A (listed migratory species). (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*) A Community Infrastructure Designation can be made in relation to a wide range of infrastructure facilities set out in Schedule 5 of IPA. (IPA s.2.6.1 – 2.6.25) (Any responsible State Minister)	Dam wall, reservoir and buffer areas. Potentially to much of the infrastructure which needs to be relocated as part of the project.
3	Resource Operations Licence (*Water Act 2000*) 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 Logan Basin. (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) 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 – 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). (IPA Sch 8 Part 1 Tab 4-3) (Chief Executive responsible for the Water Act 2000)	Works for construction of the dam. Other works which interfere with water outside the construction zone.
5	Development permit (operational works) (Water Act 2000, Integrated Planning Act 1997) Operational works that – is the construction of a referrable dam as defined under the *Water Act 2000*. (IPA Sch 8 Part 1 Tab 4-4(a)) (Chief Executive responsible for the Water Act 2000)	Works for construction of the dam.
6	Failure Impact Assessment (*Water Act 2000*) (Section 480 ss *Water Act 2000* (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) Operational works that is the clearing of native vegetation on land. (Sch 8 Part 1 Tab 4-1A – 1G) (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) 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. (IPA Sch 8 Part 1 Tab 5-1) (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*) (Section 280 *Water Act 2000*). (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) Permit to destroy vegetation, excavate or place fill in a watercourse, lake or spring. (*Water Act 2000* s.266 and s.814). (Chief Executive responsible for the Water Act 2000)	In the watercourse.
11	Licence to take or interfere with water (*Water Act 2000*) A licence to take or interfere with the flow of water in a watercourse. (Water Act 2000 s.206.) (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) Permit to take water from a watercourse for a specified purpose where the activity has a foreseeable end date. (Water Act 2000 s.237.) (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*) Making a material change of use of premises for an environmentally relevant activity. (IPA Sch 8 Part 1 Tab 2-1) (Chief Executive responsible for the *Environmental Protection Act 1994*)	The activities following listed in Schedule 1 of the *Environmental Protection Regulation 1998*. ERA 7 Chemical storage ERA 11 Storing crude oil or petroleum products ERA 20 Extracting rock or other material ERA 22 screening etc materials ERA 62 concrete batching ERA 84 regulated waste storage

No.	Approval Source/Decision Maker	Relevant Aspect of Project
14	Registration Certificate (Environmental Protection Act 1994) 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*. (Section 73D Environmental Protection Act 1994) (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) 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. (IPA Sch 8 Part 1 Tab 4-6) (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*) To remove and treat or dispose of contaminated soil from land on the Environmental Management Register or Contaminated Land Register. (EPA s 424) (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.

ATTACHMENT 2

The proponent commitments are derived from the mitigation measures referred to in the text and also the EMP which the proponent will need to incorporate into the constructors contracts. In addition to these are the sustainability outcomes which also capture a number of projects and activities to be undertaken by the proponent.

Assessment of the projects and activities against the sustainability principles indicate a strong correlation and a strong beneficial outcome in that regard.

Proponent Commitments

General
• The Proponent will construct Wyaralong Dam 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 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.

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
  - 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
  - management of night lighting to ensure lights are focussed on the areas and to limit extraneous light where necessary.

- Landscape Assessment and Design Plans should be prepared for all the Beaudesert-Boonah Road realignment and access road 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:
  - the management of existing vegetation within the FSL
  - the design and management of the FSL edge treatment to avoid erosion and protect steeper slopes and future “banks”
  - manage water level fluctuations and provide for the establishment of pioneer riparian plantings consistent with existing vegetation
  - 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.
- 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

- 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 upgrades

- All utilities will mange their infrastructure relocation activities via an EMP which embodies the principles of the Project EMP.

- 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.

Water Resources and Water Quality

- The design and management of the construction process will ensure the normal flow in Teviot Brook is maintained.
- 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 Teviot Brook 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
  - coffer dams 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
  - 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
  - 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.
- Emergency response procedures will be developed, with chemical spill response kits will be issued at all construction sites and staff trained in their use.

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
  - 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.

- Develop a Vegetation Management Offsets (VMO) strategy 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 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

- To offset the loss of habitat for fauna, the following will be undertaken as part of the Project as detailed in the EIS:

- island refuges for fauna
- re-vegetation of riparian areas
- re-vegetation of construction site areas and around the edges of the dam
- provision of vegetation management offsets in areas where vegetation connectivity can be enhanced (particularly in the northern and eastern areas identified in the EIS as conservation area and fauna movement corridors) and also buffers for existing remnant vegetation generated
- salvage habitat logs, branches and other shelters from vegetation clearing to create habitat for small mammals and reptiles
- retain dead (stag) trees within the inundation area as potential roosting sites.

- 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 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.
  - Installation of fauna crossings on the Beaudesert-Boonah Road realignment 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.

Aquatic Environments

- Prepare and implement a program to monitor and control declared and aggressive aquatic weeds, such as Salvinia 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* 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 fish and other species, such as turtles.
- QWI will develop a fish transfer system in conjunction with the DPI&F and EPA and other leading experts. This will include physical translocation of specimens of the species of interest, QWI will regularly monitor of the efficacy of the fish transfer process to ensure their objectives are achieved
- Control access to turtle 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 to assist in rehabilitation of the riparian area of Teviot Brook with links to the impacts on the water quality of the dam, through a number of funding mechanisms

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. This may be added to the Traveston Crossing Dam Project offset area.
- 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.

Noise and Vibration

- Noise and vibration will be managed as set out in the EMPs, including the preparation of detailed construction noise and vibration management plans
- 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 or car pooling for construction employees
  - maintain one lane open during roadworks for emergency vehicles
  - provide clearly marked on-site parking for employees and visitors to the site during construction
  - 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 general Project area 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 two ILUAs that have 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 ILUA 's that provides for recompense for impact upon native title interests.
- In the event that any indigenous items are uncovered during the course of the construction of the Wyaralong 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.

Social & Economic

- Actively facilitate the ongoing planning and implementation of the planned recreational and tourist facilities with Boonah and Beaudesert Local Governments and the OUM. And sporting and community organisations in the area.
- 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
- Partner with Tourism Queensland and local tourism bodies to develop visitor attraction program

- 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.
- 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 the recreational facilities 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 the upgrade of the Boonah Sewage Treatment Plant
- 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).
- Maintain Wyaralong 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)
  - a lump sum amount for disturbance and general expenses to allow the landowner to relocate as agreed between QWI and the landowner.
- 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. However, monitoring of local businesses need

for labour and the impact of the Project on the local labour market will be undertaken as part of the recruitment strategy

- 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.

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
  - 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.
- 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 measures put 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
  - 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.
- 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
  - 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.