Coordinator-General's Evaluation Report

Traveston Crossing Dam Stage 1

October 2009

Traveston Crossing Dam Stage 1

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Coordinator-General's Evaluation Report: Synopsis

Introduction

In October 2006, in response to a submission from Queensland Water Infrastructure Pty Ltd (QWI), the Coordinator-General declared the Traveston Crossing Dam Stage 1 (the Project) to be a significant project for which an EIS is required under the *State Development and Public Works Organisation Act 1971* (SDPWO Act). In November 2006, the then Commonwealth Minister for the Environment and Heritage determined that the Project was a "controlled action" requiring approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), with the controlling provisions being the world heritage values of Fraser Island, Ramsar wetlands, listed threatened species and communities and listed migratory species. Under the terms of the bilateral agreement between the Queensland Government and the Australian Government, the SDPWO Act EIS process is accredited for the EPBC Act, and accordingly my assessment has considered the relevant impacts of the Project on matters of national environmental significance under the EPBC Act in addition to State requirements.

The Project is the design, construction, operation and maintenance of the Traveston Crossing Dam Stage 1 on the Mary River approximately 27 km upstream of Gympie. The Project includes access roads and the relocation of sections of existing roads and infrastructure. The Project would inundate approximately 36.5 km upstream along the Mary River from the embankment at 207.6 km AMTD.

The dam would have a full supply level (FSL) of 71.0 m Australian Height Datum (AHD) and an inundation area of 3,039 ha, with a storage capacity of approximately 152,429 ML with a proposed yield of 70,000 ML/annum. The preliminary design consists of a Roller Compacted Concrete Dam (RCC dam) approximately 760 m wide and 52 m tall, with a gated spillway and includes fishway and passage for other aquatic fauna including turtles.

Draft terms of reference for the EIS were issued for public comment from 9 December to 19 February 2007. In August 2007, the Coordinator-General finalised those terms of reference having considered all submissions received.

The EIS was publicly notified from 20 October 2007, with submissions closing on 3 December 2007. Owing to discrepancies between the printed, web-based and electronic (disc) versions of the documentation, I extended the submission period until 14 January 2008.

A large number of submissions were received in response to the EIS, including from community groups, the general public, local and State government agencies. I also received advice from State government agencies and the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA).

Following the review of all submission received, I asked the proponent, QWI, to prepare a supplementary report to the EIS (SREIS) to respond to the issues raised in submissions. I received that report in August 2008. Assessment was undertaken of the information in both the EIS and SREIS. In my detailed consideration of the issues, I sought further information from the proponent on a number of key issues. In addition, DEWHA commissioned reviews to be undertaken of the EIS and SREIS, and in November 2008 issued the reports of those reviews to the proponent and I. Responses to those issues have been collated by the proponent in their *Response to Information Requests, Implementation Framework* and *Response to Reviewer Reports* documents, which are available at www.qldwi.com.au.

In undertaking my evaluation of the EIS, I have considered the EIS, issues raised in submissions, the SREIS, the Commonwealth Reviewer Reports, the proponent's response to my information requests and the response to Commonwealth reviewer reports, and the advice I have received on a range of key issues from State agencies and DEWHA. In addition, I received a range of communications outside of the submission period from a number of community groups and individuals, which have been considered in my evaluation.

Rationale and alternatives

I accept that additional water supply is required for the South East Queensland (SEQ) region, having considered the importance of the SEQ region to Queensland, the demand for water in SEQ, existing supply sources within the region, the identified short, medium and long term water supply/demand gaps and Government's strategy to secure supplies for the region.

The Project is one part of a portfolio of projects to ensure secure future water supply for SEQ.

I understand that surface water supply forms one component of a balanced approach to securing those supplies, while considering population growth, cost and probable climate change. That balanced approach incorporates a portfolio of diversified measures including demand management, surface water augmentation, desalination, purified recycled water and interconnection of geographically and climatically diverse water supply sources.

Estimates of required water supplies vary with assumptions in relation to population growth, effectiveness of demand management and climate change impacts, however analysis conducted by the QWC has determined that it is it is likely that 210,000 ML/annum of additional prudent yield will be required by 2026, and 490,000 ML/annum required by 2051. The Project would supply 70,000 ML/annum of this additional required yield.

I note that the QWC's strategy considered a range of alternative supply options and appropriate proportions of each supply option, while noting that sections of the community have varied views of the preferred mix of measures. I note the QWC's determination that the portfolio supply approach adopted under the strategy satisfactorily reduces the risk of failure resulting from the current narrow supply basis, both from the geographic location of the source and the method of supply perspective, and as such additional surface water supplies are considered a necessary component of the portfolio approach to required new supplies.

I agree with the findings of the EIS that the strategy for achieving a water supply balance does not represent an unwarranted reliance on surface water options. Further, the Queensland Government's water supply strategy, which is based on QWC's deliberations as set out above, has given extensive consideration to, and a balancing of, a wide range of factors in selecting supply measures to pursue. The resulting strategy represents a defensible set of diverse demand and supply measures, including support for the proponent's plans in relation to the Project.

I note that desalination can and does form an important component of this water supply strategy, however, I consider it is reasonable for Government authorities to decide to defer further reliance on desalination.

Hydrology and water quality

The Mary River flows over 300 km from the headwaters to the estuary. The Project is located on the Mary River at AMTD 207.6 km. Most of the Mary River catchment is downstream of the dam (78.5%),. 74.3% of river inflows enter downstream of the dam based on mean annual flows. Modelling indicates that downstream flow changes as a result of the Project will significantly diminish after the first 25 km downstream (approximately Fisherman's Pocket).

Modelling undertaken by the proponent has demonstrated that the dam can operate while providing all existing allocations and observing the requirements of the *Water Resource (Mary Basin) Plan 2006*, especially all environmental flow requirements.

The protection and enhancement of aquatic habitat downstream is dependent on the optimisation of flows to enhance important dependent aquatic ecological outcomes. I have set flow performance indicators[1] to be observed at Dagun Pocket to protect species requirements. In general, these flow performance indicators will ensure flows are closer to pre-development conditions with a resulting improvement compared to the existing flow regime in the most impacted downstream part of the Mary River.

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[1] Condition 8, Schedule C, Appendix 1

The outcomes of optimisation modelling with the flow performance indicators implemented support the conclusions made within the EIS and SREIS regarding the capacity of the Project to successfully manage environmental flows across all months and seasons and improve upon conditions currently experienced in the section of the Mary River immediately downstream of the dam.

Implementation of the flow performance indicators will mean that flows during July, August, September, and October will improve from the current situation and enable a return towards the larger winter and spring flow patterns experienced prior to agricultural development in the Mary River catchment. There will be an enhanced ability to manage releases to produce greater water level stability in the Mary River from Dagun Pocket to Fisherman's Pocket during the key lower flow months of July through to January. This part of the Mary River contains breeding habitat for species such as Queensland Lungfish (also called the Australian Lungfish) and nesting sites for the Mary River Turtle. Sustained lower and more stable flows during winter and spring, along with ongoing periodic large flows in summer/autumn, are particularly important for sustaining and generating macrophyte coverage and hence general aquatic life. Stable base flows and minimal extraordinary large flows during winter and spring are desirable factors in relation to Lungfish, Mary River Cod and the broader fish community. In addition, the reduced overall flows (i.e. on a whole of year basis) in the most impacted section of the River downstream of the Project will also result in an increased percentage of combined riffle and pool habitat compared to the current situation, at the expense of some run habitat.

I am satisfied that the Project in itself and cumulatively will have no discernible impact on flows to the estuary, including the Great Sandy Strait Ramsar Wetland.

Flood assessments of the dam indicate that flood mitigation benefits can be provided downstream, particularly for Gympie, but provision of those downstream benefits may impose flood impacts on areas upstream of the dam around the inundation area. I have therefore required[2] that opportunity is provided for all directly affected individuals and organisations to express their views and comment on any proposed strategies for flood mitigation. The final operating strategy must be approved by the Coordinator-General and the Dam Safety Regulator prior to the commencement of construction.

Species, habitat and connectivity

For over 150 years, this Catchment has been modified through the timber, horticulture, grazing, and river mining (originally gold but in recent years sand and gravel) industries. Additionally, an ever growing portion of the catchment is now used for rural-residential development. These intensive developments have all had a significant impact on the Mary River and its catchment, principally through vegetation clearing.

The terrestrial environment in and around the Project Area has similarly been subject to significant development. At the time of European settlement the area contained dense subtropical rainforest and eucalypt woodlands. The high rainfall, deep soils and habitat complexity contributed to a significant abundance and diversity in terrestrial life. Since European settlement, while economic development has supported the wellbeing of the greater community, the impact of timber gathering, agriculture development and other activities has significantly altered the landscape and significantly diminished the area's biodiversity values.

The original pre-European vegetation has been largely cleared with the exceptions of some narrow remnant strips along waterways and in high sloping areas. The EIS reports that 85% of the study area is cleared. Rural and residential development has brought with it exotic species, some of which are now significant weeds and pests. The development of this land has led to vegetation fragmentation. The resulting limited connectivity means wildlife is vulnerable to disease, bushfire, and inbreeding. The development of the Project would result in further landscape change that could, without mitigation and offsetting activities, lead to further impacts on local ecosystems and species.

I have considered the potential impacts of the Project on terrestrial and aquatic native species in the context of the current degraded and worsening ecological situation in the Mary River catchment,

[2] Condition 8, Schedule C, Appendix 1

particularly what actions are required to mitigate those impacts, stabilise the current ongoing ecological decline, and what further actions would reverse that decline and address uncertainty that may remain in terms of the future viability of native species.

All species, including native fauna species in the Project Area, depend on and are part of complex ecosystems. The preservation of native species, especially threatened species, requires the protection of their supporting ecosystems, which is recognised by a number of Queensland Government policies and legislative requirements which I have taken into account. The Project Area includes endangered riparian regional ecosystems. In this locality, the riparian vegetation types have demonstrated an ability to regenerate despite around 150 years of ongoing disturbances, given appropriate protection and support. Furthermore, fragmented wildlife corridors that could be augmented through actions as part of the Project to more fully restore connectivity between areas of fauna habitat are present within the Project Area. The conditions[3] that I have imposed on the Project are directed at the creation, preservation and restoration of terrestrial and aquatic habitat.

Approximately 78.5% of the Mary River catchment lies downstream of the Project, with 21.5% of the catchment upstream. At FSL the inundation area will cover 36.5 km or approximately 4% of the Mary River, included in the 21.5% of the catchment upstream. I consider that the loss of the hydraulic habitat within the inundation area requires mitigation in terms of enhancement of aquatic habitat within the Project Area and elsewhere in the catchment to improve and allow for species connectivity. Potential Project impacts on aquatic habitat and fauna will include the inundation of existing riverine habitat and its replacement with lacustrine habitat, potential flow and water quality changes downstream that will diminish with distance from the dam wall, and the potential barrier to species movement presented by the dam itself.

I have imposed conditions[4] to provide a means for native species (including Mary River Cod, Lungfish and Mary River Turtle) to move both upstream and downstream of the dam wall. The Project includes a fishway and turtle bypass system to facilitate this required movement. In addition, Project conditions supporting improved connectivity include large-scale riparian habitat restoration and protection and reintroduction of snag habitat, improved flow conditions and the retrofit of a fishway and a turtle bypass system on existing barriers in the catchment.

Connectivity between areas of habitat is broadly recognised as essential for the long term survival of fauna species. Therefore, to facilitate terrestrial fauna movement, I have required that native vegetation must be protected and native habitat restored to form largely continuous corridors (recognising existing and ongoing discontinuities associated with roads, streams etc) of native vegetation with a width of at least 100 metres to connect key areas of habitat. Those key areas of habitat that I require to provide linkages to the riparian habitat adjacent to the inundation area, the West Cooroy State Forest to the east of the Project, and at least either Imbil State Forest to the west of the Project or Amamoor State Forest to the north east of the Project. This may involve remnant or rehabilitated vegetation adjacent to Kandanga Creek, Belli Creek, Yabba Creek and existing remnant or rehabilitated areas adjacent to the Amamoor, West Cooroy and Imbil State Forests and actions to address the requirements of the Vegetation Management Act 1999 (VM Act) that are applicable to the Project.

In establishing my conditions relating to the creation of protected riparian habitat, which in most cases involve requirements for vegetated buffers in the riparian zone of at least 60 m width, I particularly noted research quoted in the proponent’s Response to Reviewers Report indicating that:

- vegetated riparian buffers between 30 m and 60 m wide are effective at removing nutrients, faecal coli forms and organic pollution, pesticides and sediment. Wider buffers are needed to protect water quality during severe storms when a large amount of sediment and pollutants can enter the waterways

- the majority of edge effects such as increased light and air movement generally extend up to or greater than 60 m from a forest edge so 30 m wide buffers are not sufficient to provide habitat for

[3] Conditions 4, 5, 7 & 21, Schedule C, Appendix 1
[4] Conditions 22 & 23, Schedule C, Appendix 1

specialist forest interior biota. Wider buffers greater than 60 m can reduce weed invasion and have potential to reduce management and weed maintenance costs.

- woody vegetation buffers in riparian areas provide inputs of large woody debris and smaller organic matter. These inputs provide a basis for aquatic food webs as well as food in the form of fallen insects and shelter for fish species. Shading of streams by riparian vegetation keeps water temperature down increasing dissolved oxygen concentrations and providing conditions for a greater diversity of aquatic invertebrates and vertebrates

- while buffers of native woody vegetation provide the greatest benefits especially for biodiversity, grassed buffers with grazing and other land uses excluded can provide water quality benefits. Woody vegetation has important advantages over grasses in the parameters of bank stability, and also has a higher ability to remove pollutants from shallow groundwater due to the deeper root zone of trees, and greater biodiversity benefits compared to grassed buffers due to its more complex structure and the provision of large woody debris

- a 60 m buffer is considered the minimum width to provide habitat for the adults of the endangered Giant Barred Frog (*Mixophyes iterates*)

- revegetation of riparian buffers can potentially result in large economic savings for municipal water treatment as a direct consequence of reduced sediment load and pollutants bound to sediment entering the water treatment plant. An annual saving of up to $60 million in water treatment costs was estimated in a buffer restoration model for the Brisbane River catchment.

I have conditioned[5] to specifically require the achievement of an overall net gain in habitat for the various terrestrial species that are present or likely to be present. In addition, in order to maximise the effectiveness of the Vegetation Management Offset and riparian restoration works, I have conditioned[6] the proponent to control and where possible eradicate weeds and feral animals and prevent agricultural animals from accessing protected areas within the inundation area buffer.

As well as the direct loss of habitat availability for native terrestrial plants and animals, the existing riparian area contains severely degraded native vegetation which, substantially affects the quality of the in-stream conditions for native aquatic flora and fauna. This degradation deprives aquatic flora and fauna of valuable ecosystem services, including the improved water quality provided by a healthy riparian zone through its filtering of runoff into streams and the erosion constraints it provides by stabilising water way banks. A healthy riparian zone also provides food and shading at the waterway edge and, importantly, generates large woody debris within adjacent waterways. Continued supply of large woody debris requires riparian vegetation cover to be maintained.

Large woody debris provides a range of environmental values to waterways, including the provision of:

- physical habitat diversity and structural complexity for aquatic organisms

- nutrient cycling

- stream channel and bed sediment stabilisation

- fine particulate organic matter for biological processing

- substrate stabilisation to assist colonisation by biofilm (algae, bacteria and fungi) and invertebrates (i.e. important elements of the food chain)

- refuge areas for fish to avoid predators, sunlight, high water velocities, and also for use as spawning sites or territory markers

- re-oxygenation of water flowing over large woody debris and prevention of stagnation

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[5] Condition 21, Schedule C, Appendix 1

[6] Conditions 4 and 21(k), Schedule C, Appendix 1

- resting, perching, foraging, lookout and crossing points for terrestrial organisms

In my view, efforts to reintroduce woody debris and substantially improve the degraded nature of the riparian zone is the key to improving the health of the aquatic fauna in the vicinity of the Project and the prospects for threatened aquatic species generally in the Mary River catchment. The availability of woody debris appears to be particularly important for species such as the endangered Mary River Cod and Mary River Turtle.

I am requiring[7] a series of interconnected and extensive risk mitigation and habitat improvement measures that will lead to:

- the revegetation, rehabilitation and protection of high quality riparian and in-stream habitats via the creation of protected riparian habitat areas

- improved flow conditions downstream of the Project, particularly in terms of improving water quality outcomes and aquatic fauna movement capabilities to coincide with two new fishways and two new barrier bypass systems for turtles

- an applied research program to help resolve residual scientific uncertainties relating to the biology of EVR fish, frog and turtle species and mitigation measures that may aid their recovery within the Mary Catchment

- specific and targeted measures to treat and reduce injury, disease and other Project risks for fish, frogs and turtles

- the application of active aquatic weed control activities to ensure no sustained aquatic weed outbreaks throughout the Project's inundation area, which extends for over 30km in relation to the main Mary River channel

- the development of individual property management systems and funding for associated capital investments targeted at properties within the Mary River Valley to optimise catchment water quality and riparian vegetation outcomes

As part of the Project, in addition to required large-scale revegetation and the creation of new aquatic fauna and frog refuge areas, I have required the proponent to implement and provide at least $35 million funding for research to address knowledge gaps relating to the requirements for key species (Mary River Cod, Mary River Turtle, Lungfish and Giant Barred Frog[8]). The outcomes of the research must be used to manage the effectiveness of the mitigation and offset areas required to protect the key species.

In recognition of risks and uncertainties associated with the complexity of biological needs and ongoing threatening processes relating to threatened species, I have required further precautionary habitat creation measures over and above the creation of new habitat within the Project Area to mitigate the loss of inundated habitat. The proponent is required to cause the establishment, protection and maintenance of further protected riparian habitat and associated in-stream aquatic fauna refuge areas outside the Project Area throughout the catchment via a Catchment Enhancement Program, funded by the proponent to a total of at least $10 million.[9]

Sediment and geomorphology

The EIS notes that the trapping of sediment by the dam will cause a major reduction in fine and coarse sediment load from the dam wall downstream to the Amamoor Creek confluence, which may cause 'clearwater' scour. Changes to flow characteristics may also lead to increased bank and bed erosion in this zone. This part of the Mary River contains important aquatic habitat, and it will become even more

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[7] Conditions 4, 5, 8, 9, 11, 21, 22, 23, 31 of Schedule C, and Schedule A (Operational works that is constructing or raising of a waterway barrier works). Appendix 1
[8] Condition 11 Schedule C, Appendix 1
[9] Conditions 4 and 5, Schedule C, Appendix 1

critical that this habitat is protected given the habitat changes that will happen in the inundation area. I consider it critical that the bank and bed stability in this part of the Mary River is managed to protect aquatic habitat. I require that that the proponent must undertake sediment movement monitoring both upstream and downstream of the proposed reservoir area in the period before construction commences. These measurements of actual sediment movement will provide a better assessment of the likely sediment in flows downstream of the reservoir and better inform required geomorphology mitigation measures downstream. Those studies must be provided to me in the Bank Erosion and Sediment Management Plan before Principal Construction Works proceed.[10]

Rates of sediment input to the Mary River have increased since European settlement and heavy siltation in certain reaches has occurred. Only 10% of the catchment is made up of remnant vegetation or national parks, with the remainder consisting of land uses dominated by grazing, forestry, rural residential, cropping, urban development and horticulture. Large volumes of sediment are transported during high flow events. The banks of the Mary River are prone to erosion due to a number of factors including groundwater flows through the bank causing undermining, lateral migration of the river, rapid hydrograph recession causing bank slumping, removal of bank vegetation and sand and gravel extraction activities. Uncontrolled stock access and scour around in-stream woody debris are also causes of bank erosion.

The erosion, transport and deposition of sediment along the Mary River and to the Great Sandy Strait are important components of fluvial geomorphology and the overall sediment balance of the Mary River catchment. The EIS has noted that sediments from the Mary River are supplied to the Great Sandy Strait and transported northwards by tidal currents where they are deposited to mix with continental shelf and shoreline sediments.

The magnitude of hydrological and sediment transport impacts will reduce with distance downstream from the dam, and it is likely that any impact on erosion, deposition or habitat maintenance processes would also diminish. The EIS findings indicate that any impacts in the Gympie and Barrage backwater zones (downstream of the Amamoor Creek confluence) are unlikely to cause any significant change from current conditions.

The EIS found that the Project would cause minimal overall change to sediment levels in the estuarine zone. Based on the information provided to me, including the findings of the Commonwealth Reviewer Reports, I am satisfied that it is unlikely that the Project will have any discernible adverse impact on the Mary River estuary. However, given the ecological significance of this area, and consistent with the precautionary approach I require that the Proponent develop an estuarine monitoring program for my approval prior to the extraction of Project Yield[11] to confirm that there are no discernible adverse impacts on the Mary River estuary.

Land use change

The Project will result in the permanent change in land use within the Project Area and potentially within additional areas used for required vegetation management offsets, downstream habitat restoration and the provision of wildlife corridors.

The EIS notes that the Project will result in the loss of an estimated 3.2% of land used for intensive agricultural purposes (including intensive animal production, cropping, and horticulture) in the Mary River Catchment. This includes 6.2% of the land used in the catchment for intensive animal production (including dairying). The Project will reduce the area of available Good Quality Agricultural Land by 3,827 ha, which is 1.7% of the Good Quality Agricultural Land in the Mary Valley River catchment.

Relevant State and regional planning documents support the Project, and while the relevant local government planning schemes do not directly address the Project, planning requirements do not prevent

[10] Condition 15 Schedule C, Appendix 1
[11] Condition 24, Schedule C, Appendix 1

the Project proceeding. I have imposed conditions to preserve rural land use and rural character as far as possible, including measures to reduce fragmentation of properties and ensure they remain viable.[12]

The Project will not preclude land other than the inundation area buffer and protected riparian habitat, or other specifically targeted offsets and wildlife corridors, from being used for farming activities.

Social and Economic

I have considered the social and economic benefits that secure water supplies would deliver to the wider community of SEQ, balanced against the impacts on affected individuals and businesses in the local community as a result of the disruption and change caused by the development of the Project. I acknowledge and appreciate that many residents in the vicinity of the Project have experienced negative impacts on their lives due to potential change and uncertainty. I also expect that the construction and delivery of the Project will create employment, training, recreational and community outcomes, amongst others, which will benefit the local community.

The township of Kandanga will be directly affected by an increased level of flooding as a result of the Project with 16 houses fully or partially below the 1 in 100 AEP flood line. Community facilities below the 1 in 100 AEP flood line, with the Project, are proposed to be replaced with upgraded facilities on higher ground at Kandanga. These facilities are already subject to intermittent flooding impacts without the Project. I require that[13] the proponent arrange for an independently facilitated consultation process with the Kandanga community and the GRC to establish a masterplan for delivery of Project mitigation measures relevant to Kandanga in an integrated way, and provide at least $3.5 million towards implementation of a Masterplan for Kandanga.

I have also required[14] that the proponent contribute at least $4 million for the upgrade of sewerage and water supply for Kandanga prior to the completion of dam construction.

The proximity of Kandanga Cemetery to the inundation area and the associated flooding risk is a significant concern for the community. While there is no impact on the cemetery by the Project at its full supply level, the proponent has investigated methods to protect burials from risk of inundation during major flood events. The establishment of a grassy verge is an option to reduce flood risk to the cemetery. This would enable the cemetery to operate in exactly the same way and all used and unused plots to be preserved. I require[15] the proponent continue to work with the community to decide on the most appropriate action. In the absence of a consensus decision, the grassy verge option as described in the EIS is to be implemented as the default option prior to the completion of dam construction.

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 including schools and sporting clubs. I require a construction camp[16] that will house at least 200 workers to help to mitigate the impact on the local housing market during construction.

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

The Project is expected to deliver enduring regional economic benefits including:

[12] Condition 13, Schedule C, Appendix 1
[13] Condition 32, Schedule C, Appendix 1
[14] Condition 32, Schedule C, Appendix 1
[15] Condition 32, Schedule C, Appendix 1
[16] Condition 30, Schedule C, Appendix 1

- a discounted national welfare benefit of around $3.44 billion raising national employment and income
- increased real Gross Regional Product and Gross State Product to SEQ and Queensland respectively and
- increased aggregate employment in SEQ (includes approximately 1745 jobs at peak construction in 2009).

The construction of the Project will result in positive economic impacts to the local area as a large workforce will be required 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 additional employment and training opportunities. I am mindful, however, that the people of the Mary Valley, particularly those subject to direct property impacts, are being asked to cope with substantial disruption to deliver water security for the SEQ region.

Economic impacts during the operational stage of the Project on balance will be positive, with the completed dam expected to provide increased tourism opportunities to the local area. Some negative impacts will result from the displacement of existing agricultural land use of the directly affected properties and to those subsequent businesses who currently service them. The injection of capital from land acquisition, replanting of timber on purchased land, up-skilling of labour, and increased capacity and capability of local businesses that provided goods and services for the construction of the Project are anticipated to result in long-term benefits to the local community.

The Project must comply with the water security arrangements set out in the *Water Resource (Mary Basin) Plan 2006* and therefore there will be no economic impacts on downstream water-dependant businesses.

While I note the strong economic benefits that the Project will provide to SEQ and in part to the local economy, I have imposed a series of conditions[17] to mitigate adverse local economic impacts. These conditions require the proponent to provide at least $20 million to implement a community and economic development program. This community and economic development program must include the development and implementation of a recreational tourism program as well as a series of programs targeted at supporting and encouraging the sustainable growth of the local economy, especially agricultural enterprises.

Other elements for assessment

Air: The EIS indicates that air emissions will result from Project construction activities. I have imposed requirements in regards to air quality,[18] and the proponent is required to implement mitigation measures as required. Where monitoring demonstrates the air quality criteria are being exceeded and all practical mitigation measures are being implemented, the proponent must implement a short term scaling back of operations. Greenhouse gas emissions for the Project are likely from construction energy consumption, indirect emissions, land use change and operational activities. I have required[19] that these emissions be offset in line with Kyoto-based accounting methods.

Noise and vibration: I have concluded that the adverse environmental impacts of noise and vibration arising from the Project can be suitably mitigated and managed. The target goals for noise and vibration presented in the EIS have been enhanced based on advice from relevant agencies. Furthermore, I have recommended that the proponent develop a strategy to engage broadly with the community with regards to noise, vibration and blasting issues.

Waste management: I have concluded that the three major issues related to waste impacts of the project were the availability of land fill, recycling of millable timber and burning of vegetative waste. I am

[17] Conditions 30, 31 and 32, Schedule C, Appendix 1
[18] Condition 17, Schedule C, Appendix 1
[19] Condition 18, Schedule C, Appendix 1

satisfied that all waste management issues can be suitably managed and have set conditions to ensure appropriate outcomes.[20]

Transport and access arrangements: I am satisfied that the Project will not lead to any significant impacts on the regional and local road network in terms of traffic capacity, road safety or pavement deterioration. The proponent is required[21] to maintain a functional road network through new roads, road upgrades and relocations, new bridges and individual property access. Traffic management plans must be prepared to minimise the disruption of works and the potential effects on safety, convenience and pavement condition.

Cultural heritage: The proponent has developed an Indigenous Land Use Agreement (ILUA), including indigenous cultural heritage as a component. The ILUA has been authorised by the native title parties and registered by the National Native Title Tribunal. For sites not covered by the ILUA I have required that an approved cultural heritage management plan be in place prior to activities that may cause harm to Aboriginal cultural heritage.[22]

No sites of non-indigenous cultural heritage within the Project Area are included on statutory registers maintained by State and Commonwealth agencies. However, a number of features that may hold general historic significance were identified within or adjacent to the Project Area. I have required additional field assessment and mitigation strategies to manage potential impacts on non-indigenous cultural heritage.[23]

Hazard and risk: A hazard identification and risk assessment was undertaken as part of the EIS to address the risks which may affect the environment, and the health and safety of the community. Dam safety, climate change, natural hazards and extreme weather conditions hazards amongst others were considered. The final design for, and construction and operation of, the Project will be in accordance with the relevant standards, including the *ANCOLD Guidelines and the Queensland Dam Safety Management Guidelines*[24] and that the response plans and actions be implemented in cooperation with the relevant agencies and authorities.[25]

Cumulative impacts: Based on the material before me, I have evaluated the potential cumulative impacts of the Project having regard to the potential risks and benefits that the Project will create, the mitigations and offset mesures and the conditions that I have imposed. I consider that on balance the potential cumulative impacts of the Project will be positive, particularly in consideration of the improved environmental and habitat outcomes that will be created. The social and economic impacts of the Project in regards to SEQ are strongly beneficial, but I recognise that while there are many positive local economic and social benefits that will result from the Project, the process of change and the resulting uncertainty has caused anxiety and distress to many local residents. However in view of the need for the Project and the mitigation and offset measures that have been imposed, I consider that overall, the cumulative impacts of the Project are positive and the adverse impacts are acceptable.

[20] Condition 27, Schedule C, Appendix 1
[21] Condition 20, Schedule C, Appendix 1
[22] Condition 25, Schedule C, Appendix 1
[23] Condition 26, Schedule C, Appendix 1
[24] See conditions for "Operational works that is the construction of a referable dam as defined in the *Water Supply (Safety and Reliability) Act 2008*" at Schedule A, Appendix 1
[25] Condition 29, Schedule C, Appendix 1

Conclusion

The Project is a key component of the Queensland Government's strategy to provide secure water supplies for SEQ. The Project will contribute to addressing the medium to long term water supply shortfall and in particular, provide a prudent increase in surface supply options as part of the overall diversified supply strategy.

The Project would complement other water supply related projects and demand management initiatives either completed (e.g. Cedar Grove Weir, Bromelton Offstream Storage, Tugun Desalination Plant), planned (e.g. Northern Pipeline Interconnector Stage 2), or underway (e.g. Wyaralong Dam).

In undertaking my evaluation of the EIS, I have considered the EIS, issues raised in submissions, the SREIS, the Commonwealth Reviewer Reports, the proponent's Response to Information Requests and Response to Commonwealth Reviewer Reports, and the advice I have received on a range of key issues from State agencies and DEWHA. In addition, I received a range of communications outside of the submission period from a number of community groups and individuals, which have been considered in my evaluation.

I am satisfied that the requirements of the SDPWO Act have been satisfactorily fulfilled, and that sufficient information has been provided to enable me to finalise the required evaluation of the potential impacts, attributable to the Project.

The various impacts, identified in both the EIS and the SREIS, are recognised. I consider that those impacts are acceptable having regard to the significance of the Project in terms of ensuring security of water supply for South East Queensland and the mitigation and offset measures that will be provided by the Project. Those mitigation and offset measures are considered particularly significant in terms of the provision of extensive and connected habitat in the context of an existing degraded environment within the Mary River catchment.

While I am mindful that the people of the Mary Valley are being asked to cope with substantial disruption to deliver water security for the SEQ region, I am satisfied that the requirements of my conditions, including the implementation of a community and economic development program including the implementation of a recreational tourism program as well as a series of programs targeted at supporting and encouraging the sustainable growth of the local economy, especially agricultural enterprises, will result in acceptable, and, over time, beneficial outcomes.

I recommend that the Project, as described in this Evaluation Report, proceed, subject to the conditions in Appendix 1, the updated commitments made by the proponent in the Response to Reviewer Reports, and my recommendations.

The conditions that are set out in Appendix 1 of this Evaluation Report include:

- conditions that must be imposed on development approvals for the Project (Schedule A)
- recommendations for other State approvals that will be required for the Project (Schedule B) and
- imposed conditions under the SDPWO Act, which are enforceable through that Act (Schedule C)

Although I have not been asked to evaluate the possible Traveston Crossing Dam Stage 2, I have reflected in a general way on the potential impacts of the possible Stage 2 on my required mitigations and offsets for this Project. I note that Stage 2 would significantly adversely impact on many of the mitigations I have imposed, making the achievement of the Stage 2 project more difficult. In light of my observations, I therefore recommend that the Government should reflect on the suitability of the potential Stage 2 project, that the strategy for long term water supply for SEQ should not rely upon Stage 2, and Government should consider alternative water supply measures to address identified long term water supply requirements.

This report will now be provided to the Commonwealth Minister for the Environment, Heritage and the Arts, pursuant to section 17(2) of the SDPWO Regulation and the Bilateral Agreement between the

State of Queensland and the Australian Government as the assessment report to enable a decision on approval of the controlled action for this Project pursuant to section 133 of the EPBC Act.

Following this Evaluation Report, the proponent will be required to obtain a number of State approvals, including for environmentally relevant activities, and interim resource operations licence and operational works approvals for clearing native vegetation and construction of a referable dam.

I would like to take this opportunity to thank all individuals, organisations and advisory agencies that have contributed to the EIS process by providing submissions on the Terms of Reference and the EIS. This input has contributed to the development of appropriate and reasonable conditions that are to apply to the Project to ensure best practice. I would particularly like to thank advisory agencies for their responses to my requests for advice and input, which has assisted in my evaluation of the EIS.

A copy of this report will be provided to the proponent and advisory agencies and will be made publicly available on the Department of Infrastructure and Planning website, at www.dip.qld.gov.au.

Colin Jensen
Coordinator-General

6 October 2009

1. Introduction

1.1. The proponent

The proponent for the Traveston Crossing Dam Project Stage 1 (the Project) is Queensland Water Infrastructure Pty Ltd (QWI). The Queensland Government established QWI in June 2006 as the entity responsible for developing specific new water infrastructure, including the Project, the Cedar Grove Weir, Bromelton Off-stream Storage and the Wyaralong Dam on the Logan River.

1.2. Project description

The Project, as proposed by the proponent is the design, construction, operation and maintenance of the Traveston Crossing Dam Stage 1 on the Mary River in South-East Queensland (SEQ).

Since the publication of the Environmental Impact Statement (EIS) and Supplementary Report to the EIS (SREIS), the proponent has advised me by letter dated 13 February 2009 that the relocation of the Bruce Highway, which was originally referred to as part of the Project in both the initial advice statement and the referral made under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act), will be progressed by the Queensland Department of Transport and Main Roads as a high priority independently of the Project.

By decision dated 10 February 2009, the delegate of the Commonwealth Minister for the Environment, Heritage and the Arts (Commonwealth Environment Minister) accepted the variation to the referral.

Construction of the Project therefore includes the following components:

- constructing a site access road
- relocating sections of local government roads and State controlled roads
- relocating local power and telecommunications infrastructure
- removing redundant infrastructure
- relocating private infrastructure required to support continued use of land not affected by the Project.

Operation of the Project involves management of land inundated at FSL and also additional land above this area comprising:

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

The Project is within the Gympie Regional Council (GRC) and Sunshine Coast Regional Council (SCRC) local government areas (LGA), and is located approximately 27 km upstream of Gympie in the Mary River catchment. The dam will inundate approximately 36.5 km upstream along the Mary River from the embankment at 207.6km AMTD. Figure 1, Appendix 2 shows the location of the Project and its components.

While the precise location of the dam wall may be subject to change with detailed site and geological investigations, the approximate location is at latitude 26°20'24"S and longitude 152°42'57"E. The Project Area, as described below, is contained within the coordinates Latitude 26°19'25" S to 26°34'20"S and longitude 152°37'30" to 152°50'00"E.

The dam would have a full supply level (FSL) of 71.0 metres (m) Australian Height Datum (AHD) and a reservoir area of 3,039 hectares (ha). At this FSL, the dam would have a storage capacity of approximately 152,429 megalitres (ML) and an average volume in storage of 127,000 ML.

The preliminary design consists of a Roller Compacted Concrete Dam (RCC dam) across the valley floor (the main dam) with an earth embankment section on the left abutment (embankment dam). A gated spillway on the right abutment has been adopted (spillway). The RCC wall length will be approximately 760 m with a height of up to 52 m. The embankment dam will have a maximum wall height of 18 m and wall length of 675 m. The preliminary design also includes a fishway, likely to be a combination lift lock arrangement, and a passage/ramp for other aquatic fauna including turtle species. Other associated dam works include the Coles Creek coffer dam and bypass.

The dam would operate in conjunction with releases from Borumba Dam. Borumba will service current licences, while the Project would meet the need for 70,000 ML per annum (ML/a) of high priority water.

The EIS has identified a "Project Area" which is also used interchangeably throughout the document with "Operational Area" and "Project Designation Area". The land included in the Project Area identified by the EIS totals about 7,000 ha (without the Bruce Highway realignment which is being undertaken separately), and includes:

- the operational area of the dam, including the dam wall, embankments, spillway, dam access road, associated infrastructure and facilities, and a buffer for this area, as well as the inundation, buffer and flood margin areas
- the construction site
- all other relocated roads and infrastructure.

The Project Area is shown in the map at Figure 2 in Appendix 2.

Preliminary site works

In section 2.1.1 of the SREIS, the proponent has described certain preliminary site works be conducted for mobilisation to site and to facilitate the timely construction of the Project.

<u>I have considered</u> the potential impacts of the proposed preliminary site works in my evaluation report and the preliminary site works that may be conducted as a result of my approval conditions.

These preliminary site works are subject to the relevant conditions in my evaluation report and securing necessary approvals.

Construction

The works to construct the Project include:

- construction of left abutment section (the embankment and saddle dam), roller compacted concrete section (the main dam) and conventional concrete spillway on the right abutment
- constructing fish transfer system (i.e. fishway) and turtle transfer device, and outlet arrangements to facilitate the release of environmental flows
- tree and shrub vegetation clearing to full supply level

- constructing a site access road
- relocating sections of local government roads and State controlled roads
- relocating local power and telecommunications infrastructure
- removing redundant infrastructure
- relocating private infrastructure required to support continued use of land not affected by the Project
- resource recovery
- decontamination of land within inundation area and buffer will be completed before dam closure
- construction of Coles Creek coffer dam and by-pass
- discharge channel tie-in
- transport of construction materials
- drawing construction water from Mary River
- construction of crib rooms, toilet and shower facilities in demountable buildings, site offices and construction camp for workers.

Operation

Operation of the Project includes:

- providing downstream flood mitigation benefits up to magnitude 1:100 annual exceedence probability (AEP) event
- managing extractions and releases
- minimising upstream impacts of flood
- safely passing flood flows such that the integrity of the dam is not compromised
- minimising environmental degradation in and around the storage and downstream
- meeting the requirements specified in the *Water Resource (Mary Basin) Plan 2006* including environmental flow requirements
- operating the dam in accordance with Australian National Committee on Large Dams (ANCOLD) and the Queensland Dam Safety Management Guidelines
- providing for effective operation of fish transfer system
- routinely inspecting the storage area to identify and manage issues that may arise
- managing dam safety and implementing maintenance program
- minimising community impacts in the areas around the storage and downstream.

Stage 2

The Project includes additional discrete works to accommodate the possible future delivery of Stage 2 (which would involve operation at a FSL of EL79.5 m AHD). The anticipated annual yield of Stage 2 would be 110,000 ML (including 70,000 ML from Stage 1) and a total capacity of 570,000 ML (including 152,429 Stage 1 capacity).

The associated infrastructure proposed to be relocated is infrastructure directly affected by Stage 1. However, as some of that infrastructure will also be impacted by the possible Stage 2, it is considered prudent to relocate that infrastructure in a manner which accommodates the possible Stage 2.

Where the marginal cost of relocating infrastructure, such as local roads, is prohibitive and does not justify present construction at the Stage 2 level, that infrastructure will be built at a level adequate only for Stage 1, and will become redundant and require replacement if Stage 2 proceeds.

The discrete dam works to be undertaken as part of the Project, which accommodate a possible Stage 2 development, include:

- construction of the RCC and embankment components of the dam wall with an increased base width
- construction of the dam crest height of the RCC and embankment sections 1 m above that which would otherwise be required for the Project
- construction of an embankment style saddle dam on the abutment allowing for the PMF for the possible Stage 2 with a volume of 2,800 m^3 (which saddle dam would not be needed for the Project alone)
- installation of vertical slot lift gates and guides of a strength which allows future installation of the larger gates
- construction strength of the water intake structure and fish transfer system to allow fitting of additional structure height at a later date.

For Stage 2 to proceed, significant further works would be required at that time, which will be subject to a separate environmental assessment if it is determined to proceed with Stage 2. The further physical works required for the possible Stage 2 include:

- extended spillway gates to be manufactured and installed
- construction and installation of a bulkhead gate extension
- additions to height of the fish transfer system and water off take to meet operational requirements
- clearing additional inundation area to Stage 2 FSL boundaries (approximate additional area of 4,096 ha in total)
- relocation of additional local roads (distance up to 30.28 km)
- relocation of part of the Mary Valley Heritage railway line (distance of 3.99 km).

1.3. Rationale for the Project

Numerous issues were raised in relation to the rationale for, and alternatives to, the Project. I have considered each of the submissions and how the SREIS has responded to the issues raised in submissions.

Key issues that I consider warrant particular elaboration and/or explanation in my evaluation included:

- How the need for the Project has been described and demonstrated
- The consistency of the Project with State and regional water supply planning policy and legislation
- The validity of demand management assumptions and their potential contribution to the demand/supply equation for SEQ
- Alternatives to surface water supplies inclusive of recycling, water tanks, stormwater harvesting and in particular, desalination
- Alternative surface water supplies, in particular, proposals to increase Borumba Dam, flood harvest from the Mary River, or flood harvest from the Somerset/Wivenhoe system, and operate a raised Borumba Dam, Somerset and Wivenhoe Dams though a series of interconnecting pipelines
- The methodology by which the costs and benefits were determined, and in particular, whether the analysis undertaken constitutes a full cost benefit analysis.

These matters are discussed further below in this and the following section of this Coordinator-General's Evaluation Report.

The need for the Project is described in sections 2.2 and 2.3 of the EIS. The EIS describes the Traveston Crossing Dam as being needed as part of a portfolio of projects to overcome a shortfall in the supply of water to SEQ.

The EIS confirms that the Project was initiated having regard to relevant national, state, regional and local planning and policy frameworks, including the:

- *National Water Initiative*
- *Water Act 2000*
- *Water Regulation 2002*
- *Water Resource (Mary Basin) Plan 2006*
- *Draft South East Queensland Water Supply Strategy*
- *Water for South East Queensland: A long term solution*
- *South East Queensland Regional Plan*
- *South East Queensland Infrastructure Plan and Program.*

The Project within the context of these frameworks is described in section 2.2 of the EIS, with specific emphasis given to the interrelationship of these policy frameworks. The EIS also highlights the basis of these policy frameworks, which are stated to be founded on the principles of sustainability, particularly those related to ecosystems, enterprises and communities.

Section 2.3 of the EIS sets out the need for the Project, giving consideration to the importance of the SEQ region to Queensland, demand for water in SEQ, existing supply sources within the region and the status of their contribution to supplies, the identification of a water supply/demand gap and the strategy to secure supplies for the region. In discussing the need for the Project within the EIS, the proponent indicated that it gave specific consideration to:

- The importance of the SEQ region, given that the gross regional product of around $100 billion represents approximately 60% of the gross State product, 11% of Australia's gross domestic product, accounts for 36% of the State's exports, and generates 67% and 70% of the State's employment in the manufacturing and service sectors respectively

- A projected annual population increase in the SEQ region of 50,000 to 60,000 people, with the SEQ population expected to range between 3.025 and 3.519 million people by 2016, increasing to between 5.08 and 6.243 million by 2051

- An estimated urban and industrial demand of 480,000 ML/annum in 2007 (without restrictions)

- The Queensland Water Commission's (QWC) published estimate of SEQ's existing available water supplies, which has been substantially reduced to 440,000 ML/annum in recent years. This reduced figure is derived after de-rating yields of existing supplies in response to the extended drought within the region, allowing for climate change, and adopting a new water planning approach based on 'level of service'. (This Level of Service (LOS) approach involves ensuring level 2 restrictions occur less than 2% of the time on an annual basis, restrictions to have a mean duration of 12 months with a maximum duration of 36 months, level 2 restrictions to achieve a demand reduction of 15% for no more than 3% of the time, with the provision for a contingency storage to allow implementation of drought projects)

- An estimate that an additional 210,000 ML/annum of additional prudent yield will be required by 2026, and 490,000 ML/annum required by 2051, based on the high population growth and high savings scenario

- The importance of achieving high savings, through the implementation of demand management programs, water efficiency management plans for businesses, rebate schemes to increase the penetration of water saving appliances, water tanks and other household water saving initiatives, and planning approval changes mandating water savings targets for new dwellings, as forecast demand is based on achieving high water savings

- The development of the *Water for SEQ: A long term solution* report, a key milestone in identifying the need for the additional water supplies. This report documented the current demand for water in SEQ, estimated future demand, documented current and expected future supplies within the region, and provided an analysis of the demand-supply gap and a discussion as to how best to bridge this gap, with the outcome of the analysis within the report being an integrated water demand and supply strategy, inclusive of the Project

- Recognising that Government is now implementing major initiatives by direction under the *Water Regulation 2002*, which collectively identifies the importance of demand reduction approaches, recycling to industry and for indirect potable reuse, water use efficiency measures, non-climate dependent forms of supply through desalination, and enhanced groundwater and surface water supplies

- Recognising that the measures being implemented under the *Water Regulation 2002* are expected to provide an additional prudent yield of approximately 261,000 ML/annum at 2012, which would bring the total prudent yield of supply sources to approximately 700 000 ML/annum

- Observing that the water supply initiatives to be implemented by 2012 (inclusive of the Project's 70,000 ML/annum yield) will place the available supply at approximately 50 000 ML/annum greater than the projected demand at 2026, noting that this is a government strategy to ensure that supply will be secure regardless of possible failure to meet demand management targets or being subject to more extreme than predicted climatic variations or climate change

- An observation that, if all committed and proposed water supply initiatives are implemented and demand savings targets achieved, there will be sufficient water to meet demand until 2051 under the medium series population growth projections, but insufficient to meet the high series population growth projections, concluding that on this basis, the targeted supply is not excessive

In consideration of the issues raised in submissions about the need for the Project, including responses to those issues detailed in the SREIS, and QWC's draft *South East Queensland Water Strategy, March*

2008, the *South East Queensland Regional Plan 2009-2031* and the *Wide Bay Burnett Regional Plan 2007-2026*, I note that:

- Updated population projections from the then Planning Information and Forecasting Unit, Department of Infrastructure & Planning, confirm the EIS/SREIS assumptions of ongoing rapid population growth for the SEQ region. Queensland's Future Population, 2008 Edition estimates that by 2016 the population of SEQ will range between 3.364 and 3.525 million people, an increase of 0.339 and 0.006 million respectively from the medium and high series estimates used in the EIS

- SEQ now accounts for approximately 66 percent of Queensland's total population

- As the fastest growing metropolitan region in Australia, SEQ's economic significance to the State includes generating 62 percent of Queensland's Gross State Product, 70 percent of manufacturing turnover and 68 percent of Queensland's employment

- The Queensland Government's strategy to address and manage population growth is through the implementation of the *South East Queensland Regional Plan (SEQRP) 2009-2031*. The SEQRP 2009-2031 and State planning regulatory provisions refines and modifies the strategic directions, principles and policies of the SEQ Regional Plan 2005, to respond to emerging issues. Population projections have been extended to 2031 and the implications for accommodating growth in SEQ have been examined and addressed

- SEQRP 2009-2031 identifies 12 regional policies, and sets out the desired regional outcomes, principles and policies to address growth management issues

- Policy 11 of the SEQRP 2009-2031 directly responds to water management issues in the region, with a key outcome being a requirement to provide assured supplies of water to meet the reasonable needs of growth and development in the region. Programs within Policy 11 include the delivery of the SEQ Water Grid in accordance with the *Water Regulation 2002* and the finalisation of the Strategy and updating and implementing the Regional Water Security Program.

- The SEQRP 2009-2031 involved a public consultation process, where issues raised included that planning should be based on a preferred population rather than a projected population, and be based on the concept of sustainable population carrying capacity. The consultation report for the SEQRP 2009-2031 stated that:

  "*The regional plan is based on managing, not controlling, regional growth, as there are no legislative mechanisms to implement a carrying capacity or restrict growth in the region*".

- The *Wide Bay Burnett Regional Plan 2007-2026* sets policy actions in relation to the health of the region's economy. Those policy actions include, subject to approvals, developing the Project to assist in meeting the water supply needs of South East Queensland, and maximise the medium to long term opportunities for the associated communities. In relation to the principle of regional water supply, the policy actions include major regional water infrastructure developments, including the Project and the raising of Borumba Dam, as integral components of the SEQ water grid.

- The QWC's water supply strategy development process, involving consideration of various planning reports developed over a period of some 17 years, culminated in the March 2008 release of the draft South East Queensland Water Strategy (Strategy), with the QWC now considering the outcomes of a consultation process on the strategy which occurred from April 2008 to end July 2008

- QWC's Strategy sets out the next significant stage in regional water planning, designed to meet the region's water supply needs for the next 50 years, with the basis of the Strategy being the provision of a plan to prevent the development of any gap between supply and demand in the face of certain population growth and probable climate change/variability impacts

- QWC's Strategy is built around a diversified and integrated approach (portfolio of supply and demand measures) to manage supply risks, with the strategy approach including demand management, surface water augmentation, desalination, purified recycled water and interconnection of geographically and climatically diverse water supply sources

- The Strategy identifies that surface water sources form an integral part of a balanced approach to satisfying the future supply requirements of SEQ, set to balance competing objectives of supply security and cost to the community

- The Strategy is based on a forecast demand of 230L/person/day, which effectively relies on a permanent reduction of water consumption of about 24 percent per capita, compared to consumption levels before the so-called "Millennium Drought" of recent years

- Economic assessments undertaken as part of QWC's Strategy focused on the economic benefit of deferring supply augmentations. From this analysis, a group of demand management measures were identified that QWC determined clearly demonstrated value and were cost effective when compared against the long-run marginal cost of supply. It is noted that the QWC included these measures in all portfolios

- QWC's new planning approach expressed as a series of LOS objectives, to ensure that medium level restrictions need not occur more than once every 25 years on average; will last no longer than six months no more than once every 50 years on average; only achieve a targeted reduction in consumption of 15 percent below the total consumption volume in normal operations

- In March 2008, QWC de-rated existing dam and weir reliable yields in the region to 416,000 ML/a, which is substantially less than previously assumed (e.g. at the time of the EIS as described above). When a medium level climate change scenario impact is considered, dam and weir reliable yields under a LOS approach are further reduced to 374,000 ML/a

- By 2012, the combined benefit of committed infrastructure projects, including the Project, as well as interconnecting bulk supply elements of the system will increase the LOS system yield to approximately 684,000 ML/a (without an allowance for climate change), reducing to 631,000 ML/a under the climate change scenario considered by the QWC

- QWC forecast that demand would increase to approximately 722,000 ML/a at 2026 (with no demand management), based on pre-drought consumption and medium series population growth. Under this scenario, demand would exceed LOS system yield of existing and committed sources of supply (including the Project) by about 38,000 ML/a. When taking potential climate change effects into account, the potential demand/supply gap extends to 91,000 ML/a

- Under a scenario of high demand management and medium series population growth, QWC estimate that demand at 2026 will approximate 567,000 ML/a, demonstrating the importance of achieving a successful demand management program to ensure available supplies stay ahead of demand.

There was considerable conjecture within submissions on the EIS about the potential for water demand management to potentially provide a greater contribution to SEQ supplies, therefore reducing the requirement to secure new sources of supply. In particular, the Institute of Sustainable Futures (ISF)/Cardno report *Review of Water Supply-Demand Options for South East Queensland, 2007* (Turner et. al, 2007) proposed an alternative strategy for achieving water balance that was considerably different in analytical approach and demand-supply options to that adopted by the QWC.

In order to consider the alternative strategy presented by Turner et. al, the QWC commissioned Marsden Jacobs and Associates (MJA)[26] to conduct a full and detailed analysis of the options presented in Turner et al. report.

The MJA analysis, *Evaluation of ISF/Cardno Report: Review of Water Supply-Demand Options for SEQ*, concluded that the options presented were overly dependent on unproven and unacceptably high risk demand management strategies, with MJA concluding that water savings presented by Turner et al. are

[26] The MJA analysis is available on the Queensland Water Commission Website at: http://www.qwc.qld.gov.au

based on unrealistic penetration rates for key demand management options and contain significant errors in the demand projections adopted in the report, leading to an adaptive management strategy that is extremely high risk for the SEQ population.

In other words, it could be considered that the proposed alternative water supply-demand option presented by Turner et al. contains a risk profile which the QWC considers to be considerably greater than the water supply-demand portfolio developed by the QWC, increasing the risk of not being able to meet essential water demands for the region's population. It is noted that if the targeted residential consumption of 230L/person/day (as relied upon by QWC in their Strategy) is achieved and maintained indefinitely through demand management initiatives, this would put SEQ well ahead of other major cities in Australia, including Sydney, Melbourne, Adelaide and Perth, in terms of demand management.

In summary, I accept the QWC's assessment that additional water supply sources for SEQ are justified because:

- The supply shortfall is real and significant even after a prudent allowance for the implementation of demand management strategies
- Given the significance of the SEQ region, the impact of not addressing the identified supply shortfall would be socially and economically unacceptable, eliminating the do-nothing option
- There is no available or generally acceptable legislative mechanism to achieve the restriction of population growth in the region
- It is appropriate to develop a strategically based risk management response which includes development of new supply sources to accommodate uncertainties relating to population projections, demand management outcomes, community acceptance of non-standard water supply sources and possible increases in extremes of climate change and climate variability.

In reaching a view that additional water supply sources are justified as set out above, it is then appropriate to consider the available alternatives to provide the required additional sources as discussed below.

1.4. Alternatives

The EIS examined additional water supply options in two parts. First, the alternatives to additional surface water supply were considered; and second, the alternative locations of surface water supply options were examined.

Alternatives to the Project were examined in the EIS and were excluded on the basis of providing insufficient volume or providing an unacceptable change to the planned level of diversification of the water supply mix, which would significantly change the risk/cost profile of the Strategy.

The EIS identified shortcomings with proposed alternatives to the Project in bridging the water supply gap as follows:

- **Recycling** – the current Government strategy includes a new network of advanced recycled water plants to utilise the largest sources of available recyclable water to supplement supplies. This strategy comprises a significant investment which will result in the third largest recycled water scheme in the world. In order to be able to recycle, there must always be an original source of supply, as recycling is subject to high process losses of up to 20 percent.

  These losses are significant, especially in an extended drought period when the volume of effluent supply to recycling plants is reduced. Additional recycling from smaller, less opportune sources is relatively more expensive in terms of energy consumption and greenhouse gas emissions because of associated treatment and pumping costs.

- **Groundwater** - the bulk of groundwater in SEQ is mostly contained in the sand mass areas, either on islands or in localised onshore areas. Most of these are in national parks and border marine parks and/or Ramsar wetlands or, in the case of the Cooloola sand mass, a World Heritage Area (Fraser Island). The environmental impacts are currently acknowledged as potentially significant and there is a great deal of uncertainty in the potential yield of these aquifers, particularly given the current extended period of drought.

- **Demand Management** – Water demand is projected to grow at a slower rate than SEQ's population, due to significant savings per capita usage that are expected given the Government's programs and initiatives for demand management. Over the planning horizon until 2051, population is forecast to grow by 92 percent, while water demand is forecast to grow by 63 percent (high water savings/medium population growth), illustrating the benefit of the demand management programs.

  QWC's target residential consumption of 230 L/person/day by 2020 (without water restrictions), if consistently achieved, would put SEQ significantly ahead of other major cities in Australia, including Sydney, Melbourne, Adelaide and Perth, in terms of demand management. The current forecasting of demand by the QWC is based on a high savings scenario and it is considered any further savings from this scenario may prove unrealistic in the longer term.

- **Rainwater Tanks** - a significant contribution from rainwater tanks has already been included in the Government's strategy and the calculations of required supply. It is not practical to consider any more substantial contribution from rainwater tanks due to the relatively high cost per megalitre, limitations on use of the water and the inevitable need for a reticulated supply to provide the resource security that the small tanks in urban areas cannot provide.

  Specific limitations of rainwater tanks include tank efficiency based on size and roof catchment area, whether rainwater tanks are connected to internal appliances, cost of installation and maintenance, and use of high amounts of energy to move relatively small amounts of water.

- **Desalination** - the current government strategy has recently delivered a desalination plant at Tugun providing 125 ML/day. This is a significant contribution and along with demand management and recycling initiatives adds a major, relatively climate independent component to the supply portfolio. The desalination plant as initially proposed by the Gold Coast City Council was to provide only 55 ML/day. The State Government contributed additional funding to the project to increase the output of the plant as part of the Government's drought response.

  The EIS contends that desalination technology is currently expensive, energy intensive, requires placement in close proximity to good quality oceanic water, is maintenance intensive, and requires replacement of major components every 20 to 30 years.

  Further, the EIS contends that desalination plants may not provide ancillary benefits to the community in which it is located, such as recreational and tourism development activities associated with the dam impoundment and surrounds.

In examining the alternative surface water supply options to service the SEQ region, the EIS considered:

- **Mary River to Borumba Dam water harvesting scheme** – this scheme involved the consideration of a proposal for the raising of Borumba Dam, construction of a weir on the Mary River (close to the junction with Coles Creek just upstream from the Traveston Crossing site) and installation of pumping infrastructure and an interconnecting pipe network between the weir and a raised Borumba Dam, in order to harvest water from the Mary River to satisfy the supply requirement of 70 000 ML/a.

  Analysis conducted as part of the EIS discounted this option on the basis that the proposed Mary River water harvesting scheme had a significantly high hydrological failure rate – 51 failures out of 109 climatic sequences modelled, with a potential capital cost in the order of $3.1 billion and an operational cost in the order of $19 million per annum.

- **Other dam sites in SEQ**- EIS investigations, which were informed by reports from the QWC and the then Department of Natural Resources and Water, determined that of the river systems within SEQ available for further water resource development, the Logan and Mary River systems were likely to present opportunities for the construction of additional water storages that could make appreciable contributions to meeting the need for water within the region.

Statutory water resource planning undertaken in these systems, conducted in accordance with the *Water Act 2000*, identified available reserves of 50,000 ML/a for the Logan catchment and 150,000 ML/a for the Mary catchment. Given that a proposal to develop water infrastructure in the Logan catchment was being progressed at the time of the development of the EIS , and it was considered strategically important to consider geographically distributing surface water supply opportunities, an analysis of other potential dam sites within the Mary River catchment was conducted. It is noted that the construction and operation of the Wyaralong Dam on the Teviot Brook in the Logan River catchment has since been granted both State and Commonwealth approval.

The EIS determined that of the options considered, both the Traveston Crossing site and a dam at Cambroon at a location upstream of the Traveston Crossing site on the Mary River would be able to provide, on a stand-alone basis, the targeted 70,000 ML/a. However, the EIS identified that extracting 70,000 ML/a at Cambroon would place this site at its upper hydrological limit, require the flooding of the township of Conondale, and put at risk an area of important terrestrial habitat.

Therefore, to assess comparable alternatives to Traveston, a combination of smaller dams was proposed for consideration, with those smaller dams comprising: raising Borumba Dam to operate in concert with a weir on the Mary River at Coles Crossing; Amamoor Dam on Amamoor Creek; Kidaman Dam on Obi Obi Creek; and a small dam at Cambroon.

To consider the possible impacts of alternative dam sites within the Mary River catchment, the EIS referred to an environmental assessment of the Mary and Logan/Albert Rivers catchments water infrastructure projects conducted by Brizga *et al.* (2007). The EIS commented that the assessment by Brizga *et al.* only considered Traveston Crossing Dam at its greatest level of impact (i.e. Stage 2), resulting in overstatement of impacts in comparison to that experienced by the Project at Stage 1 as currently proposed.

In summary, the two scenarios assessed by Brizga *et al.* in the Mary River catchment were:

- Traveston Crossing Dam (Stage 2 rather than Stage 1)
- four dams – Kidaman Dam, Amamoor Dam, Cambroon Dam and raising of Borumba Dam plus Coles Crossing Weir.

The conclusions of Brizga et al. were noted within the EIS at section 2.3.4, with comments noting significant changes as a result of comparing the proposed Stage 1 as opposed to a Stage 2 development. The more significant comparative conclusions are noted as follows:

- the four dams would affect a larger number of “Of Concern” regional ecosystems (REs) because of their wider geographical spread
- the four dams scenario would affect a greater number of flora and fauna species of conservation significance
- two of the four dams would disrupt State wildlife corridors at the subcatchment scale (one quarter of Kidaman Dam’s inundation area was wildlife corridor and the additional inundation of Borumba Dam would bisect a corridor) but Traveston Crossing Dam would not, although it would affect landscape connectivity between headwaters and lowlands
- while both scenarios would affect the EPBC Act listed stream-dependent fauna species, the Kidaman and Amamoor sites would impact known natural breeding strongholds for the Mary River Cod and Queensland Lungfish

- Traveston Crossing Dam and Coles Crossing Weir may potentially have greater impacts on the Mary River Turtle if the majority of the population exists downstream of Yabba Creek as is thought to be the case

- the four dams scenario would cause greater lengths of river/stream channel to be affected by major flow regime change and other downstream effects of dams. Given the higher prudent take, Traveston Crossing Dam would have only slightly greater impacts on freshwater inflows to the Mary River estuary and the authors predicted that neither scenario would have impacts in the estuary or Great Sandy Straits or cause a shift in the overall condition rating of those areas

- any option intended to be operated in conjunction with Coles Creek Weir (all except Amamoor Dam and Traveston Crossing Dam) caused significant impacts on fish (and turtle) movement through the imposition of multiple barriers.

From this analysis, the EIS concluded that the Kidaman site is of very high ecological value, and as such, would be excluded from further consideration on ecological reasons alone.

Further consideration was then given to comparing the Traveston Crossing Dam option against the Cambroon Dam and raising Borumba Dam plus Coles Crossing Weir options, as they all provide a similar yield at around the targeted volume of 70,000 ML/a.

From an ecological perspective, at their stage 1 levels, the EIS noted that the Cambroon/Borumba/Coles Crossing option floods significantly more of the Mary River and places two new significant barriers in the river rather than one, increasing barrier risks for EPBC listed aquatic species.

It was also noted that the Cambroon site has greater potential to impact on “of concern” REs and on listed threatened species including:

- Coxen’s fig parrot

- Eastern bristlebird

- Fleay’s barred frog

- Southern gastric brooding frog

- Southern day frog

In terms of social impact, the EIS noted Brizga’s observation that overall, the footprint of Traveston Crossing Dam will have a greater social impact, unless Conondale were inundated by the raising of Cambroon Dam.

The major difference identified between the two scenarios was the flood mitigation benefit offered by Traveston Crossing Dam. It was stated that Traveston Crossing Dam is the only storage historically proposed for the Mary River catchment with the potential to have significant flood mitigation benefits for Gympie and downstream.

In summary, the Cambroon/Borumba/Coles Crossing option was discounted from further analysis as the proposed combination of dams flooded significantly more stream-length and would not provide an additional flood mitigation benefit for communities downstream of the dams, and in particular, for the Gympie community.

- **Dams in northern New South Wales (NSW)** - Storage and distribution schemes from the northern NSW rivers were investigated by the EIS at section 2.4.2.3, as the National Water Commission considered that all options to meet the need to augment water supplies in SEQ and north east NSW should be evaluated. The Commission engaged SMEC to identify, by desk-top study, the potential for additional sustainable extraction in north east NSW. It is instructive to note that the NSW Government declined to participate, citing the view that sustainable levels of extraction could not be achieved.

Analysis undertaken as part of the EIS on proposed storage and distribution schemes from northern NSW rivers included a closer inspection of dam and pipeline routes. This sought to provide a significantly greater understanding of the terrain and resultant design requirements, to build on existing investigations and ensure that comparisons between options were on the same basis, such as prudent or reliable take rather than average yield, and costs including all ancillary costs (e.g. water treatment facilities). The EIS also indicated that desktop environmental assessments were conducted (JWP, 2007b), as these had also not been undertaken originally by the National Water Commission.

On the basis of investigations undertaken, the yield of all NSW options would be significantly reduced from the National Water Commission estimates. It was also noted that operating costs for delivering water to SEQ would be substantial because of the distance involved, the need to cross the McPherson Range and the need to treat the water because of the inter-basin transfer involved.

The EIS determined that if assessed through the draft South East Queensland Water Supply Strategy process as all Queensland options were, two Northern New South Wales options would not have progressed through the first stage on cost or yield grounds and the remaining option would have been discarded from further consideration on environmental grounds (flooding National Park, a large area of old growth forest and potentially a large number of rare and threatened species).

The EIS found that none of the northern NSW options evaluated provided prudent alternatives to the Project within an acceptable timeframe.

A large number of submissions raised numerous issues associated with how alternatives to the project have been addressed by the EIS. I have considered each of the submissions and how the SREIS has responded to the issues raised in submissions.

Key issues that I considered warranted particular elaboration and/or explanation in my evaluation included:

- Stormwater harvesting as a viable alternative to surface water supplies
- Desalination as a viable alternative to surface water supplies
- A proposal to increase Borumba Dam, flood harvest from the Mary River and Somerset/Wivenhoe system, and operate a raised Borumba Dam, Somerset and Wivenhoe Dams though a series of interconnecting pipelines as an alternative surface water supply
- The methodology by which the costs and benefits of the project were determined, and in particular, whether the analysis undertaken with the EIS constitutes a full cost- benefit analysis.

These matters are discussed further below.

- **Stormwater Harvesting** - To consider the potential contribution of urban stormwater harvesting to urban supplies, QWI commissioned Connell Wagner to undertake a literature review of potential opportunities and limitations of urban stormwater harvesting. The *Review of Urban Stormwater Harvesting* (Connell Wagner 2008) is detailed at Appendix C4 of the SREIS.

  In summary, the literature review found that stormwater harvesting and reuse opportunities may be more readily accommodated within new urban developments, with the potential to reduce water demands in new developments by 40 to 80 percent when coupled with water recycling and use of rainwater tanks. However, the review found that retrofitting stormwater harvesting within the existing urban environments becomes more challenging, when considering land required for storage/treatment/distribution. Further, opportunities for stormwater harvesting within existing urban environments must be balanced against the competing interest of removal of stormwater to manage public health and safety and control or prevent local flooding during short but intense rainfall events.

The literature review concluded, and I concur, that the role of urban stormwater harvesting within the context of water supply in SEQ is not as an alternative to surface water and groundwater supplies, but rather to reduce the demand on these traditional sources of supply in new urban developments.

- **Desalination** – Considerable attention in a large number of submissions on the EIS was given to recommending desalination as a viable alternative to the Project.

  Submitters to the EIS proposed that a desalination plant sized to provide an equivalent volume of water to the proposed Traveston Crossing Dam warrants closer consideration as a viable alternative water source. They strongly contended that a desalination alternative would result in a lower adverse ecological and social impact footprint and could be delivered at a lower cost than the proposed Traveston Crossing Dam.

  It is possible to conclude from these submissions to the EIS that a desalination plant may have a lower impact footprint than a dam, on the basis of factors such as:

  - The physical footprint of a desalination plant is likely to be smaller than that of a dam where equivalent volumes of water are to be delivered at specific levels of reliability, with potentially less ecological/social impacts
  - The number of unknowns or level of uncertainty about ecological impacts, particularly at the pre-feasibility stage, is likely to be greater for a dam than a desalination plant
  - Flexibility in locating possible dams is, by nature, likely to be less than that for a desalination plant
  - Water supplied from desalination plants can be considered ‘climate independent’.

  These points must, however, be considered against:

  - The possibility that delivered water costs to the serviced community may be greater for water provided from a desalination plant, imposing an increased economic burden on the serviced community
  - Increasing the composition of water sourced from desalination will reduce the community’s water supply risk, however the economic costs of the additional risk reduction may outweigh the benefit
  - The quantum of ecological impact footprint is likely to be very site specific
  - Ongoing monitoring will be required to better understand the longer term impacts of desalination plants on sensitive marine areas off the east coast of Australia
  - Energy requirements for desalination for each delivered unit of water is likely to be orders of magnitude greater than that provided from a dam, with resultant higher levels of production of greenhouse gas emissions
  - It is possible that, within decades, all new water supplies will have to be met through desalination as all other supply options are exhausted (i.e. desalination will make up an increasing proportion of total supplies)
  - Dam technology is well established and proven, whereas desalination, in relative terms, could be considered new technology with significant scope for improvement (and resulting cost reduction) over time (i.e. the longer implementation of desalination is deferred the more efficient and less expensive it may become).

The specific ecological, social and economic impacts of the Project are considered in detail elsewhere in this Evaluation Report and particular comment will not be made in this section. However, comments are provided below on the potential ecological impacts of a desalination plant located somewhere on the Sunshine Coast, Queensland, based on the findings of analysis conducted for the Gold Coast (Tugun) Desalination Project (Gold Coast (Tugun) Desalination Project Material Change of Use Application – ERA 7, 16, 19). The Sunshine Coast has been selected on the basis of the QWC's assessment of potential suitable sites within SEQ. To summarise this assessment, sites south of the Sunshine Coast are unsuitable given the lack of non-residential areas adjacent to non-sensitive marine environments (QWC, draft SEQ Water Strategy, March 2008, section 5.4.3).

Specific consideration is also given below to key themes arising in submissions, including concerns that an analysis of the energy requirements and cost of transporting water to Brisbane from the Project had not been suitably assessed relative to a desalination plant located closer to Brisbane. Such a plant was considered by some submitters to have lower energy requirements for distribution, with the ability for carbon impacts being offset by supplying a desalination alternative with green power.

Desalination – Ecological Impacts

A series of environmental studies (Gold Coast (Tugun) Desalination Project Material Change of Use Application – ERA 7, 16, 19) were conducted in 2006 for the Gold Coast (Tugun) Desalination Project. These investigations focused on what could be considered standard areas of interest, such as Acid Sulfate Soils, affected communities, air quality, contaminated land, cultural heritage, land use, noise, terrestrial ecology, vegetation management and visual amenity.

Of particular interest for desalination projects are the potential impacts of brine dispersion on water quality, marine ecology, fisheries and species or communities of conservation significance within the marine environment.

To understand the potential impacts of brine (waste) dispersion from a desalination plant, consideration must be given to the marine environment to which the discharge is to be made.

In generic terms, for the south-east of Queensland, analysis conducted for the Gold Coast (Tugun) Desalination Project found that large-scale circulation in the area is driven by the East Australian Current (EAC). In offshore waters of depths greater than about 30 m the EAC flows to the southeast along the coast at speeds of up to 2 knots, but in the shallower embayments, the EACs influence is to set up eddy-like circulation cells that result in a predominantly north-westerly flow.

Localised, shallow-water circulation in embayments is however, dominated by coastal processes, namely coastal trapped waves and to a lesser extent breaking internal waves. These processes modify the larger-scale residual northward flow so that the currents periodically reverse and flow to the southeast on time scales of days to weeks. It should be noted that work conducted for the Gold Coast Desalination Project only considered relatively 'open water' situations, therefore any findings are not likely to correlate to desalination sites within or adjacent to major bays, such as Moreton Bay, or channels such as Pumicestone Passage adjacent to Bribie Island.

The impingement of waves and surf at an angle to the coastline generates longshore currents, also known as littoral drift, which transport sediment along the coast. Since the predominant wave direction on the Eastern Seaboard of Australia is from the southeast, the resultant littoral drift flows to the northwest.

For the Gold Coast Desalination Project, it was observed that most of the littoral transport occurs in depths shallower than 7m (i.e. less than about 300m from shore) and 90% in depths less than 15 m (<900 m of shore), with littoral drift at the depths of the intake/outlet for the Gold Coast plant (a distance of 1,500 m offshore) negligible. The potential interaction of littoral drift at possible desalination sites on the Sunshine Coast would require specific site analysis to determine applicability.

Potential impacts to water quality and marine ecology from the discharge of brine relate primarily to:

- Increase in salinity
- Decrease in dissolved oxygen (DO)
- Potential for introduction or increase in heavy metals.

These potential impacts are most pertinent to the benthic habitat, as at certain concentrations, these could result in:

- Toxicity to benthic fauna from salinity
- Suffocation of in-fauna, due to a decrease in DO
- Changes to fauna abundance, diversity and community composition where tolerant species dominate sensitive species
- Release of sediment-bound metals to the water column
- Release of nutrients to the water column, which could stimulate plant growth.

DO is critical to sediment biogeochemical processes and the respiratory processes of aquatic fauna.

Different benthic in-fauna have different tolerances to low DO levels. Should low DO levels occur, the following impacts could result:

- Reduced diversity of taxa present due to the dominance of low DO tolerant and / or hypersaline tolerant organisms
- Modification of benthic community structure.

Analysis for the Gold Coast Desalination Plant indicated that reverse osmosis processes result in the concentration of ions, which in most desalination plants around the world, are retained in the brine concentrate and returned to the marine environment. These ions include metals that occur naturally in seawater and are not toxic to fauna at background levels or below levels of environmental concern. Further, residual iron from the addition of ferric sulphate as a coagulant in the pre-filtration process may occur in the brine discharge, contributing less than 70 kg/day to the marine environment as $Fe(OH)_3$. It could be interpreted that over time, concentrations of metals retained in the brine concentrate and dispersed to the marine environment could increase metal accumulation to levels above those found in the receiving environment.

The potential for accumulation in the receiving environment was recognised, and as a result, a large proportion of metals taken into the Gold Coast Desalination Plant in seawater will be retained in sludges for land-based disposal and not returned to the marine environment. It is noted that this is a significant improvement in plant operational design compared with other plants around the world but requires suitable land to be available.

Another potential marine impact involves the possibility of entrainment/impingement of marine life on the desalination intake structures. For the Gold Coast (Tugun) Desalination Plant, the intake was designed to minimise the potential for marine life entrainment and impingement at the intake screens by sizing to achieve low approach water velocities at around 0.05m/s, generally less than ambient sea currents in the area.

Analysis for the desalination project also concluded that marine mammals (whales, dolphins or dugong) are unlikely to be impacted by the construction of the intake or outlet risers or the release of brine discharge, as these fauna are large and very mobile and can actively avoid areas of disturbance.

In conclusion, the assessment of potential impacts on water quality and marine ecology relating to the operation of the Gold Coast (Tugun) Desalination Project relate primarily to the release of brine discharge that is about 1.9 times the concentration of seawater (for salts and trace elements) and has slightly decreased oxygen levels. The impact on the receiving water from brine discharge was determined to be relatively minor, primarily due to the 40 - 71 times dilution that would occur through the mixing effects of the outlet diffusers.

Other key considerations of note were for the local benthic communities, where there may be the possible (although unlikely) establishment of stratification above the substrate due to salinity differences between the brine plume and overlying water. This could lead to oxygen depletion, organism intolerance to increased salinity concentrations, release of metals and nutrients and changes to benthic community structure. This uncertainty resulted in the requirement for implementation of a regular monitoring program to maintain records on any changes to the marine environment – both water quality and ecological biodata.

In summary, it could be concluded from the marine environment perspective, that the location of the desalination plant's inlet/outlet infrastructure is critical to minimising impacts on the local marine environment. Further, it could be concluded that, subject to monitoring, marine impacts are likely to be localised and minor in nature. This is informative, as the possible location of a desalination plant will be governed by considerations of impacts relating to increases in salinity, decreases in DO, and potential increases in metal concentrations. This would indicate that, as a minimum, fish habitat areas, or areas providing significant ecosystem benefits, such as seagrass meadows, should be avoided. Coupled with land based considerations informed by analysis of standard environmental areas of interest, it is possible to conclude that potential desalination sites on the Sunshine Coast may be limited.

This limitation has been recognised in the QWC's Strategy, where a total of 6 future potential desalination sites have been identified for further investigation, with 3 on the Sunshine Coast.

The Queensland Water Commission (QWC) have undertaken preliminary assessments as part of the second phase investigations for possible sites for future desalination plants in South East Queensland (SEQ).

Sites under consideration were identified in the first phase of the studies completed in early 2007 and included in the Strategy.

Through consultation on the Strategy and as part of the Phase 2 studies a further three possible sites were identified, being two sites at the mouth of the Brisbane River, on land that is controlled by the Port of Brisbane Corporation and Brisbane Airport Corporation and a potential expansion to the existing Gold Coast Desalination Facility at Tugun on the Gold Coast.

The interim findings of the study have formed the basis of the preliminary categorisation of sites as 'priority', 'reserve' or 'excluded', further the study confirms that potential desalination sites in SEQ are limited.

Category	Site	Owner
‘Priority’	Lytton site	Minister for Industrial Development
	Either Marcoola site or Bribie Island site	Sunshine Coast Regional Council State of Queensland
‘Reserve’	Expansion of Gold Coast Desalination Plant	Gold Coast City Council/State of Queensland
	North Stradbroke Island site	State of Queensland
	Port of Brisbane site and/ or Brisbane Airport site	Port of Brisbane Corporation Limited Commonwealth of Australia
	Either Marcoola site or Bribie Island site	Sunshine Coast Regional Council State of Queensland
‘Excluded’	South Stradbroke Island site	State of Queensland
	Kawana site	Sunshine Coast Regional Council

Desalination – Energy use and cost

The QWC, in early 2008, commissioned Kellogg Brown & Root Pty Ltd to consider the energy consumption implications for the operation of the SEQ Water Grid.

Pertinent comments, assumptions and findings from the *South East Queensland Regional Water Supply Strategy, Energy Consumption Discussion Paper*, Kellogg Brown & Root Pty Ltd (April 2008), can be summarised as follows:

- A range of sources can be optimised to reduce operational energy demands while maintaining a level of supply risk that is acceptable to the community as defined by level of service.
- The analysis only considered future operational energy requirements within SEQ Water Grid of both demand and supply measures directed in the *Water Amendment Regulation (No.6) 2006*, and did not consider energy embodied in the manufacture/ construction of these new projects.
- Section 5 of KBR report deals with supply-side energy, which identifies that prior to the implementation of the water grid, water has been sourced from low-energy sources. The introduction of climate resilient sources, such as desalination and purified recycled water, as well as the interconnection of water supplies over large distances, will lead to a likely increase in energy demands of the water supply sector in SEQ through the utilisation of water grid assets.
- New water sources all have different operational energy requirements and different water outputs. The basis for comparison is energy efficiency provided per ML.
- Data on the energy consumption of the SEQ Desalination Facility (Tugun) was sourced from the Gold Coast Desalination Alliance, with the desalination plant requiring an estimated energy demand of 5.1 MWh/ML at full production.
- Calculations, based on first principles, were used to derive the generic pumping energy consumption, with an estimate for distribution of water over a distance of 100km used for comparative purposes.
- For new dams, including Traveston Crossing Dam, assessment of energy demand has been estimated on the basis of water treatment plants and pumping energy estimates for water delivered to Brisbane.

The KBR report estimated that the Gold Coast (Tugun) Desalination plant would have a maximum 6.7 MWh/ML of energy consumption, when manufacture and delivery of water over 100 kilometres were considered , whereas Traveston Crossing Dam was estimated as having a maximum 2.36 MWh/ML of energy consumption when treatment and transport over 100 kilometres is accounted for.

The KBR report concludes that the range of SEQ water grid bulk water sources can be optimised to reduce operational energy demands while maintaining a level of supply risk acceptable to the community. Further, large reductions in energy demands may be possible through optimising the use of energy efficient sources, such as dams, subject to meeting level of service (LOS) supply criteria.

To consider the implications for energy costs associated with the operation of a desalination plant verses the proposed Traveston Crossing Dam, QWI commissioned EnergyEdge to provide an analysis of estimated energy expenses for the proposed Traveston Crossing Dam and alternative desalination plants, sited at Marcoola, Bribie Island or Kawana on the Sunshine Coast of Queensland.

This analysis is detailed in the SREIS at Appendix C19, *Comparative Cost of Energy: Traveston Dam and Sunshine Coast Desalinator*, EnergyEdge (April 2008). Pertinent comments, assumptions and findings can be summarised as follows:

- EnergyEdge's analysis considers energy input costs that include energy purchase, transmission and distribution costs and any mandated environmental schemes, with alternative pricing provided between commercially available least-cost energy and sourcing of full green energy. The analysis also considered three scenarios to account for the possible future cost of carbon, with those scenarios being $10/tonne, $30/tonne and $60/tonne.

- The underlying assumptions for comparative purposes included sourcing energy consumption estimates from the *South East Queensland Regional Water Supply Strategy, Energy Consumption Discussion Paper*, Kellogg Brown & Root Pty Ltd (April 2008), prepared for the QWC, assuming for modelling purposes that desalination plant and dam pumping operations operate constantly, the time-span of study being 30 years commencing 2012, and discounting of dollar values to real 2008 dollars.

EnergyEdge concluded that:

- For the proposed Traveston Crossing Dam, using least cost energy under varying carbon cost scenarios, the cost of energy consumed could range between $12.41 million to $19.28 million per year. If sourcing fully green energy, the cost of energy for Traveston Crossing Dam increases to range between $20.83 million and $27.71 million per year.

- For a desalination plant located at Bribie Island (the desalination plant with the lowest energy cost of the three desalination sites considered), using least cost energy under varying carbon cost scenarios, the cost of energy consumed could range between $28.33 million to $44.05 million per year, increasing to range between $47.66 million and $63.38 million per year if sourcing fully green energy.

Marsden Jacob Associates were commissioned by QWI to provide a supplementary report to their 2007 report, *An Economic Evaluation of the Proposed Traveston Crossing Dam*, to consider, amongst other things, the potential impact of carbon credits and green energy on the comparative economic cost of Traveston Crossing Dam Stage 1 and the next best alternative supply solution – a desalination plant with similar volumetric capacity.

In the Marsden Jacob 2007 Economic Report, the difference in whole of life economic cost between Traveston and desalination was estimated to be $210 million, with Traveston being the lower cost option. The economic cost presented in the EIS only considered the cost of energy at market rates at the time of EIS preparation, and did not consider the implications of carbon credit or green energy costs.

The Addendum to the SREIS, at Appendix C, details Marsden Jacob's supplementary economic report (*Cost Benefit Analysis for Traveston Crossing Dam Supplementary Report*, 2008, Marsden Jacob Associates, prepared for Queensland Water Infrastructure Pty Ltd).

To further consider the comparative whole-of-life costs of the proposed Traveston Crossing Dam and a desalination plant sited at differing locations on the Sunshine Coast, Marden Jacob Associates considered the energy consumption analysis undertaken by Kellogg Brown & Root for the QWC, and EnergyEdge's analysis of possible energy costs for lowest cost energy and fully green energy under three carbon cost scenarios.

In the Marsden Jacob Supplementary Report of 2008, when consideration was given to how the estimated whole-of-life costs for Traveston Crossing Dam and a desalination alternative would be impacted by the inclusion of the costs of carbon credits (modelled using scenarios of $10, $30 and $60 per tonne), as well as the cost of sourcing green energy, Marsden Jacobs found:

- the cost of the desalination option utilising lowest cost energy is between $345 million and $574 million greater than Traveston Stage 1, when the cost of carbon credits (scenarios $10/tonne and $60/tonne) are taken into account

- the cost of the desalination option is between $579 million and $807 million greater than Traveston if the cost of green energy and the carbon credit scenarios detailed above are included.

(refer Addendum to SREIS figures 4.2 and 4.3 and page 35 of the Marsden Jacob Supplementary Report of May 2008)

The SREIS argues that a desalination plant located on coastal areas north of Brisbane is significantly more expensive under all scenarios using different sources of energy and differing carbon costs, with the cost differential between Traveston Crossing Dam and a desalination plant located on coastal areas north of Brisbane a minimum of $210 million greater (whole of life cost) using energy delivered from the National Electricity Market with zero cost of carbon, up to $574 million more expensive using energy delivered from the National Electricity Market with different carbon credit costs, and up to $807 million more expensive than using renewable energy with high carbon credit costs.

From the analysis presented in the SREIS and underlying reports, it appears clear that operational energy costs will have a significant bearing on the relative cost effectiveness of Traveston Crossing Dam and desalination. Further, should the range of uncertainty increase regarding the cost impost associated with carbon credits and green energy, there is likely to be an associated increased differential in comparative operational energy costs.

From the analysis conducted by Kellogg Brown & Root and EnergyEdge, it can be concluded that for comparative purposes, based on operating the Traveston Crossing Dam or a desalination plant located at the closest site to Brisbane (Bribie Island) continuously, the energy use and subsequent energy cost per year for desalination is over twice that of the energy cost per year for the proposed Traveston Crossing Dam for water delivered to Brisbane.

Given the relative cost difference between Traveston Crossing Dam and a desalination plant located on the coastal areas north of Brisbane, it is reasonable to conclude that water supplied to SEQ households from a water supply portfolio that included a higher proportion of desalination would be more expensive in comparison to water supplied from a portfolio that includes the Traveston Crossing Dam.

Desalination – Greenhouse Gas Emissions

The identified differential in energy requirements per megalitre of water delivered between desalination and Traveston Crossing Dam water also has implications for Greenhouse Gas emissions (GHG emissions). Whilst I consider the specific GHG implications of the project elsewhere in this evaluation report, comment is warranted on a comparison between desalination and the Traveston Crossing Dam relating to GHG emissions.

An analysis of the GHG emissions produced by the Traveston Crossing Dam compared to a desalination plant located somewhere on the Sunshine Coast north of Brisbane was conducted by Marsden Jacob Associates. Marsden Jacob Associates concluded that the levelised volume of GHG emissions for Traveston Crossing Dam Stage 1 is estimated at around 2.64 tonnes of $CO_{2\text{-}e}$ per ML/annum, compared to around 6.5 tonnes for desalination. It is noted from the SREIS that the emissions factor applied in the

Marsden Jacobs Associates methodology was derived from the Australian Greenhouse Office National Greenhouse Accounts Factors, January 2008.

Over a 50 year period of the analysis, I note that Marsden Jacob Associates determined that total emissions from a desalination plant (43.3 million tonnes) are estimated to be around 26.7 million tonnes of $CO_{2\text{-}e}$ higher than those from Traveston Crossing Dam (16.6 million tonnes) for an equivalent volume of water delivered into the SEQ Water Grid at a similar location.

Supplementary benefits of dams versus desalination

QWI, in comparing a desalination option with the Traveston Crossing Dam proposal, assert that there are also several significant supplementary benefits that arise out of the Project that do not occur with desalination, with these benefits including:

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

I consider the asserted supplementary benefits in greater detail throughout this evaluation report, as a number of the identified benefits could, (apart from downstream flood mitigation and possible recreational fishing opportunities) at least to some degree, be considered responses or mitigations for impacts which would be realised at the local and regional scale. Realisation of these supplementary benefits will require substantial implementation and ongoing management effort and I note that whilst directly comparable opportunities for supplementary benefits may not be available for proponents of a desalination alternative, this does not necessarily restrict a desalination proponent from pursuing innovative local/regional net benefits not directly related to their project.

Desalination – Summary

Desalination facilities do provide reliable augmentation opportunities for SEQ. The QWC's Strategy recognises that the recently completed first desalination facility in SEQ forms an important component of the region's water supply facilities. QWC's forward planning to 2056 also includes desalination as a key element for meeting future demands.

It does appear, at least from information available from analysis conducted for the region's first desalination plant, that the physical footprint of a desalination plant is likely to be smaller than that of a dam where equivalent volumes of water are to be delivered at specific levels of reliability, and with potentially less ecological/social impacts, however the ecological/social impacts experienced are highly dependent on plant and inlet/discharge locations.

The use of an increased proportion of desalination to satisfy demands in the region does however present challenges, as:

- It is highly likely that delivered water costs to the serviced community may, especially in the longer term, be greater for water provided from a portfolio of water supply infrastructure that includes an increased proportion of desalination infrastructure, imposing an increased economic burden on the serviced community
- Energy requirements for desalination for each delivered unit of water is, at this time, orders of magnitude greater than that provided from a dam, with correspondingly greater levels of production of greenhouse gas emissions.

As stated in the Australian Government's Productivity Commission report of March 2008 (Towards Urban Water Reform: A discussion paper – Productivity Commission Research Paper, March 2008), and reproduced in the SREIS, there is a risk associated with investing in desalination while the technology is still developing, and while there are alternate supply options that provide water at a lower cost. The Productivity Commission March 2008 report stated:

"Desalination can reduce the supply risk associated with reduced rainfall. However, early commitment to desalination can result in loss of flexibility to respond to new information, such as rainfall patterns and changes in technology, and result in substantially higher supply costs".

The Productivity Commission further stated:

"A risk associated with planned desalination investment is that a large proportion of plant capacity will remain unused for some time. Higher rainfall would raise dam levels, make rainfall-dependent supplies more economical and – in the absence of institutional arrangements that commit to sourcing water from desalination regardless of the availability of rainfall-dependent supplies – reduce the demands on desalination.

In the interim, investors in desalination (or consumers) would bear the capital and maintenance costs of desalination plant infrastructure. The additional costs would be akin to an insurance premium".

Large scale water harvesting and interbasin transfer – Two alternative water supply proposals that were similar in nature, were suggested by submitters to the EIS. They involved a significant increase to the storage capacity of Borumba Dam on Yabba Creek and operation of flood harvesting from the Mary River, or significantly increasing the storage capacity of Borumba Dam on Yabba Creek, increasing the storage capacity of the Somerset/Wivenhoe system, transporting stored floodwaters from the Somerset/Wivenhoe system and operating a raised Borumba Dam, Somerset and Wivenhoe Dams though a series of interconnecting pipelines.

The proposal for significantly increasing the storage capacity of Borumba Dam on Yabba Creek and operation of a flood harvesting from the Mary River was considered in section 6.3.1.3 of the SREIS, underpinned by analysis conducted by Gilbert and Associates. The analysis considered the hydrologic reliability of providing 70,000 ML/annum, and a budget cost for the harvesting and transfer scheme, concluding that the proposal would not satisfy the supply level of service set by the QWC, had a significantly higher hydrological failure rate compared to Traveston Crossing Dam (IQQM modelling indicated a period of 70 years between filling events), and was significantly more expensive, with the cost for the raising of Borumba Dam, flood harvesting and interbasin transfer infrastructure estimated to be in the order of $3.1 billion.

The proposal to significantly increase the storage capacity of Borumba Dam on Yabba Creek, as well as increasing the storage capacity of the Somerset/Wivenhoe system, transporting stored floodwaters from the Somerset/Wivenhoe system and operating a raised Borumba Dam, Somerset and Wivenhoe Dams though a series of interconnecting pipelines, relies on analysis conducted in 2005 for the Moreton Catchment, which indicated that a raised Wivenhoe system may have the potential to provide an additional yield of 80,000 ML/annum.

Subsequent analysis, culminating in the March 2008 release of the draft Strategy, confirmed a substantial de-rating of system yields of existing surface water supplies. Under a LOS water planning approach, the system yield of existing supplies in SEQ is 416,000 ML/annum, which is 20% less than the 2007 urban allocation.

The maximum amount of water permitted to be extracted from existing surface water supplies in SEQ, particularly for the Somerset/Wivenhoe system, is defined in the *Water Resource (Moreton) Plan 2007*. In addition, amendments to the *Water Act 2000*, passed in 2006, required the adoption of the LOS water planning approach in SEQ.

A review of potential future new water storages in the region, undertaken during the development of the draft Strategy, highlighted that there are very few opportunities to develop major new storages, other than those already committed by the Queensland Government. The draft Strategy also confirmed that on completing committed projects, major catchments in the region, inclusive of the Moreton catchment, will be approaching the sustainable extraction limits permitted under their respective Water Resources Plans, with the draft Strategy confirming that the Moreton Water Resource Plan may only be able to sustainably provide a further 25,000 megalitres per year, well below the 80,000 megalitre per year yield required to support the submitted proposal for a raised Borumba, Somerset/Wivenhoe floodwater capture, transfer and reuse system.

I am satisfied that, in light of the analysis presented in the SREIS, as well as the analysis presented in the draft SEQ Water Strategy and the limitations presented in the W*ater Resource (Moreton) Plan 2007*, large scale water harvesting and interbasin transfer proposals for the Mary and/or Somerset/Wivenhoe catchments are not feasible alternatives for the reliable supply of 70,000 ML/annum to the SEQ Water Grid.

Cost/Benefit Analysis - The methodology by which the costs and benefits of the project were determined, and in particular, whether the analysis undertaken with the EIS constitutes a full cost-benefit analysis, was criticised in a number of submissions about the EIS.

In response to this criticism, the SREIS states that reviews by Harry Campbell (Professor of Applied Economics at the University of Queensland) and adoption of the same cost-benefit methodology by the QWC to determine possible future supply portfolios for the SEQ region confirms that the approach adopted was correct.

I find the following commentary presented in the SREIS compelling in addressing concerns raised about the cost-benefit methodology utilised by QWI:

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

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

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

> *"The main purpose of portfolio analysis is to incorporate the principles of least-cost planning to compare the costs and benefits to the community of different suites of water supply and demand initiatives. Increasingly, governments are using this technique to find the most efficient supply solution. A portfolio model was developed for South East Queensland to estimate the overall economic cost of combinations of supply and demand management options capable of meeting water supply needs for the period to 2056. The focus of portfolio modelling is on estimating the Net Present Value (NPV) for the whole-of-life cost (capital costs and operating costs) of alternative supply portfolios over the period. The NPV is defined as the lump-sum equivalent of all future economic costs in today's terms or at some other point in time. Future costs can be brought into a present value equivalent using an appropriate discount rate."*

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

> *"The economic benefit of a given portfolio is the cost savings relative to the 'next best alternative'. Hence the objective is to quantify, and then compare, the economic cost of*

supply for alternative portfolios. The option with the lowest economic cost is assumed to be the most efficient in terms of a narrow economic assessment... "

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

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

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

On balance, I consider that the draft SEQ Water Strategy developed by the QWC demonstrates the appropriateness of a mixed portfolio strategy to satisfy the SEQ region's water supply needs, taking more than an adequate account of the urban/industrial supply/demand risk profile to ensure that the region's water supply is not compromised.

I accept that the strategy considered a range of alternative supply options and appropriate proportions of each supply option, while noting that sections of the community have varied views of the preferred mix of measures. I note the QWC's determination that the portfolio supply approach adopted under the strategy satisfactorily reduces the risk of failure resulting from the current narrow supply basis, both from the geographic location of the source and the method of supply perspective, and as such additional surface water supplies are considered a necessary component of the portfolio approach to required new supplies.

In this context, one of the key criteria in achieving a balance between water supply and demand is availability of a reliable volume. The QWC's approach essentially assessed the contribution that could reasonably be achieved with each proposed option, then to select for further consideration the projects with the best potential to contribute a reliable volume of water to address the overall water supply shortfall. I note that the approximate contribution of the various components of the strategy in meeting demand in 2026 will consist of 51% by existing supplies, 18% through demand management, 16% by desalination and recycling together and 15% by new surface water supplies.

I agree with the findings of the EIS that the SEQ strategy for achieving a water supply balance does not represent an unwarranted reliance on surface water options. Further, the Queensland Government's water supply strategy, which is based on QWC's deliberations as set out above, has given extensive consideration to, and a balancing of, a wide range of factors in selecting supply measures to pursue. The resulting strategy represents a defensible set of diverse demand and supply measures, including support for the proponent's plans in relation to the Project.

I consider that desalination can and does form an important component of this water supply strategy, however, I consider it is reasonable for Government authorities to decide to defer further reliance on desalination, particularly as the use of an increased proportion of desalination to satisfy demands in the region would have the following implications:

- It is highly likely that delivered water costs to the serviced community may, especially in the longer term, be greater for water provided from a portfolio of water supply infrastructure that includes an increased proportion of desalination infrastructure, imposing an increased economic burden on the serviced community; and

- Energy requirements for desalination for each delivered unit of water is, at this time, orders of magnitude greater than that provided from a dam, with correspondingly greater levels of production of greenhouse gas emissions.

2. The impact assessment process

2.1. Commonwealth impact assessment

On 15 November 2006 the proponent referred the Traveston Crossing Dam Project - Stage 1 to the then Commonwealth Minister for the Environment and Heritage (reference 2006/3150) for a decision on whether the Project is a controlled action under the EPBC Act.

On 29 November 2006, the then Minister for the Environment and Heritage determined that the Project is a 'controlled action' under section 75 of the EPBC Act.

The controlling provisions of part 3, division 1 of the EPBC Act for the proposed action are:

- sections 12 and 15A (world heritage)
- sections 16 and 17B (Ramsar wetlands)
- sections 18 and 18A (listed threatened species and ecological communities)
- sections 20 and 20A (listed migratory species).

Under the Bilateral Agreement between the Australian Government and the State of Queensland made under section 45 of the EPBC Act (Bilateral Agreement), if a controlled action is a significant project for which an EIS is required under the *State Development and Public Works Organisation Act 1971* (SDPWO Act), then the project does not require assessment under part 8 of the EPBC Act. Under part 4 of the SDPWO Act and the *State Development and Public Works Organisation Regulation* (SDPWO Regulation), the Coordinator-General, in preparing his assessment report, must ensure the report assesses all relevant impacts that the action has, will have or is likely to have and provide enough information about the action and its relevant impacts to allow the Commonwealth Environment Minister to make an informed decision whether or not to approve the action under the EPBC Act.

2.2. State impact assessment

On 20 October 2006, the Coordinator-General declared the Project to be a 'significant project for which an EIS is required', pursuant to section 26(1) (a) of the SDPWO Act.

Section 35(3) of the SDPWO Act requires the Coordinator-General to prepare a report evaluating the EIS for a significant project for which an EIS is required. Under section 35(1) of the SDPWO Act, after the end of the EIS submission period, the Coordinator-General must consider the EIS, all properly made and other submissions accepted by the Coordinator-General about the EIS, and any other material the Coordinator-General considers is relevant to the Project.

This Coordinator-General's Report may state conditions under section 39, 45, 47C, 49 or 49B of the SDPWO Act, may make recommendations under section 43 or 52 of the Act and impose conditions under part 4, division 8 of the Act, for the undertaking of the Project.

On completion of the Coordinator-General's Report, a copy is provided to the proponent and publicly notified on the Department of Infrastructure and Planning website. The notification of this report and its provision to the Commonwealth Environment Minister completes the assessment process under the SDPWO Act.

2.3. Terms of reference for EIS

An Initial Advice Statement was released for public information and the Draft Terms of Reference (ToR) were advertised for public and agency review and comment on 9 December 2006 by the Coordinator-General. Submissions were accepted until close of business on 19 February 2007. A total of 262 submissions were received and considered with comments incorporated into the final ToR which was released on 7 August 2007. Comments on the ToR were received from 30 organisations and community groups, 213 members of the public and 17 from agencies: [1]

- Department of Communities
- Department of Primary Industries and Fisheries
- Department of Natural Resources and Water
- Department of Tourism, Fair Trading and Wine Industry Development
- Department of Emergency Services
- Department of Main Roads
- Energex Limited
- Department of Housing
- Queensland Health
- Department of Education, Training and the Arts
- Department of State Development
- Department of Employment and Industrial Relations
- Queensland Transport
- Environmental Protection Agency
- Noosa Shire Council
- Maroochy Shire Council
- Cooloola Shire Council.

In addition, advice was received from the Commonwealth Department of the Environment and Water Resources.

The final ToR was issued to the proponent on 7 August 2007.

2.4. Public notification of the EIS

The EIS was publicly notified on 20 October 2007, with the original submission period running from 22 October 2007 to 3 December 2007. After the EIS was publicly notified, discrepancies were identified in

[1] Note that due to Machinery of Government changes and council amalgamations, subsequent to events described in this report, some agencies' names now differ.

relation to the various forms of the EIS as released. QWI prepared an Addendum to the EIS identifying the discrepancies in the documentation and by public notice advertised on 28 November 2007 I extended the submission period until the close of business on 14 January 2008.

I required QWI to distribute free of charge a hard copy of the Addendum to members of the public who had previously obtained copies of the EIS, and required the addendum to be available on the proponent's website.

2.5. Submissions received

Public notification of the Project's EIS provided any interested party with an opportunity to make a properly made submission on the EIS. Submissions on the EIS were received via a range of media (email, facsimile, post, courier), with a number of submitters providing multiple copies of the submission to my office and also to a number of State and Commonwealth Ministers.

As each submission was received by my office, it was numbered, recorded in a spreadsheet, scanned and filed electronically and the original hard copy numerically filed.

Staff from the Department of Infrastructure and Planning recorded and catalogued all submissions received during the submission period and other accepted submissions. Each submission was subject to both a primary and secondary review. The issues in each submission were identified, catalogued and recorded in a database.

In total, 15,084 submissions, inclusive of duplicates, were received in relation to the EIS. When duplicates of the submissions were identified, the individual submissions received totalled 10,225.

Of the total submissions received, the breakdown can be summarised as follows:

Submitter	Submissions
Government (Commonwealth and State) advisory agencies: Department of Employment and Industrial Relations Department of Education, Training and the Arts Department of Communities Department of Mines and Energy Department of Primary Industries and Fisheries Department of Natural Resources and Water Department of Emergency Services Department of Main Roads Department of Tourism, Regional Development and Industry Department of Local Government, Sport and Recreation Department of Housing Queensland Health Queensland Transport Environmental Protection Agency Queensland Police Service	15 plus comment from the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA)
Community, environmental, political organisations and local governments	86 from 70 organisations
Private individuals or companies	10 123
Form submissions	9 671, in 18 forms
Total	**10 225 (excluding duplicates)**

2.6. Review of the Supplementary Report to the EIS

All submissions received by the Coordinator-General on the EIS were forwarded to QWI. I asked the proponent to prepare a supplementary report to the EIS (SREIS) to respond to the submissions.

The SREIS was submitted to the Coordinator-General in August 2008 and forwarded to advisory agencies. Advisory agencies were invited to comment on the SREIS and to provide advice to me for consideration for inclusion as conditions or recommendations in this report, if I were to recommend that the Project proceed. I have incorporated matters raised by advisory agencies in my conditions and analysis detailed elsewhere in this report. The following agencies advised that they were satisfied that all issues relevant to their jurisdiction had been addressed in the SREIS:

- Queensland Health
- Department of Communities
- Queensland Police Service
- Department of Housing
- Department of Main Roads
- Queensland Treasury
- Queensland Transport

The following agencies raised issues for my consideration, provided further comment on issues, or provided advice or recommended conditions to apply to the Project if I was to decide that the Project should proceed:

- Department of Emergency Services
- Department of Tourism, Regional Development and Industry
- Department of Public Works
- Community Futures Task Force
- Department of Local Government, Sport and Recreation
- Department of Mines and Energy
- Department of Education, Training and the Arts
- Department of Employment and Industrial Relations
- Department of Primary Industries and Fisheries
- Department of Natural Resources and Water
- Environmental Protection Agency
- Gympie Regional Council
- Sunshine Coast Regional Council
- Department of the Environment, Water, Heritage and the Arts.

Key issues raised in submissions are discussed individually in section 3.

Following receipt of the SREIS, officers of my Department cross referenced the issues raised in submissions against the responses provided in the SREIS, to ensure that each issue raised had been addressed. Where further information was required to complete my evaluation report, information requests were made to the proponent.

2.7. Information requests to the proponent

Following the receipt of the SREIS, I issued to the proponent a number of information requests seeking further detail or clarification where I considered that information was required in order to inform my evaluation of the EIS.

The information requests are as follows:

- Information Request No. 1 dated 16 October 2008, which, in summary, requested:
  - additional mapping
  - clarifications of the Project description, including clarification of the Project Area
  - further detailed information regarding the areas of existing and potential future habitat and details about monitoring and captive husbandry programs for the Southern Barred Frog
  - various clarifications regarding terrestrial flora and fauna
  - various clarifications regarding social and economic issues
- Information Request No. 2 dated 21 October 2008, which, in summary, requested detail of the land area, number of properties and number of dwellings impacted by various components of the Project, and the land that had already been purchased by the proponent
- Information Request No. 3 dated 19 November 2008 requesting a response from the proponent as to how suitable habitat rehabilitation measures can be designed, implemented and maintained both before and during the construction and operation of the Project and the impact this might have on the highly modified catchment and matters of national environmental significance
- Information Request No. 4 dated 24 November 2008 which set out further detail of the information required through Information Request No. 3 in relation to rehabilitation of habitat and detail on the implementation of mitigation measures
- Information Request No. 5 dated 11 December 2008, which, in summary, requested:
  - clarification of the Stage 1 Purchase Area Boundary
  - clarifications of discrepancies in the comparison between desalination and the Project
  - confirmation as to how many houses within Kandanga are below the Q100 (with dam) flood line and details of purchases of these properties
  - clarification of clauses within land lease arrangements with the potential to constrain potential conditions requiring large-scale revegetation of these lands
  - identification of specific parcels of land where the purchase boundary is below the Q100 flood line (with dam) and/or that are within 100m of FSL
  - specificity regarding the likely causes of the water quality deterioration of the area immediately downstream of the Project in the current situation
  - quantification of the impact on water quality of revegetating the buffer area and excluding all land uses from the buffer area

- identification of the specific points in the river downstream of the Project that are at low, medium and high risk of being affected by clear water scour/erosion following construction of the Project
- an analysis of flow objectives targeted at achieving identified ecological outcomes in relation to Lungfish, Mary River Cod and the broader fish community.

- Information request No. 6 dated 12 May 2009 in relation to clarifications on the findings presented in the SREIS in relation to the Three-toed Snake-toothed Skink

- Information request No. 7 dated 28 September 2009 in relation to correspondence received by the Coordinator-General in relation to densities of riparian *Ficus coronata*.

The proponent has responded to the above information requests (Response to Information Requests Report), and those responses are available at www.qldwi.com.au..

In addition to the above information requests, I also requested the proponent prepare an addendum to the SREIS to respond to clarifications and corrections sought by advisory agencies.

QWI has prepared an addendum to the SREIS which is available on the proponent's website www.qldwi.com.au.

2.8. Commonwealth reviewer reports

At an early stage of the assessment of the Project, it was recognised by me and by DEWHA that the Project would potentially impact on matters of national environmental significance (MNES).

In order to assist in assessing those potential impacts, I agreed with DEWHA that a range of review reports should be commissioned with respect to:

- hydrology
- impacts on the downstream Ramsar wetland
- impacts on listed threatened species and communities, in particular the Lungfish, Mary River Cod, Mary River Turtle and Southern Barred Frog.

DEWHA separately commissioned the following reports be prepared in response to the EIS and SREIS for the Project:

- A review of impacts of the dam on matters of national environmental significance - Associate Professor Keith Walker
- A review of impacts of the dam on matters of national environmental significance - Professor Stuart Bunn
- A review of impacts of the dam on the Mary River Turtle - Dr Gerald Kuchling
- A review of the hydrological model used to predict flow impacts in the EIS - Drew Bewsher

I have collectively referred to these reports as the "Commonwealth Reviewer Reports" throughout my evaluation report.

The reports can be viewed via the DEWHA website at www.environment.gov.au.

I have not been provided with the terms of reference for the Commonwealth Reviewer Reports, nor with a description of the briefing material provided to the reviewers.

I understand from the content of his review report that Professor Walker's tasks included:

- To evaluate the rigour of information in the EIS relating to species of concern under the EPBC Act
- To evaluate the accuracy of judgements about the likely nature and extent of impacts and operation of the dam on these species, relative to their status prior to dam construction
- To suggest amendments to improve the rigour of the information or associated interpretations, or to offer alternative judgements/interpretations with justification, if information and/or judgements in the EIS are found to be deficient.

Similarly, it would appear that Professor Bunn's tasks were:

- Evaluating the EIS and supporting documentation
- Considering any other relevant issues raised during the public submission process
- Considering the response from the proponent to public submissions in the form of the Supplementary report and review additional technical information provided
- Presenting the findings of the review to the Department, both in written report format and as an oral presentation to relevant departmental staff working on the assessment

The terms of reference for Mr Bewsher's review require an evaluation of the:

- IQQM model ÿ including the validity of the model for the purposes for which it was used in the draft EIS, and the validity and accuracy of the data and assumptions on which the modelling has been based.
- Model output data ÿ the presentation and interpretation of the model output data in the draft EIS, including the confidence that can be applied to the modelling output and associated interpretations of that output, as presented in the draft EIS.
- Environmental flows ÿ the ability of environmental flows proposed in the draft EIS, under the Mary River Water Resource Plan and other relevant framework, to mitigate the hydrological impacts of the dam.

Dr Kuchling's report does not outline the terms of reference for his review, but I assume that it was similar to the terms of reference for the reviews undertaken by Professors Walker and Bunn.

Following the release of the Commonwealth Reviewer Reports, officers of my Department attended a briefing delivered by each of Professor Bunn, Professor Walker and Doctor Kuchling, where some opportunity was provided to understand the basis of the findings of each of the reports. At those oral briefings, qualifications pertaining to the methodology and scope of analysis, additional to those identified in the Commonwealth Reviewer Reports were identified.

On 12 November 2008, the Commonwealth Environment Minister wrote to me in accordance with clause 14 of the Bilateral Agreement to provide an opportunity to comment on the accuracy of the Commonwealth Reviewer Reports.

The Commonwealth Reviewer Reports were provided by DEWHA to the proponent to provide an opportunity to respond. On 25 September 2009, the proponent provided the final response to the Commonwealth Reviewer Reports. The proponent's response to the Commonwealth Reviewer Reports is available at www.qldwi.com.au.

2.9. Documents considered in the evaluation

In preparing this report evaluating the EIS in accordance with section 35 of the SDPWO Act, I have considered the EIS and the SREIS, all properly made submissions on the EIS and other submissions accepted by me about the EIS, advice from local, State and Commonwealth government agencies and other material relevant to the Project, including the response to information requests provided by the proponent, the Commonwealth Reviewer Reports and the proponent's response to the Commonwealth Reviewer Reports.

2.10. Approvals, permits and licences

The proponent has been directed under Schedule 10B of the *Water Regulation 2002* to take all necessary steps to prepare for, and construct, Traveston Crossing Dam Stage 1 by 31 December 2011. Further, the proponent has been directed under part 6 of the SDPWO Act to undertake the dam site project works, which includes works for Traveston Crossing Dam Stage 1 and Traveston Crossing Dam Stage 2, which is limited to early incidental works, land purchasing, surveys, physical and proposed investigations described in QWI's report of March 2007 "Report on proposed Traveston Crossing Dam - Stage 2 works".

Under Schedule 9 of the *Integrated Planning Act 1997* (IP Act) all "aspects of development a person is directed to carry out under a notice, order or direction made under State Law" are exempt from assessment against a local government planning scheme, and therefore planning scheme approvals will not be required for the Project.

Apart from approval under section 133 of the EPBC Act to take a controlled action, other key statutory approvals necessary for development of the Project include:

Legislation	**Approval**
Integrated Planning Act 1997 and *Water Act 2000*	Operational Works for constructing or raising a waterway barrier works
Integrated Planning Act 1997 and *Water Act 2000*	Operational Works for taking or interfering with water
Integrated Planning Act 1997 and *Water Act 2000*	Operational Works for removing quarry material in a watercourse or lake
Integrated Planning Act 1997 and *Water Supply (Safety and Reliability) Act 2008*	Operational Works for referrable dam
Integrated Planning Act 1997 and *Vegetation Management Act 1999*	Operational Works for clearing of native vegetation
Integrated Planning Act 1997 and *Environmental Protection Act 1994*, *Environmental Protection Regulation 2008*	Material Change of Use for Environmentally Relevant Activities (ERAs) including: ERA 8 - chemical storage ERA 16 - extracting and screening activities ERA 21 - motor vehicle workshop preparation ERA 43 - concrete batching ERA 56 - regulated waste storage ERA 57 - regulated waste transport ERA 61 - waste incineration and thermal treatment ERA 63 - sewage treatment
Integrated Planning Act 1997 and *Building Act 1975*	Building works

Nature Conservation Act 1992	Permit for taking, using or interfering with protected plants or animals
Transport Infrastructure Act 1994	Interference with a state controlled road or its operation
Water Act 2000	Permit to destroy vegetation, excavate or place fill in a watercourse, lake or spring
Water Act 2000	Interim Resource Operations Licence/Resource Operations Licence
Water Supply (Safety and Reliability) Act 2008	Failure Impact Assessment
Water Act 2000	Allocation notice for quarry material
Water Act 2000	Permit to take water
Water Act 2000	Licence to take or interfere with water
Environmental Protection Act 1994	Registration Certificate
Environmental Protection Act 1994	Permit to dispose of contaminated soil
Dangerous Goods Safety Management Act 2001 and *Dangerous Goods Safety Management Regulation 2001*	Storage of flammable and combustible liquids on premises
Explosives Act 1999	Authorities to possess, store, transport and use explosives
Fire and Rescue Services Act 1990	Permit to light a fire

The proponent has expressed a preference for the use of a community infrastructure designation under the IP Act, which would enable the use of the land required for the Project. The proponent proposes to seek a community infrastructure designation for the Project Area only.

A community infrastructure designation has the effect that development under the designation is exempt development under IP Act (i.e. no development approval is required) to the extent the development is:

- assessable under a planning scheme and/or
- the reconfiguration of a lot.

The effect of both the emergency direction under the *Water Regulation 2002* and the regulation made under section 100 of the SDPWO Act is that the Project is, under Schedule 9 of the IP Act, exempt from assessment against the relevant local government planning schemes. I further note that IP Act provides an existing exemption for a reconfiguration of a lot for acquisition of land for a "water infrastructure facility" which is a measure, outcome, works or anything else that QWI is directed to carry out or achieve under the SDPWO Act or the *Water Act 2000*.

At this stage, I am not recommending that a community infrastructure designation be made for the Project, as the designation will not provide any additional benefit to the undertaking of the Project.

3. Evaluation of environmental impacts

3.1. Land

Numerous issues were raised in relation to land matters. I have considered each of the submissions and how the SREIS has responded to the issues raised in submissions. I have divided my considerations of land issues into land use and tenure, topography and geomorphology, geology and soils, visual amenity, and land contamination. Key issues that I considered warranted particular elaboration and/or explanation in my Evaluation Report included:

Land use and tenure

- the impact of the project on rural activities and primary production, including the loss of good quality agricultural land
- land use controls that may be implemented on surrounding properties once the dam is in operation
- the source of materials for dam construction and whether surplus extractive resources within the inundation area will be made available for commercial use
- land that will be required for Vegetation Management Offsets (VMOs)
- the impacts of the proposal to change some existing farmed lands to plantation timber production areas
- the impacts on Kandanga township and how these will be mitigated

Topography and geomorphology

- sediment movement predictions
- the erosion, transport and deposition of sediment along the Mary River, the estuary and Great Sandy Strait
- the potential for river flows inducing greater erosion of riverbanks and bed downstream and at the end of the spillway, and the subsequent impact on habitat and adjacent lands
- potential erosion impacts within the inundation area

Geology and soils

- the potential for leakage and seismic activity at the dam wall
- the potential for increased erosion and sediment transport as a result of the Project
- the inundation of rural land, especially GQAL
- the reuse of disturbed topsoil

Visual amenity

- the impact of infrastructure changes the landscape character and visual amenity of adjacent property, and the effectiveness of mitigation measures to lessen any adverse impacts

- the impact of changed views across water due to potential stagnation of water downstream and within the impoundment

Land contamination

- the processes used to identify contaminated sites, particularly cattle dips throughout the inundation area, the remediation of these sites and the need for a Third Party Reviewer

- the extent of investigations to delineate potential contamination within the Project Area.

- Concern that stockyards and quarries are not notifiable activities under the *Environmental Protection Act 1994* (EP Act) but may contribute to land contamination

These matters are discussed further below in this section of this Coordinator-General's Evaluation Report.

Land use and tenure

Key land use and tenure issues raised in submissions that I considered along with other relevant matters included the impact of the project on agricultural activities, new land use controls, dam construction materials, possible surplus extractive resources within the inundation area, land required for VMOs, the impacts of possible plantation timber production, and impacts on Kandanga township.

The proponent indicates in its Response to Information Request Report that the area required for the Project comprises:

- the inundation area at FSL and dam wall construction site – 3055 ha (232 properties)

- the buffer area – 2470 ha (67 properties)

- the dam access road – 18 ha (1 property)

- relocated roads and infrastructure - 765 ha (34 properties)

This will result in the permanent change in use of the land in these areas. I understand that the proponent has also purchased, or offered to purchase, additional land outside these areas. These additional land purchases relate to the balance of a property directly affected by the Project where the owner does not wish to make a partial sale, or where land falls within the possible Stage 2 area and the previous owner wanted a more certain outcome.

In addition to the purchase of the reservoir area (which is the land inundated by water when the Project is at its full supply level) to ensure satisfactory operation of the Project the proponent has sought ownership and/or control of additional land directly adjacent to the reservoir area comprising:

- a buffer area (aimed at protecting water quality, bank stability, addressing safety matters, excluding activities with a high risk of adverse impacts on water quality and/or dam operations, allowing for revegetation and control of access); and / or

- a flood margin area where there is a risk of damage to the land caused by any increased extent or duration of temporary flooding as a result of the dam – the significance of this risk, and the impact of extra flooding, diminishes the further upstream from the dam wall.

As discussed further in the water quality and terrestrial ecology sections of this Evaluation Report, I observe that the buffer zone adjacent waterways and the inundation area will have a number of functions, including:

- providing sediment removal and erosion control by creating setbacks for sediment producing land use, reducing erosion during overland flows, capturing sediments transported by surface runoff, slowing the velocity of water and allowing sediments to settle onto land and capturing sediments on vegetation during floods, reducing stream bank erosion and wave effects on the margins of the inundation area

- protecting water quality through the natural absorption of nutrients and sediments from overland flows from adjacent agricultural areas

- providing riparian habitat containing food and refuge for a range of species

- providing wildlife connectivity along waterways and around the inundation area and between tributaries

- protecting and enhancing adjacent aquatic habitat including providing a source of large woody debris that traps sediment in-stream and provides aquatic habitat in streams and the inundation area

- excluding cattle and to some extent dogs from riparian habitat including potential turtle breeding areas, and avoiding the lowering of water quality and increased erosion due to the impacts of cattle

- enhancing the visual and recreational aspects of the Project

I understand, from the assessment of buffers in the proponent's Habitat Restoration Plan (part of the Response to Reviewer Reports document), that:

- vegetated riparian buffers between 30 m and 60 m wide are effective at removing nutrients, faecal coli forms and organic pollution, pesticides and sediment

- conservation of a full range of forest dwelling terrestrial plants and animals in riparian buffers requires greater buffer widths in the order of 100 m or more. Narrower buffer strips ecological values are diminished by edge and disturbance effects including plant species richness, air temperature, understorey cover, light, chemical substances, air pressure, mortality, bird density, canopy cover, and nest predation

- the majority of edge effects such as increased light and air movement generally extend up to or greater than 60 m from a forest edge so 30 m wide buffers are not sufficient to provide habitat for specialist forest interior biota. Wider buffers greater than 60m can reduce weed invasion and have potential to reduce management and weed maintenance costs. Wider buffers are needed to protect water quality during severe storms when a large amount of sediment and pollutants can enter the waterways

- woody vegetation buffers in riparian areas provide inputs of large woody debris and smaller organic matter. These inputs provide a basis for aquatic food webs as well as food in the form of fallen insects and shelter for fish species. Shading of streams by riparian vegetation keeps water temperature down increasing DO concentrations and providing conditions for a greater diversity of aquatic invertebrates and vertebrates

- while buffers of native woody vegetation provide the greatest benefits especially for biodiversity, grassed buffers with grazing and other land uses excluded can provide water quality benefits. Woody vegetation has important advantages over grasses in the parameters of bank stability, and also has a higher ability to remove pollutants from shallow groundwater due to the deeper root zone of trees, and greater biodiversity benefits compared to grassed buffers due to its more complex structure provision of large woody debris

- given these differences a viable management Strategy would be to fence off all areas of buffer providing the water quality benefits of un-grazed grass buffers then progressively regenerate native riparian forest of the appropriate regional ecosystem from the stream outwards to the buffer margin

- a 60 m buffer is considered the minimum to width to provide habitat for the adults of the endangered Giant Barred Frog Mixophyes iterates

- revegetation of riparian buffers can potentially result in large economic savings for municipal water treatment as a direct consequence of reduced sediment load and pollutants bound to sediment entering the water treatment plant. An annual saving of up to $60 million in water treatment costs was estimated in a buffer restoration model for the Brisbane River catchment

I have considered these issues and require an integrated approach to activities and mitigations within the Project Area. I have therefore required a Land Use Master Plan in Condition 2, Schedule C, Appendix 1, which must address, within the Project Area, all elements of the Project infrastructure, buffer requirements, protected riparian habitat and wildlife corridors, visual impact measures, greenhouse offset areas, vegetation offset areas, non-indigenous cultural heritage sites, accommodation areas, and recreation and tourism initiatives. The Proponent must submit the Land Use Master Plan, identifying the location of all proposed land uses in the Project Area, to me prior to the commencement of Principal Construction Works.

As discussed further in section 3.3, all species including native fauna species in the Project Area, depend on and a part of complex ecosystems. The preservation of threatened and endangered species necessarily requires the protection of their supporting ecosystems. I have therefore imposed conditions primarily directed at the preservation and restoration of habitat. Additionally, riparian vegetation will also protect water quality in waterways and the inundation area.

I require an inundation area buffer in Condition 3, Schedule C, Appendix 1 which must be the greater of the 1 in 100 AEP inundation extent with the Project, adjusted to incorporate any changes that result from flood mitigation optimisation during detailed design, or 100 m (i.e. horizontally distant) from FSL. I have allowed for adjustments to the perimeter boundary to take into account topography, property boundaries and other features. The proposed inundation area buffer is illustrated on the map in Appendix 1, Schedule F.

I have conditioned that the Proponent must have tenure (e.g. freehold, easements) over all lands not retained by the State within the inundation area buffer prior to the commencement of the Principal Construction Works.

I consider that the Project will impact on the aquatic environment both within the inundation area and in the Mary River downstream of the dam wall with those impacts diminishing with distance as downstream tributaries contribute to river flows. I also note that there is currently very limited riparian vegetation in the Project Area, despite the outcomes sought under the current planning scheme. I have already discussed above the important role that riparian habitat plays in terms of water quality and terrestrial fauna movement. Riparian vegetation also provides bank stability and links with aquatic habitat to form important food chains, supports in-stream aquatic habitat, turtle nest conservation fauna foraging and breeding habitat. The Project will introduce a partial barrier to terrestrial fauna movement both along and across the inundation area. To mitigate and offset those impacts and to support native fauna I have set out requirements in Condition 4, Schedule C, Appendix 1 for protected habitat areas and wildlife corridors. I have required the creation of protected riparian habitat, which must contain restored and protected vegetation and be adjacent to associated restored and maintained in-stream habitat.

Upstream of the inundation area in both the Mary River and its tributaries, to the extent shown on the map in Schedule F, Appendix 1, I have required that protected riparian habitat is established and maintained, with a minimum width of 60 m from either FSL, or the waterway edge in areas upstream of the inundation area by protecting existing remnant native vegetation and restoring native vegetation. Stock must be excluded from those areas with fauna friendly fencing installed as required.

I have also imposed at Condition 4, Schedule C, Appendix 1 protected riparian habitat requirements for the areas adjacent to the western side of the inundation area, within the inundation area buffer discussed above and illustrated on the map in Schedule F, Appendix 1. I understand from community newsletters issued by the proponent the intention to create both habitat as well as trails and nature based recreation within the Project Area. I also note that this area is suitable for providing connectivity along the Mary River past the inundation area. I have therefore required that on the western side of the inundation area, protected riparian habitat must be established over 80% of the inundation area buffer and a wildlife corridor be provided at least 100 m in width to connect the western riparian habitat area to the Kybong riparian habitat areas, with no significant interruption to that connectivity.

On the eastern side of the inundation area buffer riparian habitat is also required for the reasons set out above. However those riparian linkages and habitat need to be considered in light of the future alignment of the Bruce Highway, which will be adjacent to this part of the inundation area buffer. That will make is less desirable for this riparian habitat to be developed as a major wildlife corridor. The opportunity for users of the realigned Bruce Highway to have views across the inundation area needs to also be considered. I have therefore required that on the eastern side of the inundation area protected riparian habitat must be established over 30% of the inundation area buffer in recognition of those other considerations.

The Mary River immediately downstream of the dam wall is a critical area in terms of potential bank erosion and aquatic habitat protection. Riparian vegetation will support these requirements and provide connectivity. I have therefore required in Condition 4, Schedule C, Appendix 1 that within this area, which I have called the Kybong Riparian Protected Habitat Area (as illustrated in Schedule F, Appendix 1), native vegetation must be protected or restored to cover a width of at least 60 m from the waterway edge on both banks of the Mary River from the Project dam wall to one kilometre downstream, with no significant interruption to connectivity.

Connectivity between areas of habitat is broadly recognised as essential for the long term survival of fauna species. Therefore, to facilitate terrestrial fauna movement, I have required that native vegetation must be protected and native habitat restored to form largely continuous corridors (recognising existing and ongoing discontinuities associated with roads, streams etc) of native vegetation with a width of at least 100 metres to connect key areas of habitat. Those key areas of habitat that I require to provide linkages to the riparian habitat adjacent to the inundation area, the West Cooroy State Forest to the east of the Project, and at least either Imbil State Forest to the west of the Project or Amamoor State Forest to the north east of the Project. This may involve remnant or rehabilitated vegetation adjacent to Kandanga Creek, Belli Creek, Yabba Creek and existing remnant or rehabilitated areas adjacent to the Amamoor, West Cooroy and Imbil State Forests and actions to address the requirements of the *Vegetation Management Act 1999* (VM Act) that are applicable to the Project.

As set out in Condition 4, Schedule C, Appendix 1, I require the establishment and maintenance of protected riparian habitat to be supported by fencing where required to exclude stock, as well as weed control, protection and restoration of native vegetation and other management measures. These requirements will ensure the creation of a largely continuous and connected vegetated riparian zone from the inundation area up into the contributing tributaries and in some cases adjacent forests. This will provide habitat for a wide variety of species including opportunities for movement of species such as the Giant Barred Frog. The necessity for the establishment of protected riparian habitat and associated in-stream habitat creation activities is further explained in sections 3.3 (Terrestrial Environments) and particularly 3.4 (Aquatic Environments) of this Evaluation Report.

These habitat requirements must be addressed by the Proponent in a Habitat Restoration Plan which must be submitted to me for approval within 6 months of the date of this Evaluation Report (or an alternative date agreed in writing by the Coordinator-General). That Habitat Restoration Plan must set out auditable rehabilitation benchmarks that describe the habitat characteristics and attributes to be achieved at defined milestones. I have further required that prior to the commencement of Principal Construction Works, the proponent must provide a certification by an independent, appropriately qualified person approved by the Coordinator-General, that the relevant rehabilitation benchmarks have been achieved.

The Proponent must document on the Land Use Master Plan required in Condition 2, Schedule C, Appendix 1 how these lands will be restored with habitat or otherwise used. Within 12 months of the date of this Evaluation Report or an alternative date agreed in writing by the Coordinator-General, coordinates for the protected habitat areas and wildlife corridors must be identified. I note that these protected habitat areas and wildlife corridors may also be used for vegetation management offsets as required in the conditions in Schedule A, Appendix 1, *operational works for clearing native vegetation*.

The proponent has suggested in their Response to Information Requests report some riparian management approaches that may be incompatible with the above requirements, suggesting that controlled grazing may assist in managing the vegetation mass in the area between FSL and the actual water level at any time. In addition, the proponent suggests that agricultural activities could take place on the balance areas of land that would fall within the inundation area buffer but outside the areas of protected riparian habitat. I agree that the control of terrestrial vegetation in the area below FSL may be desirable to avoid impacts on water quality when the area is subsequently inundated, especially DO levels. Additionally, subject to suitable practices and controls and demonstrated water quality and habitat outcomes as part of the approval process for the Land Use Master Plan, as per Condition 3(b)(iv) Schedule C, Appendix 1, it may be possible for the proponent to allow limited agricultural activities on the balance areas. I will consider proposals for controlled agricultural use. Such proposals would need to include management trials to demonstrate that such management approaches would provide enhanced ecological and/or water quality benefits via the Land Use Master Plan for the inundation area buffer. Any such proposals below or within 100 m of FSL would need to include details of rotational grazing control for defined periods across relatively small areas through the use of relocatable fencing such as electric fencing, and monitoring to ensure that there would be no adverse ecological impacts on species or protected vegetation.

I note that the position of the Q100 line may change both with flood mitigation procedures to be agreed with stakeholders as discussed in Section 3.2, and as the flood modelling is refined with time. The location of the inundation area buffer and protected riparian habitat boundaries must be defined through legally enforceable boundary definition and mapping, and in a form that can be checked in the field as per Condition 3(b) and 4(a) Schedule C, Appendix 1.

In recognition of risks and uncertainties associated with the biological needs and ongoing threatening processes relating to endangered, vulnerable or rare (EVR) aquatic fauna, I consider that further precautionary habitat creation measures are required over and above the required creation of new habitat within the Project Area to mitigate the loss of inundated habitat. I am therefore requiring, at Condition 5, Schedule C, Appendix 1, that the proponent causes the establishment, protection and maintenance of further protected riparian habitat and associated in-stream aquatic fauna refuge areas outside the Project Area throughout the catchment via a Catchment Enhancement Program. The Catchment Enhancement Program must be funded by the Proponent to a total of at least $10 million and be designed and implemented to create protected riparian habitat areas preferably be distributed across all, but in at least 2, of the following locations:

- Mary River Turtle nesting areas on the banks of the Mary River as verified by the chief executive administering the *Nature Conservation Act 1992*

- both banks of the Mary River from one kilometre downstream of the Project dam wall to the Amamoor Creek confluence

- priority Mary River Cod recovery areas[27] (which may also be relevant to Queensland Lungfish recovery) selected from the following: Six Mile Creek from Lake McDonald to Mary River Junction, Tinana Creek from the mouth of Goomboorian Creek (Anderleigh Road) to Teddington Weir, Coondoo Creek from Windsors Road to the junction with Tinana Creek, Obi Obi Gorge from Lake Baroon to Skene's Creek (or Baxter Creek), Amamoor Creek from McGills Creek to Amamoor.

- areas within the Mary River Catchment occupied by the Giant Barred Frog as verified by the chief executive administering the *Nature Conservation Act 1992*

That habitat must be created by protecting existing remnant native vegetation, restoring native vegetation and controlling and where possible eradicating weeds. The protected riparian habitat must be

[27] As set out in Table 4.5, Mary River Catchment Coordinating Committee "*Mary River and Tributaries Rehabilitation Plan Implementation Edition*" 19 July 2001

created along bank stretches individually of not less than 100 m in length to establish areas of protected riparian habitat with a minimum width of 30 m (and desirably 60 m where achievable) from the waterway edge. Where the protected riparian habitat areas include Mary River Turtle nesting areas, the Mary River Turtle nesting areas may remain uncovered by vegetation, and must be surrounded by suitable protective measures including native vegetation and predator and stock exclusion fencing on the non-riparian boundaries.

I consider it desirable that local community groups, landholders, and government agencies become involved in the Catchment Enhancement Program and I have set out in Condition 5(b), Schedule C, Appendix 1 my requirements for the Catchment Enhancement Program to be developed in consultation with a steering committee, including representatives of the relevant government agencies and community groups involved in catchment management and/or land management in the Mary River catchment. The Catchment Enhancement Program must identify all actions necessary to achieve the required outcomes, demonstrate that the actions are adequately funded, and include benchmarks against which progress can be verified.

The ongoing protection and management of the aquatic refuge areas associated with all required protected riparian habitat must include weed control, vegetation propagation, snag creation and other relevant land control and/or management measures (i.e. that enable positive actions such as weed control and limit land uses, such as cattle grazing, which would adversely impact on riparian vegetation).

I note that the proponent proposed buffer areas of 2,470 ha and a flood margin out to the 1 in 100 AEP inundation extent within which land use controls would apply. The area between FSL and the 1 in 100 AEP inundation extent is 3,687 ha based on table 4-11 of the EIS. Together, the buffer area and flood margins proposed by the Proponent cover a similar land area to that I have conditioned in regards to the inundation area buffer, however I have required that the inundation area buffer be the greater of the 1 in 100 AEP inundation extent or 100 m from FSL.

I have set stringent conditions governing the land uses permitted within the inundation area buffer. I have required the creation of protected riparian habitat over 80% of the western part, and over 30% of the eastern part, of the inundation area buffer. The final area of protected riparian habitat will be determined in accordance with my conditions, and subject to my approval during detailed design but is anticipated to be of a similar magnitude to the Proponent's proposed buffer area of 2,470 ha after my upstream and downstream requirements set out for the Upstream and Kybong protected riparian habitat are satisfied. The final boundary locations will be incorporated within the Land Use Master Plan required in Condition 2.

I note that I have been more conservative in considering the impacts of potential agricultural activities in these buffer areas than the approach proposed by the Proponent, and in particular, require that no agricultural activities are to take place in protected riparian habitat areas. Some agricultural activity may be possible within the balance of the inundation area buffer not covered by protected riparian habitat subject to the controls discussed above. In regards to any conversion of current agricultural land back to native vegetation habitat that exceeds the areas set out in the EIS and SREIS, I have required in Condition 31, Schedule C, Appendix 1 measures that will not only assist in riparian protection but also provide greater agricultural productivity.

I consider, based on the material presented to me, that provision for the protection and re-establishment of native vegetation set out above is essential to provide mitigations in direct response to predicted Project impacts. My conditions in regards to buffer requirements, riparian habitat and wildlife corridors are directed at enhancing habitat values around and within the inundation area. The buffer requirements will provide significant mitigation for the conversion of degraded riverine habitat to lacustrine aquatic habitat with substantial and enduring fringing riparian habitat, with resulting advantages for native species increasing over time. The establishment of extensive riparian buffers and related in-stream restoration within the Project Area, both upstream and downstream of the inundation area, will provide bank stability and water quality improvements but most importantly will provide enhanced habitat compared to the current situation for a range of important and vulnerable species including the Giant Barred Frog.

I consider that the successful provision of these areas of required riparian habitat and wildlife corridors within the Project Area will provide direct mitigation and offset measures for predicted Project impacts. However, to address any remaining risks and uncertainties associated with the biological needs and ongoing threatening processes relating to EVR aquatic fauna, I require further precautionary habitat creation measures to be provided through the Catchment Enhancement Program. I estimate that the additional protected riparian habitats created under the Catchment Enhancement Program and associated refuge areas are likely to relate to at least 20km of stream length (as per the current structure of creeks and rivers) within the Mary catchment and deliver in the order of 250 ha of associated riparian vegetation to provide catchment wide benefits. Any potential minor impacts on agricultural production must be considered in light of the environmental benefits and the measures noted above that I have conditioned in Condition 31, Schedule C, Appendix 1.

The purpose of the VM Act is to regulate the clearing of vegetation in a way that, amongst other things, conserves remnant regional ecosystems, prevents the loss of biodiversity and maintains ecological processes. This is consistent with the outcomes I am seeking in relation to protected riparian habitat, however in addition I have considered water quality and fauna habitat outcomes for specific species. Where both the VM Act and my conditions can be addressed, I am satisfied that the areas of protected riparian habitat and wildlife corridor can be used to satisfy the vegetation offsets requirements in Schedule A, Appendix 1, requiring vegetation offsets of at least 780 ha.

As a result, if additional VM Act offsets are required outside of the Project Area, that area is likely to be considerably less than 780 ha. I consider that any agricultural impacts that result from this additional vegetation offset requirement are acceptable when balanced against the environmental benefits provided. I note also that any lands beyond the Project Area must already be held by the proponent or secured on a voluntary basis.

At the time the EIS was prepared, the Project was located within the LGA boundaries of Cooloola, Noosa and Maroochy. Following local government amalgamations in 2008 the Project area is now within the new GRC and the SCRC. The previous Cooloola Council was a part of the GRC amalgamation and the previous Noosa and Maroochy Councils were included within the SCRC amalgamation. I understand that the Cooloola, Noosa and Maroochy planning schemes will continue to apply in the interim until new schemes are implemented by the GRC and SCRC.[28] The majority of the Project Area is located within the old Cooloola LGA which contains 95% of the inundation area, dam wall and majority of the associated road realignment works and flood margin area.

The South East Queensland Regional Plan (SEQRP) provides a strategic framework for the sustainable management of growth in the SEQ region including the need for the timely provision of regional infrastructure to support the existing and future population in the region. The SEQRP provisions affect those parts of the study area located in the SCRC LGA. I note that the SEQRP incorporates by reference the SEQ Regional Water Supply Strategy (SEQRWSS), which aims to balance water demands and supplies in the region. The Project is also included in the South East Queensland Infrastructure Plan and Program 2009–2026 (SEQIPP) which outlines the government's infrastructure priorities for the SEQ region to support the SEQ Regional Plan. SEQIPP anticipates the Project will be delivered over the period 2009-2019, including mitigation measures required prior to construction of the dam wall.

The Wide Bay-Burnett Regional Plan 2007-2026 (WBBRP) provides a regional framework for growth across 22 local government areas in the region, including the then Cooloola LGA. The WBBRP addresses the need for long-term water supply strategies, including the Project, to provide flood mitigation for downstream communities and to supplement water supply for SEQ.

I also note that the Project is included in the *Water Regulation 2002* as one of a number of measures to be carried out to ensure the security of essential water supplies for the SEQ region, consistent with the above regional planning measures.

[28] s42 *Local Government Reform Implementation (Transferring Areas) Regulation 2007*

The preferred dominant land use for the majority of the area directly affected under the Cooloola, Noosa and Maroochy LGA planning schemes is mainly for sustainable rural production with some areas preferred for environmental protection.

I find that the relevant State and Regional planning documents support the Project, and while the relevant LGA planning schemes do not directly address the Project, planning requirements do not prevent the Project from proceeding providing relevant impacts can be suitably addressed. When considering those impacts, as documented in this report, I have paid close attention to the protection of the environment and the preservation of rural land use and rural character as far as possible given the impacts of the Project. These matters are addressed in the relevant sections of this report.

Land tenure in the Project Area is largely freehold, with a small proportion of land held under leasehold tenure and as reserve. No petroleum exploration tenures and forest reserves have been identified. State Planning Policy (SPP) 2/07: Protection of Extractive Resources lists Key Resource Area (KRA) No. 89 – Moy Pocket with a buffer area that includes a section of the upper reaches of the inundation and land purchase areas on the Mary River. That buffer area is intended to protect the KRA from adjacent inappropriate development and I consider that the Project will not constrain the extraction of resources from the KRA. SPP2/07 obliges the proponent to not undertake or permit any activity, which would constrain the extraction of the KRA resources, on lands under the proponent's control within the separation area of the Moy Pocket KRA 89.

An Exploration Permit for Minerals held by Gympie El Dorado Mining Pty Ltd (EPM 14860) partly overlies the dam inundation area and buffer zone. The exploration permit was granted prior to the announcement of the project on 28 February 2005 with an expiry date of 22 February 2010 and the existing exploration permit holder's rights persist until the area is surrendered or the permit expires. I am informed by the proponent that the permit holder is aware of the Project and has no concerns in regards to any impact on the exploration permit.

The Project Area is characterised by rural land use comprising predominantly dairying and grazing, with a smaller area for irrigated cropping located mainly on the Mary River. Rural residential land is located near the dam wall, around Kandanga, in the upper reaches of the Coles Creek arm and in two other small areas.

The proponent intends to purchase directly affected tenures by commercial negotiation in the first instance and if agreement cannot be reached, the proponent intends to request the Coordinator-General to exercise compulsory acquisition powers under the SDPWO Act. I note that the proponent is also acquiring some properties that would be affected by Stage 2, should it proceed, where requested by property owners in order to provide certainty. That is not a matter I am considering in this report as it is not part of this Project.

Where partial purchase of properties occurs, the ongoing viability of existing land uses may be compromised for the balance area. Additionally around the extremities of the dam, a number of lots will only be partially inundated at FSL. I have imposed conditions as per my Condition 13(d), Schedule C, Appendix 1, to ensure that the proponent considers consolidating smaller lots and leaseback arrangements to achieve lot sizes that are considered viable for rural uses where practicable. The majority of the Project area is located within the old Cooloola LGA and I note that the Cooloola Planning Scheme in Schedule 9 requires a minimum lot size in the rural zone of 100 ha.

Changes to access associated with the severance of existing properties are discussed in section 3.8 of this Evaluation Report. The realignment or reinstatement of affected private infrastructure will also need to be incorporated within the Project. I require that consultation must be undertaken with the owners and users, as per Condition 13, Schedule C, Appendix 1 to facilitate the continuation of current land use around the storage area and in the vicinity of road realignments or new roads, and to finalise changes to infrastructure (i.e. realignment, replacement and/or retirement).

I require a complaints and response process for impacts on privately held land that must be addressed in accordance with Conditions 13 and 14, Schedule C, Appendix 1.

The proponent has partnered with the DEEDI to deliver a "Food and Fibre Futures" package which will provide targeted assistance to landholders adjoining the river system in the catchment and particularly adjoining the storage, to develop farm management plans that minimise potential conflict but maintain productivity. This approach is supported and will further assist in ensuring that rural land uses continue to the greatest extent possible. Refer to sections 3.10 and 3.11 of this Evaluation Report for further discussion of this matter.

Whilst the Project FSL will not have a direct impact on land use in Kandanga, flooding will increase on low lying areas on three sides of the town. The extent of those changed flooding impacts, particularly in regards to changed 1 in 100 annual exceedance probability (AEP) inundation extents, may vary depending upon agreed final flood mitigation approaches for Gympie as discussed in section 3.2 of this report. Flood levels will increase as a result of the Project and a number of low-lying properties and residences in Kandanga will be affected as shown on Figure 6-39 of the EIS. I have been advised that 16 houses within Kandanga are fully or partially below the 1 in 100 AEP inundation extent with dam flood line. 14 of these are owned by the proponent who remains ready to purchase the 2 remaining properties. I have conditioned, at Condition 3(a), Schedule C, Appendix 1, that the proponent must have tenure over all lands not retained by the State within the inundation area buffer, which extends from the edge of the inundation area FSL to the greater of a horizontal distance of 100m from FSL or to the 1 in 100 AEP inundation extent, prior to the commencement of Principal Construction Works. Acceptable tenure arrangements includes water storage easements as an alternative to freehold for relevant areas within the inundation area buffer.

I note that, in accordance with the proponent's land purchasing policy, the proponent will assist property owners who wish to retain the unaffected parts of a lot to ensure their continued land usage is viable. I require, at Condition 8(e) and 8(f), Schedule C, Appendix 1, that property owners (who have partially affected lots) must be consulted in relation to the finalisation of detailed operational rules relating to downstream flood mitigation, as discussed in section 3.2 of this report.

The SREIS notes that the proponent has worked with local Kandanga groups and provided funding and support including sponsorship of a bowls competition, painting shopfronts, a new public toilet with disability access, bus pull-in bays, and air conditioning for the general store, Friends of Kandanga shop and the Kandanga Fire Brigade control building. The proponent is consulting with the GRC on an upgrade to the sewerage and water supply to Kandanga, and concept plans have been developed for the relocation of the Kandanga Bowls Club for which the proponent has agreed to contribute at least $2.5 million to the new facility, which I have conditioned at Condition 32(l), Schedule C, Appendix 1.

The proponent has recommended that the Cooloola Shire Planning Scheme be amended to include additional land in the "Village" designation and the "Community" designation. Such an amendment would assist in the mitigation of any impacts from changed land use as a result of changed flooding impacts. The proponent has recommended mitigations including the re-location of community facilities such as the public swimming pool, sports ground and possibly the Kandanga Memorial Hall. This appears to me to be a desirable outcome provided these measures have the support of the people of Kandanga and the GRC. The proponent suggests that provision should also be made to develop a new main street for the Kandanga township, where commercial, retail and community facilities can be located to promote a renewed focus and identity for the township.

I have therefore required at Condition 32(a), Schedule C, Appendix 1, that within 12 months of the date of this Coordinator-General's Evaluation Report, the proponent arranges for an independently facilitated consultation process with the people of Kandanga and the GRC to establish an Urban Development Master Plan for Kandanga's redevelopment.

I have conditioned, within Condition 32(c) Schedule C, Appendix 1, that providing Kandanga and GRC support can be demonstrated as discussed above the proponent must provide at least $3.5 million toward the development and implementation of the Urban Development Masterplan for Kandanga, which must include the following measures:

- provision of a replacement swimming pool
- development of sports fields

- public hall facilities
- relocation and/or upgrade of the Kandanga rural fire brigade headquarters and training facilities
- other measures selected from options identified through the abovementioned independently facilitated consultation process.

I require at Condition 32(h) - 32(k), Schedule C, Appendix 1, that in regards to the provision of flood mitigations for the Kandanga Cemetery opportunity is provided to members of the Kandanga community and those with a direct connection to the cemetery to determine by consensus the preferred approaches. I have also included the approach to be followed if that consensus cannot be achieved.

I have also required at Condition 32(m), Schedule C, Appendix 1, that the proponent provides funding of at least $4 million and ensure the upgrade of sewage and water supply for Kandanga prior to the Completion of Construction.

The EIS notes that the Project will result in the loss of an estimated 3.2% of land used for intensive agricultural purposes (including intensive animal production, cropping, and horticulture) in the Mary River Catchment. This includes 6.2% of the land used in the catchment for intensive animal production (including dairying). The Project operational area will also reduce the area of available GQAL by 3827 ha, which is 1.7% of GQAL in the Mary Valley River catchment. SPP1/92: Development and the conservation of agricultural land seeks to protect GQAL from incompatible land use and subdivision unless there is an overriding need in terms of public benefit and no other site is suitable.

Land within the inundation area buffer will be under the proponent's control and is required to be managed to protect water quality in the dam and to provide riparian habitat. The inundation area buffer will contain protected riparian habitat within which remnant native riparian vegetation must be protected and native riparian habitat restored as discussed above. I have set out my requirements in Condition 3(b) and 3(c), Schedule C, Appendix 1 for the approaches to be followed if the proponent wishes to propose agricultural activities within the remaining balance of the inundation area buffer. Other than specific conservation offsets and wildlife corridor requirements, the land beyond the inundation area buffer and protected riparian habitat, not under the proponent's ownership, is not subject to any additional land use controls as part of the Project, and land use will continue to be controlled by the relevant State, Regional and Local Government planning provisions. Therefore, the Project will not preclude land other than the inundation area buffer and protected riparian habitat, or other specifically targeted offsets and wildlife corridors from being used for farming activities.

A Vegetation Management Offset (VMO) strategy is being developed for the Project to offset impacts to significant regional ecosystems and vegetation communities. I have required, as conditioned at Schedule A of Appendix 1 at least 780 ha of land be used to offset impacts on remnant vegetation and consider the environmental benefits provided by this offset any additional adverse impacts on agricultural lands including GQAL. The VMO strategy environmental benefits are considered in Section 3.3 of this Evaluation Report.

The proponent has proposed that timber plantations are used to offset the carbon emissions associated with the construction of the Project as well as provide a range of other environmental and operational benefits, and committed to establish timber plantations of more than 2000 ha over time. Studies presented by the proponent suggest that there is good potential for forestry development. The proponent has further suggested that such a development would contribute to the local community, as well as broader government and industry objectives to transition the native forest industry from State forests to a resource based on plantations and private forests.

While I accept the potential benefits of this timber plantations proposal, I require, as conditioned at Condition 2, Schedule C, Appendix 1 that provision for the timber plantation be included within the Land Use Master Plan.

A construction site will be located in the vicinity of the dam wall to accommodate site offices, worker facilities, concrete batching plant, maintenance and minor repairs. I have required at Condition 30, Schedule C, Appendix 1 that a construction accommodation camp be provided for at least 200 workers.

The proponent has noted in the EIS the potential for any accommodation camp to be used after construction has finished for beneficial purposes such as an education centre or tourist accommodation. I support this approach provided it is compatible with the objectives of the SCRC or GRC as appropriate and require that the proponent consult with the relevant local government in regard to the proposed construction accommodation camp.

Construction of new roads and changes to existing roads will cause land use changes, but these impacts have been reduced where possible by locating new roads on land already impacted by purchase arrangements.

I note that the Mary Valley Heritage Railway line will not be inundated by the Project, and that a 1 in 100 AEP flood event will not compromise the flood immunity of the railway line. Kandanga Creek Road, which currently passes underneath the railway line, will need to be realigned and this is dealt with in the section 3.8 of this report.

Existing power and telecommunications infrastructure will be affected by the Project and the EIS describes how the required relocations will be undertaken. The proponent will be required to liaise with utility owners including Energex, Telstra, GRC, SCRC and Powerlink during detailed design and realignment of infrastructure and the relocation costs. Infrastructure relocation activities will occur in accordance with the respective legislative and environmental codes of practice of the utility undertaking the relocations.

Topography and geomorphology

Key topography and geomorphology issues raised in submissions that I considered along with other relevant matters included sediment movement predictions, sediment processes downstream, potential flow related increases in riverbank and bed erosion downstream and resulting impacts, and erosion within the inundation area.

The Mary River rises between the Conondale and Blackall Ranges, about 15 km west of Maleny. The Mary River has been subjected to repeated episodes of channel down-cutting and refilling due to sea level change and changes in rainfall and runoff patterns. The present river bed is thought to be about 5 to 10 m above that level of maximum incision and is broadly set within three terrace levels. Significant meanders and complex reversals of stream direction occur, related to exposed bedrock controls.

The zone upstream of the inundation area has steep banks, and generally has a sand and gravel bed substrate with transient sand and gravel bars subjected to scour and fill processes. High rates of bank erosion occur and are due to natural causes, sand and gravel extractions and stock access. Runs and pools are dominant within the inundation zone but with many riffles and glides with occasional bedrock outcropping. The pools are variable in length and depth, but dominated by deeper pools.

Downstream of the inundation area to the barrage backwater zone the river is generally broader but incised with occasional rock outcrops controlling the riverbed level, and is confined in some reaches and elsewhere flows through wider alluvial flats with a variety of in-channel habitat features. Processes of migration and cut-and-fill are active in these alluvial reaches, with mainly sand and gravel bed material. Bank erosion is widespread throughout due to natural causes, sand and gravel extraction, riparian vegetation loss and uncontrolled stock access. Pools are the dominant within-channel habitat, with riffles and runs with occasional rapids present. The susceptibility to bank erosion varies and is very high in a number of locations.

The Mary River Barrage has resulted in a freshwater pondage with relatively stable water levels extending some 26 km upstream. The barrage structure is completely drowned out at flows of approximately 2000 m^3/s, which maintains sediment movement downstream in the long-term. Within the barrage reservoir, bank erosion is very severe due to natural processes, sand and gravel extraction, riparian vegetation loss, uncontrolled stock access, elevated water level and power boat use.

The Mary River estuary upstream to the barrage is tide-dominated and highly modified due to the Barrage. Key estuary habitats include intertidal flats, mangroves, salt marshes and tidal sand banks.

The Project will have no impact on the magnitude or duration of flows beyond the upstream limit of storage. Nevertheless, there will be a transitional zone in the vicinity of FSL along the Mary River and flooded tributaries where incoming flows will slow as a result of backwater effects when the reservoir is at or above FSL. Sediment deposition will occur in this zone, both within the channels and on the floodplains. The inundation zone will act as a sediment trap retaining all coarse sediment entering the reservoir and a proportion of the suspended sediment. Bedload sediments entering the dam will tend to be carried into the reservoir to or just above the water level at the time where they will be deposited as a series of 'slugs' in the channels and over time, existing stream channels below and just above FSL may become blocked and a series of deltas could form. The increased deposition of sediment in this zone may lead to pool infilling, smothering of riffle habitat with finer sediment, a reduction in the extent of current riffle habitat, sand bar build up and channel constriction and associated concomitant vegetation encroachment.

The EIS found that deposition of this sediment would only have a minor impact on dam volume, with a 0.15% reduction in dam capacity occurring each year. I note that this is a significant volume of material if such deposition occurs, and that it is based on estimations and previous studies, rather than direct, Project-specific field observations. I therefore require that that the proponent undertakes sediment movement monitoring both upstream and downstream of the proposed reservoir area in the period before construction commences. These measurements of actual sediment movement will provide a better assessment of the likely sediment in flows to the reservoir and better inform required geomorphology mitigation measures downstream. I also require that these monitoring results are used to assess anticipated quantities of useful soil, sand and gravel that may be extracted from the area of inflow to the reservoir during project operations. This would both protect against reductions in dam capacity while providing material useful for both project mitigations and generally for the construction industry. The studies must consider the detail of how such material would be extracted, and the subsequent impacts on dam capacity due to sediment inputs. I have therefore required in Condition 15, Schedule C, Appendix 1 that the proponent must submit a Bank Erosion and Sediment Management Plan prior to the commencement of Principal Construction Works. The Plan must include modelling, assessment of sediment flows into the reservoir and downstream, identification of quantities of sediment that may need to be extracted from the reservoir during project operations and any additional geomorphology mitigation measures required downstream.

Existing habitat in the inundation area will be drowned, although new but different habitat will establish in the reservoir in time. As part of Condition 15, Schedule C, Appendix 1, monitoring both upstream and downstream of the inundation area is required to ensure that bank condition and therefore habitats outside of the inundation area are maintained and impacts on habitat quality and diversity are minimised. In addition, the Proponent has committed to recreating sand bar habitats along the margins of the inundation area and on islands created by inundation, using sand sourced from the upstream sections and immediately upstream of the inundation area. I support those commitments but additionally require in Condition 4, Schedule C, Appendix 1, extensive protected riparian habitat that will assist in mitigating and offsetting the impacts on the inundation area habitat. I have also required, at Condition 5, a catchment enhancement program that obliges the proponent to achieve further riparian habitat protection through voluntary arrangements outside of the Project Area. These matters are discussed above in relation to the inundation area buffer and protected riparian habitat requirements within the Land Use and Tenure section of this Evaluation Report.

The EIS also notes that the trapping of sediment by the dam will cause a major reduction in fine and coarse sediment load from the dam wall downstream to the Amamoor Creek confluence, which may cause 'clearwater' scour. Changes to flow characteristics may also lead to increased bank and bed erosion in this zone. This part of the Mary River contains important aquatic habitat, and it will become even more critical that this habitat is protected given the habitat changes that will happen in the inundation area, as discussed in section 3.4. I consider it critical that the bank and bed stability in this part of the Mary River is managed to protect aquatic habitat. I have discussed above that that the proponent must undertake sediment movement monitoring both upstream and downstream of the proposed reservoir area in the period before construction commences. These measurements of actual sediment movement will provide a better assessment of the likely sediment in flows downstream of the reservoir and better inform required geomorphology mitigation measures downstream. Those studies must be provided to me in the Bank Erosion and Sediment Management Plan before Principal Construction Works proceed.

The value of this aquatic habitat will be dependent on the nature of adjacent riparian habitat on the banks and, as described below, I require that adjacent riparian habitat downstream from the dam wall must be thoroughly assessed, rehabilitated and enhanced within the first kilometre downstream of the dam wall on land owned by the proponent (the Kybong Riparian Protected Habitat Area). In addition, riparian habitat should be further rehabilitated and enhanced where voluntary arrangements can be made with landowners further downstream, or as required following ongoing monitoring.

The Project Area is predominantly contained within the previous Cooloola LGA. The former Cooloola Local Government Planning Scheme (which continues to apply to the previous Cooloola LGA) contains a Code which I believe provides useful guidance on what protections are required. The *Cooloola Natural Waterways and Wetland Area Code* considers how to protect natural waterways from adjacent development. I consider that the measures discussed in PS-2 of that code are desirable adjacent to the Mary River, especially in terms of this Project from the dam wall downstream to Fisherman's Pocket . Those requirements are that vegetated areas comprising existing vegetation and new plantings must be provided for at a minimum width of 50 metres along each bank of the Mary River, and in-stream habitat features and overhanging waterway vegetation are preserved. I note that PS-7 in the *Code* requires that landscaping works must retain all existing remnant vegetation and use only local indigenous species in new planting. These requirements are similar to those set out in my Condition 4, Schedule C, Appendix 1 although I have provided for more extensive riparian vegetation around the inundation area.

The required protected riparian habitat directly downstream of the dam wall (the Kybong protected riparian habitat) and my further requirements for the area downstream to Fisherman's Pocket, in Condition 15 will not only protect and enhance habitat, but also, consistent with the assessment presented in the EIS, will reduce the risk of bank erosion resulting from changes to flow and sediment loads. I require monitoring to be implemented to confirm that acceptable outcomes have been achieved. Further mitigation measures in response to monitoring must be sufficiently specified and detailed to ensure certainty as to the measures to be implemented if specified trigger thresholds are exceeded.

Reduction of intermediate flows may encourage the expansion of sand bars and resulting encroachment of riparian and within-channel vegetation. Within-channel vegetation has a flow diversion effect which may instigate localised bank and bed erosion immediately downstream of the inundation area. I require that this impact be primarily managed through the riparian habitat protection measures I have imposed to apply to the Kybong Riparian Protected Habitat Area in Condition 4(e), Schedule C, Appendix 1.

Additionally the spillway discharge channel may affect stability of the bank opposite the discharge point. I have required in Condition 15(b) that the Proponent design the spillway outfall and outlets from bridges, culverts and drains to minimise erosive flows and downstream disruption and provide erosion protection. This may require the angle of spillway to be considered in detailed design work and the bank opposite may need to be armoured.

Rates of sediment input to the Mary River have increased since European settlement and heavy siltation in certain reaches has occurred. Only 10% of the catchment is made up of remnant vegetation or national parks, with the remainder consisting of land uses dominated by grazing, forestry, rural residential, cropping, urban development and horticulture. Large volumes of sediment are transported during high flow events. The banks of the Mary River are prone to erosion due to a number of factors including groundwater flows through the bank causing undermining, lateral migration of the river, rapid hydrograph recession causing bank slumping, removal of bank vegetation and sand and gravel extraction activities. Uncontrolled stock access and scour around in-stream woody debris are also causes of bank erosion.

The erosion, transport and deposition of sediment along the Mary River and to the Great Sandy Strait are important components of fluvial geomorphology and the overall sediment balance of the Mary River catchment. The EIS has noted that sediments from the Mary River are supplied to the Great Sandy Strait and transported northwards by tidal currents where they are deposited to mix with continental shelf and shoreline sediments.

The magnitude of hydrological and sediment transport impacts will reduce with distance downstream from the dam, and it is likely that any impact on erosion, deposition or habitat maintenance processes would also diminish. The EIS findings indicate that any impacts in the Gympie and Barrage backwater zones (downstream of the Amamoor Creek confluence) are unlikely to cause any significant change from current conditions.

The EIS found that the Project would cause minimal overall change to sediment levels in the estuarine zone, suggesting that significantly increased sediment delivery since European settlement would have contributed to increased sedimentation in the estuary and that accelerated deposition of material has probably occurred in parts of the northern Great Sandy Strait. The EIS further suggested that considering other estuarine flow and sediment influences and variability, it is unlikely that the processes of formation of banks and bars, and the distribution of size fractions would change significantly over the expected life of the Project.

Studies presented in the EIS and SREIS assess the impacts of the Project on changes to sediment transport in the Mary River and any subsequent impacts on sedimentation processes in the Great Sandy Strait.

Those studies were based on a spreadsheet-based application of the SedNet model and drew on the results of two previous SedNet model studies undertaken by the then DNRW and CSIRO. The two previous studies reached different conclusions about the magnitude of pre-dam sediment transport down stream reflecting a number of uncertainties in the assumed model inputs. The EIS study concluded that while there was some uncertainty about the actual quantity of both existing and post dam sediment movement the studies did provide a reasonable estimate of the broad scale sediment-related changes expected from the Project.

The studies found that that the Project will result in a large reduction in coarse sediment load immediately downstream of the dam, and a slight reduction in coarse sediment at the mouth of the River as about 60% of the suspended sediment in the Mary River enters the river downstream of the Project. It was found that that there will be minimal impact on morphology of the river mouth, estuary or supply of sediment to the Great Sandy Strait. It was also found through the model studies that any minor reductions to sediment supply to the estuary and Great Sandy Strait would partially return sediment delivery rates towards pre-European settlement levels.

The proponent has also provided correspondence from CSIRO who reviewed the sediment studies undertaken. I note that CSIRO found that the modelling undertaken was appropriate for the task, the procedures used were fully described and justified, and the interpretations were sound. CSIRO also observed that their reviews indicated that at the estuary, the consequences of the Project are insignificant relative to the current situation.

As discussed in Section 4.7 of this Evaluation Report, two of the Commonwealth reviewers concur with this assessment. For example, Professor Walker advised that:

> *"…it is difficult to identify likely changes (to the estuary) that could confidently be ascribed to dam operations, and none is likely to be on a scale to match the specifications in the (EPBC Act) guidelines."*

CSIRO recommended that SedNet modelling be used as part of post-construction monitoring and management. To inform the ongoing development of mitigation measures, <u>I require</u> more accurate estimates before Principal Construction Work proceeds. <u>I require</u>, at Condition 15 that estimates are further developed, informed by further monitoring data to better understand sediment flows into the reservoir and potential sediment related impacts downstream. I have not formed a view on the appropriate method of analysis required, and have left it to the proponent to justify the approach followed.

Based on the information provided to me, including the findings of the Commonwealth Reviewer Reports, I am satisfied that it is unlikely that the Project will have any discernible adverse impact on the Mary River estuary. However, given the ecological significance of this area, and consistent with the precautionary approach <u>I require</u> at Condition 24, Schedule C, Appendix 1 that the Proponent develop an estuarine monitoring program for my approval prior to the extraction of Project Yield. My specifications for this program require monitoring to be implemented to continue to confirm that there are no discernible adverse impacts on the Mary River estuary.

The Estuarine Monitoring Program requires the inclusion of threshold criteria based on an understanding of the estuarine environmental values, its natural processes, and potential threats. Should the Estuarine Monitoring Program indicate set threshold criteria are being exceeded and adverse impacts may be fully, or partially, attributed to the Project then mitigation actions must be implemented by the proponent.

The Estuarine Monitoring Program monitoring activities are to commence prior to the commencement of operations. The Estuarine Monitoring Program must be maintained for at least the first 5 years after Extraction of Project Yield, however I may require this time be extended.

The Proponent must submit ongoing reports to me on the findings of Estuarine Monitoring Program, as part of the report required in Condition 24, Schedule C, Appendix 1. The reports will assess the monitoring data against the thresholds identified in the Estuarine Monitoring Program.

Geology and soils

Key geology and soils issues raised in submissions that I considered along with other relevant matters included the potential for leakage and seismic activity at the dam wall, the potential for increased erosion and sediment transport, the inundation of rural land, especially GQAL and the reuse of disturbed topsoil.

Geological investigations at the site found that the basement rocks form a good foundation for the dam wall. The right abutment is underlain predominantly by medium to high strength rocks at depths of seven metres and is a suitable site for the concrete spillway structure. The left abutment is underlain by foundation materials at a depth of two metres suitable for the construction of an earthfill embankment. The main dam wall crosses alluvial materials of the terrace and channel environment, and suitable foundations occur at a depth of between 15 m and 26 m.

There are no acid sulphate soils or materials with acid sulphate potential in the area likely to be affected by the Project. The EIS notes that acid sulfate soils have not been noted in soil surveys, and that potential acid sulfate soils are most common along the coastline at elevations less than 5 m AHD and would not be expected on land within the Project Area.

The EIS identifies a range of sources for required construction materials from quarries and borrow pits from within the Mary River Valley and construction site area. The SREIS notes that construction materials will be obtained, where possible, from within the Project Area from extraction operations and borrow pits in the inundation area. Varying qualities of clay, sand, rock and gravel are required and further geotechnical testing needs to be undertaken to confirm that sufficient quantities are available. If the material within the Project Area is found to be unsuitable or insufficient, it is likely that some concrete aggregate and riprap material will be sourced from Meadvale Quarry and Moy Pocket Quarry. Those quarries operate under their own approvals and are not part of this Project, although in relevant areas of the EIS (e.g. materials haulage within the transport section) the impacts of quarry access have been considered.

The EIS states that soil, sand and gravel resources which will not be used for the Project, will be made available to the commercial market, and that those materials will be stockpiled in areas free of flood risk. This is addressed by the processes set out in the EIS and SREIS. The then DNRW advised me that the extraction of soil, sand and gravel resources from watercourses including those within the inundation area is undesirable and application to do so is unlikely to be approved. There are however likely to be soil sand and gravel resources within the inundation area but outside of the existing waterways. I consider that access to any of those materials surplus to project needs is desirable. While I would encourage the proponent to facilitate such access it is up to interested parties to investigate the potential for use of material in the Project Area and to address any necessary approval requirements. I have required at Condition 7(c), Schedule C, Appendix 1 that the proponent provide access for reasonable proposals to extract surplus soil, sand and gravel resources from the future inundation area, subject to required approvals being obtained, and except where inconsistent with the conditions in Appendix 1, any other statutory approval or Project construction requirements.

The Project is in a low earthquake risk area based on historical ground-acceleration measurements in the area. Two independent studies of the geological conditions at the dam site noted shear zones in the basement rock but that these structures are geologically very old and have been solidly fused for probably millions of years with no movement in the last 20,000 years at least. These studies will inform the design of the dam to ensure the structure can withstand ground movement considerably greater than that expected in the area.

Minor erosion due to wavelet action at the edge of the stored water body may occur, especially when dam water levels fall below FSL and expose unvegetated bank materials. The susceptibility of soils at the interface of the inundation area have been identified to generally have a low erosion potential, with areas most susceptible to erosion being adjacent to steeper slopes. However, areas with dispersible subsoil have been identified within the storage along the boundary of the FSL, as well as downstream of the dam wall.

In addition to potential wavelet erosion, those areas cleared and/or disturbed during the construction phase may also be susceptible to erosion by overland flow when dam levels are low, if not properly managed.

The proponent is required in Condition 7(a), Schedule C, Appendix 1 to maintain vegetation within the flood margins around the FSL to ensure the stabilisation of soil and to reduce raindrop impact erosion and runoff velocities, which would likely result in the detachment and transport of soil particles. Furthermore, I have required in Condition 16, Schedule C, Appendix 1 sediment and erosion control measures for any construction activities that will potentially expose or disturb soils and geological materials.

The Project Area has been identified as having areas of low to moderate soil salinity levels based on soil chemistry and groundwater quality. The Project will not increase recharge in the upstream catchment above the storage and therefore will not increase salinity risk. Nevertheless, land salinisation at the margins of the inundation level may occur due to elevated groundwater levels and the barrier to drainage posed by the impounded water. However, with the variation in the water level in the storage this risk is considered low. Dam leakage and discharge downstream are not considered salinity risks due to the high permeability of the river bed enabling flushing and dilution of salts from dam releases and rainfall infiltration.

Erosion and sedimentation may occur from a range of construction activities. All construction activities must be controlled by the implementation of erosion and sediment control plans (including treatment of sediment-laden runoff). The proponent has committed to, and I have imposed at Condition 16, Schedule C, Appendix 1 mitigations to prevent or minimise erosion, and to rehabilitate any areas where erosion does occur as a result of construction of the Project. These conditions include monitoring and reporting requirements to ensure that all instances of erosion are detected and dealt with in an appropriate and timely manner.

Water levels in the reservoir will continually change, however there may be appreciable periods during wet times when the reservoir is at FSL. Erosive wave action induced by wind fetch is unlikely but nonetheless, I require that controls must be implemented in accordance with Conditions 7(a) and 7(b).

Visual amenity

Key visual amenity issues raised in submissions that I considered along with other relevant matters included the impacts of infrastructure changes on the landscape character and visual amenity, and the visual impact of changed views across water.

The EIS notes that the visual catchment contains a predominantly rural landscape that has been substantially cleared of native vegetation in the lower lying parts of the valley, whilst the steeper mountain slopes in the south of the catchment are generally more natural and less altered by human activity. The valley floor is interspersed with undulating hills and several small rural townships, rural residential areas and urban infrastructure such as transmission lines and roads.

The landscape is dominated by rural land use activities largely associated with beef cattle grazing and dairy farming. Dairy farming activities dominate the good quality agricultural land along the Mary River floodplain, its tributaries and the valley floor with cattle grazing occurring on the steeper slopes.

Views are often confined to a relatively short distance due to the undulating landform and the presence of vegetation. A variety of rural land uses can be seen within the landscape with the scenery changing due to seasonal variations, crop rotations and harvesting times. Public views of the Mary River are limited but riparian vegetation marks the location of the river. Public access to scenic vegetated ridgelines in the catchment is limited. Notably public access is available to the Imbil lookout but views are partially obscured by vegetation.

The landscape character and visual amenity of the affected parts of the Mary Valley will be altered by the Project. Some impacts may be beneficial and some adverse. Potential beneficial aspects are largely associated with the landscape and visual effect of the new waterbody. Potential adverse impacts are associated with construction activities, the scale of the dam wall and spillway and the potential loss of upstream riparian vegetation and local creek landscapes.

The visual catchment includes the townships of Dagun, Amamoor, Kandanga, Imbil, and Brooloo and a number of areas of rural residential settlement, as well as areas of State Forest, parts of the Bruce Highway, other potentially affected roads and public viewing sites such as Amamoor lookout and Imbil lookout.

The physical elements and scale of the dam wall and associated engineering infrastructure will have a visual impact, particularly as viewed from downstream. The proposed dam would include a RCC dam wall across the valley floor with a wall height of up to approximately 25 m above ground level, an earth embankment and saddle dam structure on the left abutment and a reinforced concrete spillway on the right abutment.

The proposed access to the dam wall will be via a two lane, two way bitumen road, which will intersect with Traveston Road, and extend approximately 3km in a southerly direction. At this point, the road will cross west over the Bruce Highway via a proposed six span overpass bridge approximately 150 m in length, and continue west for 1km to the location of the proposed dam wall.

Construction activates may also have a visual impact, particularly clearing, material extraction, rock cutting for the spillway, spoil distribution, construction work sites and accommodation, night lighting, and support developments such as concrete batching and road works.

The Project would inundate the main channel of the Mary River for a length of some 36.5 km creating a large body of open water and inundate some parts of local creeks with resulting changes to existing riparian vegetation and local creek landscapes. I note the views expressed in the EIS that these potential new aspects of the visual landscape may increase the variety of views created by the new water body within the landscape, and that many people may consider that this increases the visual amenity of this section of the valley for both surrounding residents and passing travellers. This may well be the case but only if sensitive landscape design is undertaken as a core part of the Project.

Issues have been raised by submitters in regards to views across water, should those waters become stagnant or degraded in quality. I have set conditions in Conditions 8 and 9, discussed in Section 3.2 of this report, to ensure that appropriate water flows and water quality standards are achieved. I am satisfied that the measures required by my conditions, including those within Condition 4, Schedule C, Appendix 1 relating to riparian habitat, will adequately address the concerns raised.

In addition, I require specific mitigation and management measures focused on integrated landscape design and management measures to rehabilitate and restore the new landscape to an acceptable level. I have set requirements in Condition 6, Schedule C, Appendix 1, to ensure that changes are beneficial as far as practicable, and that mitigations are provided to limit any adverse impacts on visual amenity. These requirements include the implementation of management measures to integrate the new structures and the impoundment into the landscape and the development of landscape design plans that will address all Project elements.

Land contamination

Key land contamination issues raised in submissions that I considered along with other relevant matters included the processes used to identify contaminated sites, the remediation of these sites and the need for a Third Party Reviewer.

Contaminated sites within the FSL have the potential to impact on the aquatic organisms and water quality within the dam, and its use for water storage and recreational activity. Once inundated, contaminated soils from these sites will become sediment within the dam. Potential sources of contamination include cattle dips, railway yards, service stations, transformers, septic tanks, farm landfills, chemical storage areas, quarries and a former tin mining area. Contaminated sites located outside the FSL may also have the potential to impact on terrestrial flora and fauna, humans, and water quality and organisms within the dam. Potential contaminant pathways include the erosion and deposition of contaminated soils into the impoundment, and the leaching of contaminants into groundwater, and their subsequent movement into the impoundment.

The EIS documents the results of contaminated land investigations, which included searches of the Contaminated Land Register (CLR) and Environment Management Register (EMR) and aerial photograph interpretation. On-site inspections and sampling were not conducted as part of the EIS studies however, which noted that further assessment would be undertaken if the Project is approved to assess the identified potential contaminated sites.

Potential contaminated land issues in the Project vicinity arise mainly from past mining activities and rural activities including the use of agricultural chemicals. The EIS site investigations screened 597 land parcels through aerial photography interpretation of visible features that could be related to these activities. Of these, 82 were identified as having potential notifiable activities and of these 56 were located within the FSL. Seventeen of the 82 sites were listed on the EMR because of notifiable activities and of these seven were located within the FSL. None of the 17 properties are listed on the CLR

The EIS site investigations included a risk assessment of the 82 land parcels identified as potentially contaminated, based on factors including the types of contaminants potentially present, location and potential to exposure, and potentially impacted receptors. The assessment found that in terms of potential contamination risk, 29 sites were of medium risk and 53 sites were of high risk.

I require in Condition 28 that all identified sites be inspected to determine whether the identified potentially contaminating activity took place at the site, and if so, a Preliminary Site Investigation (PSI) will be undertaken. All high-risk sites will be subject to a more detailed PSI and if contamination is found or suspected of being present a Detailed Site Investigation (DSI) will also be undertaken. These further investigations will also include the gathering of additional site histories including interviews with landholders, local residents and historians, and the updated mapping of potential contaminated sites. All contaminated land investigations and remediation will be undertaken in accordance with the National Environmental Protection Measure (NEPM) and the Department of Environment and Resource Management (DERM) guidelines including the requirements of the Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland (DEH 1998). This will include sampling and analysis, detailed soil and groundwater investigations if contamination is found, assessment of human health and environmental impacts on the reservoir in consultation with the relevant authorities, and if necessary the development and implementation of a remediation plan in consultation with DERM.

Based on the results of these investigations, including the risk to human health posed by the contaminants of concern, sites will be assessed as necessary (depending on contaminant concentrations encountered and evaluation of the source-pathway-receptor linkage post inundation) and remediation and management options evaluated and implemented where required, prior to inundation.

DERM has recommended, and I have imposed at Condition 28, Schedule C, Appendix 1, the processes required to be followed to investigate potential sources of contamination bellow the 1 in 100 AEP flood level to determine appropriate remediation actions.

All contaminated land investigations and management measures will be undertaken by suitably qualified and experienced practitioners. All studies and proposed management measures will be reviewed and approved by Third Party Reviewer (TPR) as defined by DERM. TPR will undertake all investigations and remediation where necessary and validation of all potentially contaminated sites located below the 1 in 100-year AEP flood level. Given the preliminary nature of the EIS studies undertaken, I also require that a review of the adequacy of contaminated land investigations is completed by TPR and approved by DERM prior to inundation.

The proponent has recognised in the SREIS that activities described as unregistered waste dumping, stockyards and quarries are not strictly notifiable activities as prescribed by the EP Act but committed to investigating all potential contaminated sites whether or not subject to a Notifiable Activity as defined by the EP Act.

Land contamination could potentially result from the spillage or on-site disposal of hazardous materials or wastes used in the construction and operation of the dam

As a precautionary measure, procedures will also be implemented to monitor sites during the construction phase of the Project, in the event that unidentified or unexpected contamination is encountered. A construction EMP will be prepared to manage this approach and provide for management of soil transfer during construction to avoid cross–contamination of soil, deposition of (potential) contamination in uncontaminated areas and importation of contaminated soil into the construction site and/or inundation area.

There are a range of contamination risks that may impact land during construction, operation and decommissioning of the Project. I have conditioned, consistent with the then EPA's recommended requirements and as explained above, suitable management and risk mitigation arrangements that must be implemented. This is detailed in Schedule A and Condition 28, Schedule C, Appendix 1.

3.2. Water resources and water quality

Introduction

Numerous issues were raised in submissions in relation to water resources and water quality. I have considered each of the submissions and how the SREIS has responded to the issues raised in submissions. I have divided my consideration of water resources and water quality issues into hydrology, climate change, groundwater and water quality. Key issues that I considered warranted particular elaboration and/or explanation in my evaluation included:

Hydrology

- the hydrologic modelling undertaken for the EIS and SREIS and the conclusions reached particularly in regards to the protection of downstream habitat
- the flood modelling undertaken for the EIS, the potential mitigation of flooding at Gympie and potential upstream impacts

Climate change

- the approach used to assess the Project's ability to withstand long term climate change and the climate change projections used
- the potential for climate change to impact on the yield of the Project

Groundwater

- the alteration of groundwater and surface water interactions near the dam

- long term monitoring of the behaviour of the groundwater systems in the Project Area
- salinity
- effect of the dam wall on groundwater flow

Water quality

- the impact of construction on downstream water quality
- water quality during the filling phase and proposed mitigations
- the potential impacts on the inundation area water quality during operations due to nutrients from upstream land uses, stratification and eutrophication, pathogens due to cattle access, wave action and turbidity, and the potential accumulation of toxicants and nutrients due to evaporation
- the potential impacts of aquatic weed proliferation on water quality, particularly DO levels, and the impact of weed management measures
- the relationship between changes in downstream flows and water quality, and the resulting potential impacts on the Mary River, the estuary and the Great Sandy Strait
- the suitability of impoundment water for drinking

These matters are discussed further below in this section of this Evaluation Report.

Hydrology

Key hydrology issues raised in submissions that I considered along with other relevant matters included the hydrologic modelling and the conclusions reached particularly in regards to the protection of downstream habitat, and the flood modelling, the potential mitigation of flooding at Gympie and potential upstream impacts.

The Project is located on the Mary River upstream of Gympie. The Mary River rises in the Conondale Range near Maleny and flows some 250 km north-east to River Heads near Maryborough where it discharges into the Great Sandy Strait west of Fraser Island. The estuary (and Highest Astronomical Tide) commences downstream of the Mary River Barrage at AMTD 59.3 km. The dam has a catchment area of 2090 km² while the total Mary River catchment is approximately 9,700 km².

Annual average rainfall totals vary from almost 2000 mm in the upper catchment near Maleny to less than 800 mm in the western part of the catchment. The catchment of the dam is within the higher rainfall area with average annual rainfall of around 1,170 mm at the dam site. Most rain falls in summer although significant winter rainfalls can occur. Summer rainfall is generally caused by thunderstorms or tropical cyclone activity and is characterised by high intensity rainfall while winter weather patterns are influenced from the south.

The Project's dam wall is to be located on the Mary River at AMTD 206.7 km. Along the 40 km stretch upstream of this point, the major tributaries of Obi Obi Creek and Yabba Creek join the Mary River, as well as a number of smaller tributaries including Kandanga Creek.

The inundation area extends into Yabba Creek downstream of Imbil, and Kandanga Creek downstream of Kandanga Weir at Kandanga.

Below the proposed dam wall and upstream of Gympie, three other major tributaries enter the Mary River (i.e. Amamoor Creek, Deep Creek and Six Mile Creek) along with a number of minor tributaries.

The Mary River and western tributaries are characterised by a large high flow channel with wide floodplains and widespread bank erosion. Eastern tributaries of the Mary River vary significantly. Obi Obi Creek flows through a deep bedrock gorge before joining the floodplains of the Mary River while Six Mile Creek is a low-energy rainforest stream.

Water is extracted from the Mary River and its major tributaries for irrigation, stock, domestic and urban water supply use. Both supplemented water (i.e. from a dam) and unsupplemented water (i.e. run of river) is extracted from the waterways in the catchment.

Under the current Interim Resource Operations Licenses (IROL), the total supplemented allocation available within the catchment is 103,652 ML/yr. This is the maximum volume of water that is permitted to be extracted from storages in the catchment. This consists of 46% high priority (urban and industrial) and 48% medium priority (primarily agricultural) allocation with the remainder allocated to distribution losses. A series of small weirs are used in the local storage and distribution of this water.

Unsupplemented water licences within the Mary River catchment take the form of area-based, volumetric or water harvesting licences. No recording or reporting is undertaken regarding use of these entitlements. It is estimated that area licences of approximately 6100 ha and volumetric licences of 3300 ML currently exist within the Mary River catchment.

Existing water storage structures in the Mary River catchment provide a total storage capacity of 136,420 ML and impound an estimated 110 km of waterway. This is equivalent to approximately 5.4% of the length of reaches of the major rivers and creeks within the catchment. The Project will impound approximately 95km of the waterways in the Mary River Catchment including 36.5 km of the Mary River. This will result in an additional 4% of the waterways in the catchment being impounded.

Supplemented allocations within the Mary River catchment are currently managed under two IROLs - the Baroon Pocket Water Supply Scheme (WSS) and the Mary River WSS. The Baroon Pocket WSS operated by the Caloundra-Maroochy Water Supply Board (trading as AquaGen) includes Baroon Pocket Dam and Obi Obi Creek, and provides urban supplies to Caloundra and Maroochy. The Mary River WSS operated by SunWater includes the Lower Mary River, Mary Valley and Cedar Pocket Dam WSS. Separate announced allocations are determined for each of these schemes.

The Lower Mary River WSS includes the Mary River Barrage, Tinana Barrage and the Lower Mary Irrigation Area. The scheme mainly supplies irrigation requirements but also supplies some water to Fraser Coast Regional Council and industrial users.

The Mary Valley WSS covers the Mary River catchment upstream of the Mary River Barrage excluding Deep Creek and Obi Obi Creek. The scheme includes Borumba Dam and supplies irrigators and town water supply for Sunshine Coast Regional Council, Fraser Coast Regional Council and Gympie Regional Council. The Noosa town water supply offtake is currently located on the Mary River within the inundation area.

The Mary Basin incorporates the catchments of the Mary River, Burrum River and Sunshine Coast Rivers (including the Noosa, Maroochy and Mooloolah Rivers) and covers an area of approximately 13,400 km^2. Flows within the Burrum River and Sunshine Coast River catchments do not interact with flows in the Mary River catchment.

The setting of river system flow requirements, to be adhered to by infrastructure operators and other water users, that maintain the duration, magnitude, variability and seasonality of flow patterns to ensure environmental and public benefit outcomes, are achieved through the development and implementation of Water Resource Plans (WRPs) and Resource Operations Plans (ROP) prepared under the *Water Act 2000*.

The *Water Resource (Mary Basin) Plan 2006* (Mary Basin WRP) provides the legislative framework for water resource development within the Mary Basin. It specifies the use of the Integrated Quantity Quality Model (IQQM) developed by the then DNRW for the period 1890 to 1999 to assess water resource development within the catchment. The IQQM was used as part of the EIS studies, and for those studies in addition to the simulation period 1890 to 1999 the model was extended to include the period 1999 to 2007. The extended simulation period was used to examine the impact of the recent drought on river flows.

A WRP includes water allocation security objectives (WASOs) specifying the probability of being able to obtain water under a water allocation. For supplemented water this is set as compliance with a minimum

Water Sharing Index (WSI). The system reliability is determined using the DNRW IQQM model for the catchment incorporating all the storage, operation and distribution rules contained within the IROLs. Environmental flow requirements to protect the health of natural ecosystems are defined in the WRP as a series of Environmental Flow Objectives (EFOs) for defined nodes or locations within the basin.

There are three WRP nodes downstream of the dam:

- Mary River at river mouth AMTD 0.0 km (EFO 1)
- Mary River at Home Park AMTD 89.0 km (EFO 2)
- Mary River at Fisherman's Pocket AMTD 170.4 km (EFO 3).

The WRP sets aside a strategic reserve of 150,000 ML/year of unallocated water available within the Mary Basin from which it is proposed that the Project will be provided with 70,000 ML/year of High Priority water.

The Mary Basin WRP will be supported by a ROP that will define the procedures used to implement the targets and objectives set out in the WRP. The Draft Mary River ROP is currently being prepared by DERM. The Draft ROP will be released for public comment and community consultation before being finalised. The Mary Basin WRP sets out interim procedures for the processes that will be further defined under the ROP. This includes a statutory process for granting an Interim Resource Operations Licence (IROL) for unallocated water.

The Project must be operated to comply with the WASOs and EFOs set out in the Mary Basin WRP. Supplemented entitlements are supplied from storages and are classed as either High Priority or General (Medium) Priority. Under the Mary Basin WRP the high priority monthly reliability must be at least 95%, and the extent to which it is less than 99% must be minimised.

Medium Priority Licences provide the large volume general priority (irrigation) licences, which are supplied after high priority licence needs are satisfied. An allocation level (%) is announced at the beginning of each water year, usually being less than 100%. In the Mary Valley WSS the medium priority monthly reliability must be at least 80%, and the extent to which it is less than 85% must be minimised. In the Lower Mary Valley WSS the medium priority monthly reliability must be at least 88%, and the extent to which it is less than 93% must be minimised.

The proponent used the IQQM to model the changes in flow associated with the Project, starting with the calibrated WRP model, produced by the then DNRW, and modified elements of the model setup to predict predevelopment flows in the Mary River Basin. Studies included simulations with all infrastructure and water licences removed (pre-development), existing flows as currently operated (existing), and future flows with the Project in place. I note that IQQM is the standard tool used in Queensland and NSW to simulate the impacts of water resource management on flows, has been subject to rigorous and widespread scientific reviews, and is well regarded.

The operation of the Project was modelled assuming a full storage volume of 152,400 ML, and a dead storage volume of 3,440 ML. Releases cannot be made unless at least 3,940 ML is stored. Outlet valve releases of up to 500 ML/day are possible. The preliminary design of the dam incorporates a multi-level offtake that allows the storage to be drawn down to approximately 2% of Full Supply Volume. The modelled spillway discharge was capped at 3000 m^3/s (259,200 ML/day), but the EIS noted that this might be further optimised as part of detailed flood mitigation design. The proposed 70,000 ML yield was modelled as a 70,000 ML/yr high priority demand extracted directly from the dam with a constant monthly demand pattern, consistent with urban and industrial demands.

The preliminary dam design allows downstream flows to be released in three ways, depending on how much water is in the dam at any given time. These include releases over the spillway, through the outlet works and through the fishway and turtle bypass system. These mechanisms would be operated independently or in conjunction, depending on dam water levels. Fishway and turtle bypass system flows were not included in the model on the basis that they are small compared with average daily releases, predicted to occur almost every day, and have therefore been included in the daily release flows.

I note that the proponent, in its modelling, provides that existing entitlements currently supplied by Borumba Dam continue to be supplied by Borumba Dam, and that there will be no change to the method of operation for any licensed diverters other than those that will be impacted by the inundation area. Modelling presented in the EIS demonstrates that the Project will comply with all WASOs set out in the Mary Basin WRP. The system reliability in the Mary Valley WSS and Lower Mary WSS will be maintained.

Changed flow regimes have the potential to cause environmental impacts downstream. Key issues to be considered when seeking a suitable balance between water extraction and environmental requirements include impacts on riparian vegetation, impacts on river geomorphology, connectivity and depth of water for aquatic species and impacts on nesting sites. These matters are discussed further in Section 3.4 of this report while the desirable flow targets to support habitat requirements are considered below.

Key ecological considerations for flow optimisation were summarised in EIS Table 8.21 and further illustrated in Figure 15-14 in the SREIS. These key ecological considerations are noted in the EIS as originating from a variety of literature sources, data contained in the Mary River Cod Recovery Plan, the Ecological Asset–Critical Water Link table produced by the WRP Technical Advisory Panel (TAP) members as part of the development process underpinning the WRP, and through the EIS process. I acknowledge that the EIS and SREIS summarised the proponent's understanding of species' flow requirements at the time of publication and the Proponent committed to further flow optimisation to enhance important ecological outcomes reliant on flows. In this regard sustained lower and more stable flows during winter and spring, along with ongoing periodic large flows in summer and autumn, are particularly important for sustaining and generating macrophyte coverage and suitable water quality outcomes and hence general aquatic life. As depicted in Figure 15-14 of the SREIS, stable base flows and minimal extraordinary large flows during winter and spring are desirable for Lungfish, Mary River Cod and the broader fish community. In addition, the EIS and SREIS indicated that further optimisation should mitigate the impacts associated with reduced overall flows (i.e. on a whole of year basis) in the most impacted section of the river downstream of the Project. In particular, modified flows have the potential to result in an increased percentage of combined riffle and pool habitat, at the expense of some run habitat.

In light of this, I subsequently issued an information request asking the proponent to consider specific flow objectives targeted at desirable ecological outcomes, particularly in relation to water quality, connectivity and aquatic fauna movement and breeding opportunities, while maintaining compliance with WRP objectives and outcomes. The response from the proponent is included in its *Response to Information Requests* report, with related material in its *Response to Reviewer Reports* document. The response includes optimisation of the operational strategy for the Project mimicking natural flow variability based on the EIS and SREIS and advice received from the Commonwealth Reviewers and scientific advisors to the proponent. This work focused on identifying key flow depths that could be used as indicators of ecological requirements; and refining the flow performance requirements relating to the species. Three flow ranges have been identified as being appropriate indicators of ecological health including maintenance of water quality, connection of riffle/pool habitat, facilitation of fish movement and breeding requirements. These depth ranges are:

- Flows >10 cm above cease-to-flow - indicator for maintenance of water quality.
- Flows >30 cm above cease-to-flow - indicator for maintenance of fish movement.
- Flows >2 m above cease-to-flow - appropriate indicator of a flushing flow in Mary River.

The need to maintain natural variability within the system to reflect the diverse range of flow and water level requirements of these species is recognised, and that some years will suit some species better than other species and this will result in natural biodiversity. I understand that variability of flow regime is important for the survival of aquatic ecosystems and the requirements of different species are not always complementary.

I understand from the documents provided to me that the following ecological flow requirements are important.

Lungfish - the maintenance of macrophyte beds is important, particularly during the breeding season. Observations identified that a flow of 10cm above a riffle is sufficient for macrophyte establishment on the riffle. Stable baseflows during the Lungfish breeding season favour successful reproduction, in part due to the lower risk of Lungfish eggs being stripped from macrophytes. The Mary River is a naturally variable river system and in some years floods will occur during the Lungfish breeding season. The dam has some capacity to manage flood flows, but generally this natural variability will continue to occur. While the avoidance of artificial flushing flows during the breeding season will favour Lungfish reproduction, these flows are important for scouring of pools and flushing of macrophytes outside of the Lungfish breeding season.

Mary River Cod - require pools to be maintained at depths greater than 2 m during spring for breeding. At Dagun Pocket, the pool is incised at greater than 2 m below the downstream riffle control, and therefore if 10 cm flows occur over the riffle at Dagun Pocket, pool depth is maintained at greater than 2 m. A requirement was identified in the EIS for a flushing flow in autumn (greater than 2 m above cease-to-flow) to stimulate cod movement for over-wintering and generally these flows would not be greatly affected by the dam and hence provided by natural variability in the Mary River. In terms of general movement within the Mary River a depth greater than 30 cm is sufficient to allow a large fish (such as the Mary River Cod) to move across a riffle. Flushing flows are also important for scouring of pools and flushing of macrophytes outside of the breeding season, and artificial flushing flows are not desirable during the breeding season.

Mary River Turtle - The main flow-related requirements for the Mary River Turtle are linked to maintaining water quality and reducing the potential for nest inundation. Flows to a depth greater than 10 cm above a riffle have been identified as creating turbulence to produce sufficient aeration and mixing to maintain water quality. As outlined within the EIS, nests are generally placed 2.3 m ± 1.3 m above water level (EIS p8-93). Therefore artificial flushing flows (greater than 2 m flows) are not desirable during the nesting season, although natural flushing flows may occur at times and be relatively unaffected by the dam.

Wider Fish Community - The main flow requirement identified for the wider fish and aquatic community is a general requirement for connectivity to facilitate movement. As for the Mary River Cod, a depth greater than 30 cm is considered sufficient to allow a large fish to move across a riffle. For smaller fish, a depth greater than 10 cm over a riffle is considered sufficient to facilitate movement. The wider fish community also require stable flows during their breeding seasons, which in general are between August and November and overlap the breeding seasons of the three key listed threatened species under the EPBC Act (NES species). Artificial flushing flows are not desirable during the breeding season. The EIS identified that Australian Bass, Striped Sea Mullet and Freshwater Mullet had a requirement for brackish habitat to be maintained. Brackish habitat in the Mary River exists only downstream of the Mary River Barrage in the estuary. The EIS and Supplementary EIS Report identified that the Project will not significantly impact on the estuary salinity levels.

I have summarised those ecological flow requirements targets in Table 1 below.

- **Table 1 Key ecological flow optimisation targets**

Species requirement	Hydrology	Season
Lungfish		
Breeding		
• Require macrophyte establishment prior to breeding season	>10 cm over riffles	June – July
• Require water cover over macrophytes to avoid predation / desiccation	>30 cm over riffles	Aug – Dec
• No artificial flushes through breeding season to avoid stripping of eggs	<2 m over riffles	Aug – Dec
Habitat condition		
• Require maintained water quality	>10 cm over riffles	All year
• Seasonality maintained		
Mary River Cod		
Breeding		
• Require deep water in pools in Spring	>2 m in pools*	Sep-Nov
• No artificial flushes through breeding season		Sep-Nov
Habitat condition		
• Require maintained water quality	>10 cm over riffles	All year
• Seasonality maintained		
Movement		
• Require >30cm above riffle to move to forage	>30 cm over riffles	All year
	Longest spell not connected	All year
Mary River Turtle		
Breeding		
• nests not artificially inundated during breeding season	<2 m over riffles	Oct-Feb
Habitat condition		
• Require maintained oxygen levels	>10 cm over riffles	All year
• Seasonality maintained		
Movement		
• Require >30cm above riffle to move to forage	>30 cm over riffles	All year
	Longest spell not connected	All year

Dagun Pocket, directly downstream of the proposed dam, is the site most impacted by changes in flow resulting from the Project. The potential impact of the dam on flows diminishes rapidly with distance downstream of the dam. By Fisherman's Pocket, 38 km further downstream, the impact on river flows by the proposed dam has been reduced due to the additional catchment downstream of the dam and the tributaries that flow into the Mary River from within that catchment. Key objectives surrounding species' flow requirements at Fisherman's Pocket have previously been identified for Fisherman's Pocket as Environmental Flow Objectives (EFOs) under the WRP. These EFOs include objectives related to the 10 cm and 30 cm flows and flushing flows already identified as important ecological flow requirements.

I understand that maintaining flows over riffles and pools will provide the following benefits as set out in the proponent's Response to Information Requests report:

- Continued flows will oxygenate water over both riffles and pools, because DO is higher in moving waters. The provision of flows through pool habitats can reduce the risk of thermal and oxygen stratification. Stratified waters can become deoxygenated and potentially lethal to aquatic organisms. The turbulence created by flowing water is usually enough to thoroughly mix pools and prevent stratification from occurring. Mixing is also important because it allows for materials to be exchanged between the different strata.

- Maintaining a wetted perimeter over the riffles and pools is important to avoid desiccation and loss of aquatic biota. A larger wetted perimeter through the provision of flows provides greater habitat availability, allowing a greater diversity and abundance of biota to survive.

- Periphyton assemblages (plants and animals that live in water attached to rocks and other submerged objects) on substrates in riffle and pool habitats are an important source of aquatic food. Changes due to lack of flows can have flow-on effects to food sources for invertebrates, fish, and in stream processes such as nutrient uptake.

- The provision of flows will facilitate a greater food resource for aquatic macroinvertebrates and subsequently higher organisms such as fish. This will in turn enable greater stream productivity. In flowing riffles, large rocks and beds of cobbles and pebbles may support complex biofilms of benthic algae, fungi, bacteria and detritus. Mobile and attached invertebrates graze the epilithon or attach to the rocks and filter-feed, taking advantage of the current to transport food particles.

Statistical indicators have been identified for each of the species' flow requirements identified in Table 1 above. Low flow objectives were identified relating to flows greater than 10 cm and greater than 30 cm above cease-to-flow to represent water quality, habitat maintenance and fish movement requirements. Low flow statistics provide an indication of connectivity. Both connection and disconnection are fundamental ecological requirements and it is the balance between these two that provides healthy ecological function. A high degree of connectivity is necessary to maintain water quality and allow movement of aquatic species between pools, particularly for foraging. Periods of disconnection provide a number of ecological functions including potential respite from predation. The disconnection statistics address the longest period that flows are less than 10 cm and 30 cm, respectively, within the 109 year simulation. This period of disconnection would not occur each year or even in most years. Modelling indicates that while the longest period of disconnection within the 109 year simulation may be between 40 and 103 days, the average period of disconnection will be between 1-3% of the time, or approximately 4-11 days each year. This must be considered in the context of the requirement that flows greater than 10 cm must be maintained at Dagun Pocket 97-99% of the time on a yearly basis over the simulation period.

Minimisation of artificial flood pulses is critical during the breeding seasons of each of the key species. The frequency of flows greater than 2 m above cease-to-flow during breeding season has been used as an indicator for these flows. The proponent has advised that the Project provides an opportunity to supply additional flushing flows, if required and if Project storage levels permit, that may be prompted by an ecological or water quality requirement downstream. This opportunity cannot be represented by a statistical parameter and would be realised through cooperative discussions between the proponent and the relevant downstream stakeholders with an interest in water quality and weed management.

Maintenance of seasonal variability within the system is vital for all species including the three key species of Mary River Cod, Lungfish and Mary River Turtle. Seasonality of flows is important for a range of ecological functions including movement and breeding and provides for natural variability of flows. The global classification of river regimes identified by Haines, Finlayson and McMahon (1988) uses monthly flow volumes to assign a flow regime based on the months in which the largest and smallest proportion of total flow occurs within a river system. This classification is already used in other Queensland rivers as an EFO relating to seasonal flows. The majority of coastal catchments in South East Queensland, including the Mary River, have a Late Summer Flow Regime Class, as floods generally occur in the late summer/ early autumn months (January to April).

Most of the Mary River Catchment area is downstream of the dam (78.5%), and 74.3% of river inflows enter downstream of the dam based on mean annual flows. Modelling indicates that by Fisherman's Pocket due to those downstream inflows, the impact on the flow regime will be minimal and water levels will become comparable to existing levels. Approximately 90% of existing flows are predicted to pass Fisherman's Pocket and approximately 96% of existing flows are predicted to reach the estuary.

EIS modelling shows that the dam will result in flow impacts immediately downstream of the dam wall but that these impacts reduce downstream through tributary inflows, significantly diminishing after the first 25 km downstream. Downstream of the dam, median daily flows in summer and autumn (January to May) are reduced while impacts on median flows during the rest of the year (July to December) are much less. Low flows and high flows will remain similar to the current situation with some season variations as in autumn, smaller frequent flows are impacted while in winter and spring larger infrequent flows are impacted.

Modelling presented in the EIS showed that the dam would meet all mandatory EFOs at Fisherman's Pocket (EFO 3) under the assumed current operating assumptions but did not meet some Low Flow Duration objectives, which is also the case for current flows without the dam. All annual EFOs are met at the Mary River mouth and Home Park with the dam. However, medium-high flows occur less often than the objective for some months during winter and spring at these nodes.

EFOs under the Mary Basin WRP have been assigned with the objective of maintaining aquatic habitats and biological diversity. The proponent has committed to meeting all the EFOs and demonstrated through optimisation provided in response to my information requests that this can be achieved. The Project would be new infrastructure on the Mary River not necessarily envisaged when EFOs were set. I consider that it is therefore important to consider the underlying requirements addressed by the EFOs and to ensure that any alteration to flow regimes because of the Project achieve acceptable environmental outcomes.

The reach of the Mary River immediately downstream of the dam and the first EFO Node downstream of the dam at Fisherman's Pocket will be the most impacted in terms of flow changes. The inundation area will drown important aquatic habitat including runs, pools, riffles and glides. The importance of these types of aquatic habitat in the Mary River is discussed further in Section 3.3. The loss of riverine habitat within the inundation area requires downstream flow management measures to be optimised for the preservation of a range of species. Potential adverse geomorphology impacts on the Mary River from the dam wall to Fisherman's Pocket have also been discussed in the section 3.4 of this report and mitigation requirements set. Potential flow impacts encompass the whole flow regime, with particular concerns including impacts on flushing flows, low flows, and no flow periods.

I require that additional environmental flow requirements be established and adhered to in the Mary River below the dam at Dagun Pocket to protect and enhance ecological processes downstream, especially in the length of the Mary River between Dagun Pocket and Fisherman's Pocket.

I have set at Condition 8(b), Schedule C, Appendix 1, the following acceptable ranges for each of the statistical indicators based on the understanding of the species requirements and an analysis of the flow regimes before water resources development and under current extractions. In general statistics closer to pre-development conditions have been set to improve the existing flow regime.

- **Table 2 Required Flow Performance Indicators (FPI) at Dagun Pocket**

Indicator	Season	Range
Low Flows (10cm)		
% of time >10cm	All year	97-99%
% of time >10cm	June - July	97-99%
% of time >10cm	Sep - Nov	96-99%
Low Flow Spells (10cm)		
Longest spell <10cm	not to exceed 103 days under extended drought conditions, with a maximum duration of less than 40 days desirable	
Low Flows (30cm)		
% of time >30cm	All year	55-75%
% of time >30cm	Aug - Dec	40-60%
Low Flow Spells (30cm)		
Longest spell <30cm	not to exceed 300 days under extended drought conditions, with a maximum duration of less than 180 days desirable	
Medium to High Flows (2m)		
% of time >2m	Aug - Dec	<1.1%
% of time >2m	Sep - Nov	<1%
% of time >2m	Oct - Feb	<7%
Seasonality of Flows		
Seasonal Flow Regime	Late Summer	

These FPIs are consistent with the EFOs under the Mary Basin WRP. This means that the FPIs are long-term statistics which are assessed using the IQQM model for the Mary River System for the WRP simulation period of 1890-1999.

I am satisfied that the proponent demonstrated the ability, based on the EIS and SREIS modelling, to continue to optimise achieve the flow objectives of the WRP and to optimise environmental flows immediately downstream of the dam.

In response to my information requests, the proponent has undertaken further optimisation of the operating strategy to demonstrate the capacity of the dam to meet the FPIs downstream while also meeting the WRP requirements. The further FPI Optimisation modelling achieved the following outcomes:

- the proposed 70,000 ML Project yield is maintained and meets the high reliability requirements of the WRP
- existing users' entitlements are maintained downstream of the dam (as required under WRP)
- All downstream mandatory EFOs are compliant with the WRP
- All non-mandatory EFOs outcomes are improved
- All the above FPIs are met at Dagun Pocket.

Table 3 below, reproduced from the *Response to Information Request* report (Table 5-3) presents a comparison of the modelled performance of the dam operations under a range of conditions including Pre-development, Existing Entitlements, after further Secondary Optimisation, and the FPI Optimisation.

- **Table 3 Performance against Flow Performance Indicators (FPI) – Dagun Pocket**

Indicator	Season	Range	Pre-development	Existing Entitlements	Secondary Optimisation	FPI Optimisation
Low Flows (10cm)						
% of time > 10cm	All year	97-99%	97.8	98.3	98.0	98.0
% of time > 10cm	June - July	97-99%	99.0	97.0	97.7	97.6
% of time > 10cm	Sep - Nov	96-99%	96.3	98.3	99.7	98.0
Low Flow Spells (10cm)						
Longest spell < 10cm	40-103 days		103	44	168	47
Low Flow Spells (30cm)						
% of time > 30cm	All year	55-75%	74.3	53.7	58.3	58.3
% of time > 30cm	Aug - Dec	40-60%	58.3	36.1	44.7	45.2
Low Flow Spells (30cm)						
Longest Spell < 30cm	180-300 days		227	312	219	219
Medium to High Flows (2m)						
% of time > 2m	Aug - Dec	< 1.1%	1.1	1.0	0.5	0.5
% of time > 2m	Sep - Nov	< 1%	0.5	0.5	0.3	0.3
% of time > 2m	Oct - Feb	< 6%	5.8	5.3	3.8	3.8
Seasonality of Flows						
Seasonal Flow Regime	Late Summer	Late Summer	Late Summer	Late Summer	Late Summer	Late Summer

*All statistics calculated using IQQM simulation for WRP simulation period (1890-1999).

Table 3 demonstrates that the Project would comply with the set FPIs over the historical 109 year record.

The IQQM simulation of the Project presented in the EIS and SREIS was based on a number of assumptions in relation to operations, storage characteristics, outlet configuration and climate. The IQQM FPI Optimisation simulation of the dam is modelled for the same simulation period (1890-1999) and based on all the same assumptions as the modelling undertaken previously, apart from the optimised operating rules.

The operating rules modelled as part of the EIS were directed at meeting the WRP requirements (WASOs and EFOs) as set out in the Terms of Reference for the EIS. To meet the WRP requirements, simplified operational rules were modelled, as detailed on p6-28 of the EIS. The Preliminary Optimisation Scenario documented in the SREIS built on these simplified rules to provide additional environmental releases to meet non-mandatory EFOs downstream of the dam. The resulting rules characterising dam operations for this scenario were documented in Table 15-7 of the SREIS.

The Secondary Optimisation and FPI Optimisation Scenarios have further built on these rules, exceeding the minimum requirement set out in Table 15-7 of the SREIS. The aim of this further optimisation has been to meet the needs of the downstream environment, now characterised by the FPIs. These operating rules are based around the size of inflows, the volume in the dam and the season. These rules enable the dam to provide appropriate environmental releases in both wetter and drier periods. The ecological outcomes and FPIs that have been used to develop the operating rules will be incorporated in the dam operating instructions which will dictate the releases from the dam. Dam releases will be controlled in accordance with these operating instructions, supported by computer based interfaces to determine the required release volume for a specific day based on external inputs such as the storage volume, inflows to the dam and customer orders on that day. These releases could be made via the spillway, outlet works, fishway or turtle bypass system.

At my request the proponent has provided information regarding the effect of implementing the FPIs at Dagun Pocket. The modelling results provided to me are set out below.

10 cm above cease to flow have been identified as the appropriate indicator for the maintenance of water quality. The proportion of times flows of a depth less than 10 cm are predicted to occur within the 109 year simulation period are set out in Table 4 below.

- **Table 4 Proportion of time flows <10cm are predicted to occur within the 109 year simulation period**

	Pre-development	Existing Entitlement	With Dam (EIS)	Preliminary Optimisation	Secondary Optimisation	FPI Optimisation
Dagun Pocket (3km)	2%	2%	3%	3%	2%	1%
Amamoor (5km)	2%	1%	2%	1%	1%	1%
Six Mile (22km)	1%	1%	2%	1%	1%	1%
Deep Creek (26km)	1%	2%	3%	2%	2%	2%
Fisherman's Pocket (38 km)	1%	2%	3%	2%	2%	2%

The longest sequential number of days when disconnection of a reach of the Mary River downstream of the dam may occur is decreased to levels less than that currently experienced within the catchment (Existing Entitlements) or under the Pre-development scenario, below Deep Creek. Immediately downstream of the dam at Dagun Pocket, the duration of flows less than 10 cm increases above the Existing Entitlements but is less than in the Pre-development scenario. While flows are below 10cm for an increased period of time at Dagun Pocket, a level of flow is expected to continue.

- **Table 5 Longest period of time flow < 10cm are predicted to occur within the 109 year simulation period**

		Pre-development	Existing Entitlement	With Dam (EIS)	Preliminary Optimisation	Secondary Optimisation	FPI Optimisation
Dagun Pocket (3km)	**Number of days**	103	44	93	93	168	47
Amamoor (5km)		103	44	44	56	49	47
Six Mile (22km)		139	34	34	38	45	47
Deep Creek (26km)		139	66	66	66	49	49
Fisherman's Pocket (38km)		139	66	66	66	44	44

The timing of flows less than 10cm are presented below in Table 6 and highlight that potential disconnection would occur less than the existing situation at Dagun Pocket for the months of July, September, October and November. Small increases in the average percentage of flows below 10 cm are experienced in the other months however these are not considered to be significant.

- **Table 6 Flows less than 10cm above cease to flow at Dagun Pocket (3km downstream of the dam wall)**

Scenario	Percentage (%) of Simulation Depth at Dagun Pocket < 10cm												
	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pre-Development	2.2	4.3	1.8	0.1	0.2	0.7	0.9	1.0	1.3	1.8	4.5	4.8	4.4
Existing Entitlements	1.7	3.0	1.8	0.4	0.1	0.0	0.0	5.9	1.2	1.5	1.2	2.3	2.3
With Traveston Crossing Dam	2.7	3.9	2.2	0.7	0.5	1.2	0.7	7.7	3.0	3.4	1.9	3.3	3.8
Preliminary Optimisation	2.9	4.8	3.8	1.7	0.8	1.4	1.5	2.9	2.9	3.2	2.0	3.5	5.7
Secondary Optimisation	2.0	4.6	2.7	2.0	1.6	2.0	1.3	3.2	2.0	1.0	0.0	0.0	3.4
FPI Optimisation	2.0	4.6	2.7	2.0	1.6	2.0	1.3	3.4	2.0	1.0	0.0	0.0	3.4

Table 7 below demonstrates that connectivity can be improved beyond that currently occurring downstream of the Project.

- **Table 7 Percentage of time flows < 30 cm**

	Pre-Development	Existing Entitlements	With Dam (EIS)	Preliminary Optimisation	Secondary Optimisation	FPI Optimisation
Dagun Pocket (3km)	26%	46%	77%	56%	41%	41%
Amamoor (5km)	24%	44%	60%	41%	39%	39%
Six Mile (22km)	22%	42%	47%	32%	38%	38%
Deep Creek (26km)	20%	40%	44%	30%	36%	36%
Fisherman's Pocket (38km)	20%	40%	45%	31%	37%	37%

The longest period of movement disconnection for larger fish is reduced at Dagun Pocket compared to both the Existing Entitlements and Pre-development scenarios and maintained at other downstream locations.

- **Table 8 Longest period of time within a 109 year simulation period flows may fall below 30cm**

		Pre-Development	Existing Entitlement	With Dam (EIS)	Preliminary Optimisation	Secondary Optimisation	FPI Optimisation
Dagun Pocket (3km)	Number of days	227	312	1050	887	219	219
Amamoor (5km)		256	311	528	528	311	311
Six Mile (22km)		233	318	368	368	310	310
Deep Creek (26km)		233	318	368	368	304	304
Fisherman's Pocket (38km)		263	318	466	466	304	304

With the FPIs implemented, the timing of flows below 30 cm is equal to or occurs less than the existing situation experienced within the catchment for the months of April, July through December. Slight increases in the average duration of flows below 30 cm are experienced in some months however these are not believed to be significant, as discussed below.

The outcomes of the optimisation modelling with the FPIs implemented further support the conclusions made within the EIS and SREIS regarding the capacity of Project to successfully manage environmental flows across all months and seasons and will improve upon conditions currently experienced within this section of the Mary River.

In my view, implementation of the FPIs at Dagun Pocket, as demonstrated by the modelling undertaken by the proponent described above, will mean that flows during July, August, September, and October will improve from the current situation and enable a return towards the larger winter and spring flow patterns experienced prior to agricultural development in the Mary River catchment. I consider that there will be an enhanced ability to manage releases to produce greater water level stability in the critical stretch of the Mary River from Dagun Pocket to Fisherman's Pocket during the key lower flow months of July through to January. This part of the Mary River contains breeding habitat for species such as Lungfish and nesting sites for the Mary River Turtle. Sustained lower and more stable flows during winter and spring, along with ongoing periodic large flows in summer/autumn, are particularly important for sustaining and generating macrophyte coverage and hence general aquatic life. Stable base flows and minimal extraordinary large flows during winter and spring are desirable factors in relation to Lungfish, Mary River Cod and the broader fish community. In addition the reduced overall flows (i.e. on a whole of year basis) in the most impacted section of the River downstream of the Project will also result in an increased percentage of combined riffle and pool habitat, at the expense of some run habitat.

The proponent has committed to undertaking further optimisation of flows during the detailed design and ROP submission phases (see 15.1.3.1 of the SREIS). I have required at Condition 8(d), Schedule C, Appendix 1 that alternatives to the FPIs in Condition 8(b) may be permitted only if it can be demonstrated to my satisfaction that the alternatives will achieve enhanced outcomes, having regard to riparian habitat and the flow conditions that support the Mary River Cod, Queensland Lungfish and Mary River Turtles.

Long term FPIs such as those required during dam operation, are not suitable during either the Construction or Transitional (filling) flow regimes which will occur for a relatively brief period of time. However, the desired downstream ecological outcomes for this period of time are unchanged. For this reason, no changes to the current situation are proposed during construction, and a modified sub-set of the FPIs will be required during the transition to operation.

The existing flow regime in the Mary River will be maintained throughout construction and a range of diversion strategies will enable flow to pass through the dam site unimpeded:

- Initially, flow will continue to pass down the natural river channel with minimal interruption. During this time, the spillway will be excavated and construction of the spillway monoliths and parts of the dam wall to either side of the channel will be commenced.

- The next stage is to divert flow through the spillway excavation and / or partially complete spillway monoliths. During this time the main wall across the natural river channel will be constructed. Once again, stream flows entering the dam site will not be impeded and allowed to flow downstream.

- On completion of the main wall across the natural river channel, the spillway will be constructed to its final height. During this time, a diversion conduit will be used to maintain flow in the Mary River. In order to minimise impacts to flow, the diversion conduit will be located at or close to the natural river bed level, allowing flows to pass downstream.

These construction flow arrangements will sustain flows to the downstream environment, provide pass flows for Borumba Dam orders and preserve fish passage.

I understand that flows in the Mary River must be maintained throughout construction in accordance with relevant provisions of the *Water Act 2000* and any approvals under that legislation. I note that the proponent has committed to ensuring normal flows during construction. The proponent proposes to purchase up to 250ML per year of construction water from SunWater's Borumba Dam which will be sourced from Borumba's unused allocation, which is currently approximately 9,000 ML.

Once construction of the dam is complete, inflows will continue to pass through the diversion conduit until the close off of the diversion and the storage of water. This point marks the end of the Construction stage and the beginning of Transitional Operations.

In response to my request for further information about the procedures to be followed during initial filling to protect downstream flow and environmental requirements the proponent proposed Transition Release Rules to apply during initial filling and further examined the initial filling period. The proponent also proposes that filling would not commence until a "trigger" rainfall event in the catchment was predicted to occur. The diversion conduit will not be closed until a streamflow event was predicted to occur of sufficient volume to be captured in the dam to reach at least the dead storage volume (DSV) in an 'acceptable timeframe'. An optimum trigger event (flow, rainfall or forecast event) would be developed during detailed design.

Once the storage volume in the dam reaches the level of the spillway, the dam can release flows through all mechanisms including the spillway and outlet works. It can then be operated according to the FPI Optimisation, or other optimised operation strategy, such that:

- all FPIs are met

- all requirements of the WRP are met (including EFOs and WASOs)

- it can provide the full 70,000 ML/annum yield

At this point, the dam can meet all the objectives of normal operation and can therefore be considered fully operational. From this point forward, the Project would operate subject to the ROP and my conditions. Before full operation commences, the transitional operational strategy must achieve:

- the desired ecological outcomes downstream

- maintenance of downstream users' entitlements

- the operational capacity of the dam at different storage volumes

The desired ecological outcomes during Transition are identical to those during normal operation of the dam: maintaining water quality and maintaining connectivity for passage of fish and other aquatic species. These downstream ecological outcomes must be achieved before any yield is taken from the dam during the Transition period.

The operational capacity of the dam was discussed in detail in the SREIS (s15.1.4). There are three key levels governing the operational capacity of the dam. Until the dam reaches the DSV (3,440ML), releases cannot be made through the outlet works. The dead storage for Traveston Crossing Dam is equivalent to approximately 2% of the Full Supply Volume with a surface elevation of 56 m AHD. The proposed spillway for the dam incorporates a fixed spillway crest at 67 m AHD with six flood gates. Releases can be made over the spillway once the dam reaches the spillway crest level. The volume of the dam at the spillway crest level is 60,700 ML, equivalent to approximately 40% of Full Supply Volume. The Full Supply volume of 152,400 ML (100% capacity) is reached at 71 m AHD, 4 m above the spillway crest. The proponent has proposed an additional state to define transition rules when the water stored in the inundation area reaches 12% of Full Supply Volume (20,700 ML).

I have accepted the transition rules proposed by the proponent. Those transition rules are defined in terms of three possible defined states and conditioned by me at Condition 8(b), Schedule C, Appendix 1. It is desirable that the trigger event to indicate that dam filling should commence is of a sufficiently large runoff volume that the dam capacity rapidly passes through the three defined water storage volumes which are Empty to DSV, DSV to 12% capacity, and 12% capacity to about 40% capacity (spillway level). Once the spillway level is reached the dam will become fully operational.

These transition rules require all WRP and water allocation requirements to be achieved to the same extent that they would have been achieved without the dam, and progressively provide increasing environmental benefits through modified FPIs at Dagun Pocket. Downstream allocations released from Borumba Dam must be maintained at all times. None of the 70,000 ML/annum yield may be taken, until the storage volume exceeds 12% of Full Supply Volume (20,700 ML), and then only up to 25% of the 70,000 ML/annum yield may be taken until the spillway level is reached and the dam becomes fully operational.

In the lowest transition state when the inundation area capacity is between empty and the DSV the FPI for longest period less than 10cm and medium to high flows (2m) must be observed. Pumps or other interim measures will be required to ensure required flows are achieved.

In the middle transition state when the inundation area capacity is between the DSV and 12% capacity the FPI for medium to high flows (2 m), longest period less than 30 cm and the longest period less than 10 cm (moderated to be no more than 40 days) must be observed.

In the upper transition state when the inundation area capacity is between 12% capacity and about 60,700 ML (the spillway level) all FPIs must be observed, and as noted above provided all other requirements can be achieved up to 25% of the 70,000 ML/annum yield may be taken.

A water quality management plan will be implemented during this transition period using a risk management strategy. This regime would apply to maintain environmental flows should the storage fall below DSV before reaching Full Operation.

The commencement of the dam filling period was modelled by the proponent for a range of different starting climatic conditions based on the historical record. The results of this modelling are discussed in the proponent's *Response to Information Requests* report. From this modelling the length of time for the dam to transition to full operation and the probability of this occurring was assessed. The modelling shows there is a 92% chance of a trigger event occurring in each year which would prompt the decision to start storing during the Wet Season months of October, November, December, January and February. Once a trigger event occurs, there is a 50% probability that the dam will be fully operational within 48 days and a 90% probability of being fully operational within one year.

Additionally, based on modelling undertaken, once a trigger event occurs, there is a 98% probability that the dam will be above 20,700 ML and in full environmental compliance (meeting all FPIs + EFOs) before the following breeding season for the key species (August – February). This modelling shows that a trigger event would have occurred in each of the wet seasons from 1999/2000 to 2005/2006, but not in the 2006/2007 wet season (in which case the dam would not have been closed off and existing flows would have been maintained).

The modelling shows if the dam had been completed during 1999, a trigger event would have occurred in October, the dam would have reached DSV in 4 days and become fully operational within 32 days. Similar events occurred in 2000, 2002 and 2003. At the other extreme, if the dam had been completed in 2001, a trigger event would have occurred in November, the dam would have reached DSV in a single day. While in this low flow sequence, it would have taken approximately 16 months to become fully operational. However, during this period the dam would have been able to provide releases for pass flows and to meet the 10 cm, 30 cm and 2 m FPIs.

The proponent has committed to undertake further optimisation of flows during the detailed design and ROP submission phases (see 15.1.3.1 of the SREIS). I have required at Condition 8(d), Schedule C, Appendix 1 that alternatives to the Transition Rules in Condition 8(c) may be permitted only if it can be demonstrated to the satisfaction of the Coordinator-General in consultation with the chief executive administering the *Water Act 2000*, that the alternatives will achieve enhanced outcomes, having regard to riparian habitat and the flow conditions that support the Mary River Cod, Queensland Lungfish and Mary River Turtles.

I require that native fish species are able to move via a fishway both upstream and downstream of the dam wall following the Commencement of Extraction of Project Yield when releases are being made in accordance with the FPIs in Condition 8, Schedule C, Appendix 1. Additionally, I have allowed that this does not need to happen during periods of flood at an AEP trigger level to be established during detailed design and have provided a single allowance of 60 days for initial commissioning and an allowance of 15 days per calendar year for temporary decommissioning for structural improvements, maintenance or equipment failure. This will allow connectivity at all times when downstream flows permit this less the allowances mentioned above.

From the Completion of Construction until the commencement of Extraction of Project Yield, the proponent is required to make provision for ongoing fish passage across the dam barrier.

Prior to commencing operations of new in stream water infrastructure, the owner / operator of the water infrastructure is in most situations required to obtain a Resource Operations Licence (ROL) or an interim ROL (IROL). In order to secure an IROL, detailed operating rules must be submitted to the chief executive administering the Water Act, describing how the infrastructure will be operated in order to meet the objectives defined within a WRP and a ROP.

I have required in my conditions that as part of the application for any IROL or ROL, the proponent must provide to the chief executive administering the *Water Act 2000* the constraints imposed on the operation of the infrastructure by my conditions, including the rules and procedures governing dam and fishway operations consistent with the FPIs set in the my conditions and the provision of a report demonstrating that the proposed operating rules and FPIs achieve compliance with relevant legislative requirements and my imposed conditions 8(f) - 8(h), Schedule C, Appendix 1 (see Condition 8(i)).

I consider that the modelling developed for an EIS process must necessarily build upon, and provide the next level of detail relative to, the modelling undertaken during a WRP process. It also should establish a solid baseline for further optimisation during a ROP process and provide confidence that a ROL is warranted for the Project. The operating rules or procedures applying to proposed infrastructure must be progressively developed and improved upon during each phase of the WRP, EIS, ROP and ROL process continuum.

I note that the proponent is committed to ongoing optimisation of flows to better achieve ecological outcomes, based on monitoring data and new research information as it becomes available. I concur with this approach and require that ongoing monitoring programs, as a minimum, must include the indicators and monitoring methods set out in Table 8.24 of the EIS and allow assessment of compliance with the FPIs.

Noting the further development of rules that will occur in the future as discussed above, the proponent has adopted a series of assumptions and key dam operating rules, which are consistent with the WRP, to underpin the modelling outcomes within the EIS, SREIS and the Response to Information Requests report.

The EIS and SREIS studies show that volumes and levels of water stored in the Mary River Barrage will not be affected by the Project, and therefore riparian access will not be affected. Spills and fishway flows are only minimally impacted by the Project. Under existing conditions, the Barrage spills 85% of the time and the fishway operates 10% of the time, while with the Project the Barrage would spill 84% of the time and the fishway operate 11% of the time. Zero flows to the Estuary from the barrage with the Project are increased by 1% over the 109 year simulation. There is no change to the longest no-flow period in 1901-02 which continues for 213 days "with" or "without" the dam. The Project will reduce the Mean Annual Flow to the estuary by approximately 4% compared to the existing entitlements scenario and reduce Median Annual Flow by 6%. Flood peak daily flows to the estuary may be reduced by 4-17% in floods greater than a 1 in 20 AEP event. It is suggested in the EIS that these changes are minor but it is noted that they may result in some changes to salinity levels in the upper estuary. This is discussed further in the water quality section of this Evaluation Report.

A flood assessment of the dam was undertaken with a one dimensional digital hydraulic model (MIKE11) as described in the SREIS section 15.2.1. The model extended upstream of the dam site to Kenilworth (AMTD 264.3 km) and downstream to Fisherman's Pocket (AMTD 170.4 km), just downstream of Gympie. A large proportion of the area to be inundated by the dam is currently inundated by the 1 in 100 AEP flood. The Project will attenuate flood flows, resulting in lower peak flows and a greater duration of flow. Flow attenuation is greatest immediately downstream of the dam, reducing with downstream distance from the dam.

Historical records show that Gympie has a significant flood risk with two major bridges cut by minor to moderate floods and houses starting to be inundated in events with an AEP of approximately 1 in 20. Moderate flooding in Maryborough, further downstream, occurs less often. The preliminary design modelled assumed that the dam would be fitted with flood gates to optimise the flood mitigation for Gympie. The EIS modelling undertaken assumed that the flood gates would be used to limit the discharge from the dam to the pre-dam discharge for the same event until 3000 m³/s at which point the outflow was capped. The preliminary gate design can pass significantly higher than this but the strategy was shown to achieve downstream flood impact benefits for floods with greater than the 1 in 20 AEP discharge. With the dam in place the achievement of flood mitigation benefits downstream, particularly for Gympie, may impose flood impacts on areas upstream of the dam around the inundation area.

The balance between upstream and downstream flood effects needs careful consideration and consultation with all those affected. Additionally the dam must be operated safely. <u>I have</u> therefore conditioned at Condition 8(e) and 8(f), Schedule C, Appendix 1, that the design and operation of the dam including the proposed flood gates must be optimised during the detailed design process. This must be undertaken in accordance with the Queensland Dam Safety Management Guidelines (DNRM, 2002), as part of the design process and in consultation with the GRC, Dam Safety Regulator, and the Department of Emergency Services. Opportunities must be provided for all directly affected individuals and organisations to express their views and to comment on any proposed strategies. The final operating strategy must be approved by the Coordinator-General and the Dam Safety Regulator prior to the commencement of construction.

Backwater effects from the dam will cause some localised flooding impacts in the areas surrounding the inundation area although as noted above there may be some minor changes to the modelled impacts depending on the final adopted flood gate operation strategy.

Flood impacts in the Mary River will extend approximately 32 km upstream of the dam wall. There will be an increased susceptibility to flooding in lower lying areas of Kandanga. Land within the inundation area buffer will be affected by increased levels of flooding. The flood mitigation optimisation processes discussed above may affect the exact location of the upper boundary of the inundation area buffer as indicated by current flood mapping set out in the EIS. <u>I have required</u> that the inundation area buffer be defined by coordinates in consideration of the flood mitigation optimisation in condition 3(b)(i), Schedule C, Appendix 1.

Figure 6-39 of the EIS suggests that there will be a significant number of properties impacted by flooding (with dam) in the lower lying parts of Kandanga. I have been advised by the proponent that consultation has been undertaken with each flood-affected landholder who have been offered the opportunity to sell their property, to receive assistance to relocate their house or business to an alternative site in Kandanga, or to receive an assistance package to allow re-establishment.

The Bowls Club is already susceptible to flooding but with the dam, flood levels are expected to increase and floods would last longer. I note that the proponent has signed a Memorandum of Understanding with the Bowls Club and other community groups to plan the provision of alternative facilities outside of the flood-affected area, but within Kandanga.

Lower areas of the Kandanga cemetery already flood in major events but would be subjected to increased and longer floods with the dam. The proponent has suggested a grass verge be engineered to provide flood protection up to the 1 in 100 AEP event, and undertake consultation with the community on this issue. This issue is clearly of considerable concern to the Kandanga community and I require the proponent to continue to consult with the community to identify and implement the preferred approaches to dealing with cemetery flood impacts prior to construction. The proponent must identify and fund the involvement of an appropriately qualified independent facilitator approved by me. The terms of reference for the independent facilitator must include the identification of members of the Kandanga community and those with a direct connection to the cemetery who wish to be involved in a process to determine by consensus the preferred approaches to dealing with cemetery flood impacts.

In the absence of a consensus decision, as determined by the Coordinator-General based on the advice of the independent facilitator, the grass verge option as described in the EIS is to be implemented as the default option prior to the Completion of Construction. These requirements are specified in Condition 32(h) - 32(j), Schedule C, Appendix 1.

EIS flood modelling shows that the Project will have essentially no additional impact on flood levels in Yabba Creek at Imbil township. The Imbil Town Bridge over Yabba Creek currently floods at all modelled levels and there will be essentially no change with the dam in place. The Project may have a very minor impact (an additional 15 minutes) on the length of time that the bridge is flooded in a 1 in 100 AEP flood and no effect in lower level floods. Other infrastructure in Imbil including houses and community facilities will not be additionally affected by flooding.

The Project is predicted to cause an increase in flood levels in the Mary River to the west of Carters Ridge. No additional community infrastructure is affected by this impact. Flood levels in Skyring Creek in the 1 in 100 AEP event would extend as far as Federal, but the Federal Hall and Federal School buildings are not affected by flooding with or without the Project. Flood affected properties are within the Project Area and will be incorporated within the inundation area buffer and inundation area. These matters have been also been considered in terms of land use implications in Section 3.1 of this report.

Several roads and bridges are inundated at the full supply level of the dam. These roads will be relocated, upgraded or closed as appropriate. All infrastructure upgrades and relocations will be designed to ensure no increased adverse flood impacts. Further information on transport and access arrangements is provided in section 3.8 of this report. In addition to the roads and bridges that are inundated at full supply level of the dam, several roads will be impacted by increased flood levels due to the dam.

Dam safety requirements are addressed within section 3.11 of this report and by the conditions at Appendix 1, Schedule A – Conditions for Operational Works that is the Construction of a Referable Dam.

The spillway must be appropriately sized to pass the Probable Maximum Flood (PMF) – the most extreme flood that can be reasonably expected to ever occur, and the adopted embankment crest level conservatively provides for the peak PMF reservoir level plus the effects of waves and wind. I further note that a dam break analysis will be undertaken during detailed design, as required by the conditions in Appendix 1, Schedule A– Conditions for Operational Works that is the Construction of a Referable Dam.

Climate change

Key climate change issues raised in submissions that I considered along with other relevant matters included the approach used to assess the Project's ability to withstand long-term climate change, the climate change projections used, and the potential for climate change to impact on the yield of the Project.

Climate change predictions for Queensland currently include altered rainfall patterns with extended periods of reduced rainfall but increased intensity and frequency of extreme rainfall. The uncertainty regarding these projections was dealt with in the EIS using a conservative approach consistent with QWC's approach in its strategic water supply planning for SEQ. In response to submissions on the EIS, the proponent presented a more detailed assessment of potential climate change effects in the SREIS. The EIS and SREIS both dealt with potential climate change impacts on yield through the adoption of a prudent yield that allowed for possible climate change effects.

The Queensland Government has required that by 2012 climate change estimates must be incorporated into all WRPs and ROPs in Queensland. Further consideration of climate change will continue through the ROP process and the operation of the project. It is possible that this further consideration may identify the need for adaptive changes to the management of the Project.

The WRP requires that the yield from the Project be provided with greater than 95% reliability and the extent the reliability is below 99% minimised. The proponent has demonstrated that the Project will be able to meet these requirements and still provide a substantial buffer available for future climate change and additional environmental requirements downstream. The adopted prudent yield was found by the proponent to be equivalent to 72% of the potential yield for the dam, providing a suitable buffer to allow for potential climate change impacts without impacting the performance against EFOs or WASOs downstream.

Predicted climate change for Queensland published in Climate Change in Queensland under Enhanced Greenhouse Conditions Report, 2004-2005 (CSIRO, 2005) was reported in the EIS. Since the EIS was published, this report has been superseded by the Bureau of Meteorology (BoM) and CSIRO (2007) document, Climate Change in Australia – Technical Report 2007 – Chapter 5. The CSIRO (2007) report provides estimates for Low, Medium and High emission scenarios. The SREIS considered the High Emissions scenario to be the most appropriate estimate for the 2030 planning horizon.

For the "best estimate" of rainfall change CSIRO adopted the 50th percentile or median prediction but also presented the 10th and 90th percentile values, based on 23 climate models. The predicted climate change impact on average rainfall in the Mary River catchment for each season was assessed. CSIRO (2007) estimates for future changes in potential evapotranspiration were also used. The estimates for rainfall and evaporation change were used with existing water entitlements in the IQQM to predict climate change impacts on flows and yield.

Climate change impacts without the Project in place were predicted to result in a 10% reduction of median annual flow across the catchment for the 50th percentile or median case, while the range of the estimates was -36% (10 percentile) to +17% (90 percentile). With the Project in place, the magnitude of the climate change impacts was predicted to be similar to those predicted without the Project.

Flushing flows for the reach immediately downstream of the dam were predicted to reduce due to climate change from 5.4% of the time under existing conditions and 5% under the best estimate (median) climate change scenario to 4.1% of the time with the Project in place, over the 109 year simulation period.

Climate change will, with existing entitlements, result in a reduction in the time when flows are greater than the 30 cm above cease-to-flow level, ranging from 3.4% at Dagun Pocket to 1% at the estuary. The relative impact of the dam on the occurrence of these flows is unaffected by climate change, with the greatest impact being immediately downstream of the dam at Dagun Pocket (approximately 30%). This impact reduces to about 5% at Fisherman's Pocket and 1.5% at Home Park. The proponent has indicated that impacts could be significantly mitigated by the adaptive management approach proposed for the dam through the provision of specific environmental releases targeting this parameter. However, the proponent did not propose specific release rules. As discussed above in the hydrology section of this report, I have set flow requirements to guide necessary further environmental flow optimisation and ensure that downstream habitat values are protected for the benefit of aquatic species.

The SREIS comparison of the existing entitlement, current climate and 2030 climate modelling results shows that climate change will increase the number of low flow periods within the Mary River Catchment, however the impacts of the dam under both climate change scenarios are of similar magnitude or in some cases less. The SREIS indicated that the impact of the Project on the number of low flow periods will not be significantly altered due to climate change. I have required at condition 8(a), Schedule C, Appendix 1 that flows are managed by the proponent to ensure flows greater than 10 cm at Dagun Pocket occur 97-99% of the time, which will continue to be required in the event of climate change.

Under current climate conditions a buffer of between 12.5% and 28% of the available yield is available from the Project to ensure that climate change will not impact on the ability of the Project to provide the prudent yield of 70,000 ML/year, maintain the reliability of downstream users' entitlements, and accommodate both WRP requirements and the FPIs I have conditioned.

The Project forms one part of a larger strategy for water supply in SEQ. The draft Strategy released in March 2008 by the QWC provides the strategic framework for water supply in SEQ over the next 50 years. The plan includes a diverse range of new and existing water sources both traditional water sources such as the Project and non-climate dependent sources including desalination and reuse. The plan also identifies a prudent yield from Traveston Crossing Dam of 70,000 ML/year. The draft Strategy incorporates a reduction of 10% of yield as an allowance for climate change in estimating the timeline for the provision of additional water sources at around 2028.

CSIRO undertook an independent review of the work undertaken as part of the Climate Change Sensitivity Analysis. I note that CSIRO found this assessment 'reasonable', 'robust' and 'relevant and appropriate to the assessment of potential impacts of Traveston Crossing Dam'.

From the information presented above, I consider that climate change has been actively incorporated into the strategic and specific planning for the Project to address downstream environmental requirements, maintaining downstream entitlements for existing users and providing additional urban water supplies to SEQ. Further, the presence of the dam has the potential to improve the downstream ecological processes under changed climate conditions. Given the Project's role in the overall water supply for SEQ, the role of the water grid and the role of water restrictions and regulatory requirements in times of lower water supply, I consider that adequate information has been provided to me to demonstrate that the Project will remain viable under predicted climate change impacts.

Groundwater

Key groundwater issues raised in submissions that I considered along with other relevant matters included groundwater and surface water interactions near the dam, long term monitoring requirements, salinity and the effect of the dam wall on groundwater flow.

Groundwater hydraulic testing at the Project's dam wall site indicate that bedrock structures or defects have very low permeability, and leakage from the water storage through structures or other defects in the underlying bedrock is expected to be extremely low. The design for the dam also includes a grout curtain for a depth of 20 m into the solid rock beneath the foundation of the dam wall to prevent water leakage or seepage if any undetected geological structures or defects exist.

A review of the then DNRW's groundwater database (GWDB) was undertaken to assess information on the location of registered groundwater bores, physico-chemical parameters, yields and lithological data. An initial search of GWDB records within a 20 km radius of the study area identified a total of 397 registered groundwater bores. Results from this search were used to derive broad regional groundwater information.

A second focused search was conducted to assess groundwater bores within and near the area of inundation. Twenty four groundwater bores were identified during this search with four of these bores installed during current groundwater investigations. Of the bores identified, 16 are existing, seven abandoned and destroyed and one currently abandoned but still useable. Only two of the 24 bores are situated within the inundation area, and both were installed as part of the current investigations.

Groundwater investigations reported in the EIS found that groundwater resources in the vicinity of the Project occur within underlying basement rocks and overlying Quaternary and Tertiary alluvial sediments. The basement rock (Amamoor Beds) are of extremely low hydraulic conductivity. Any groundwater in the basement rocks will be contained in joints and fractures. The capacity of any fractured rock aquifer is expected to be very small and to host negligible groundwater reserves. Local differences in yield may occur due to geological variation, fractures, fracture frequency and faulting. The Quaternary and Tertiary alluvial sediments comprise heterogeneous sequences of gravels and sands inter-dispersed with finer clays and silts. The alluvium predominantly forms an unconfined aquifer. Relatively thick (up to 10 metres) localised high permeability zones associated with the main drainage systems host localised groundwater resources, which are suitable for domestic and stock use.

There has only been limited monitoring of the alluvial systems and no long term hydrographs are available to assess seasonal variation in groundwater levels. The EIS suggested that fluctuation in water levels, possibly up to five metres, occur in response to rainfall infiltration or flood recharge events. Regional groundwater flow is likely to be towards the Mary River and its tributaries, and the EIS suggests that the primary groundwater recharge source is groundwater.

The EIS studies found that the permeability of the basement rocks at the dam wall are generally low to very low. A small number of geological structural features have been identified within the bedrock that may provide groundwater seepage paths from the dam storage but these would be grouted to minimised losses.

Water quality is spatially variable and it appears to be primarily influenced by the host rock chemistry. Groundwater salinity levels measured in the basement rocks of the dam wall were slightly higher than values encountered in the alluvial aquifer, but still suitable for drinking. Water quality for the alluvium was predominately fresh with electrical conductivity (EC) measurements ranging from 229 µS/cm to 966 µS/cm.

The EIS found that, based on the absence of saline soils in the inundation area and the absence of any significant aquifer in the area, the impacts of vegetation clearance, sedimentation and salinity on groundwater are considered negligible.

The EIS found that the Project may result in some localised increase in groundwater levels in the bedrock and in the alluvium in the immediate vicinity of the inundation area, and that fluctuations in groundwater levels may occur due to variable dam storage levels. There is no information on existing groundwater level fluctuations in the bedrock but the EIS suggests that the magnitude of fluctuation would be low. Given the predominantly non-saline groundwater quality in both the basement rocks and the alluvium, any impacts on water quality are expected to be minor.

Impacts of the dam on downstream groundwater levels were predicted in the EIS to be low, as rainfall is the major recharge source to both the basement and alluvial aquifers throughout the area. Additional recharge into the alluvial aquifers is also likely from surface water discharge during high flows, when the stream stage height is greater than that of the groundwater level. While a reduction in medium flows are likely to occur immediately downstream of the dam, high flows will be similar to existing conditions and the EIS suggests that groundwater levels in the alluvial aquifer downstream are unlikely to change.

Dewatering activities during construction will take groundwater from the alluvium at one place upstream of the proposed dam and replenish into the stream further downstream. The EIS studies found that the volume of water being transferred during this activity is small relative to the baseflow, and would have little or no effect on water chemistry characteristics downstream of the dam construction works.

While the proponent’s views in regards to groundwater impacts both adjacent to the inundation area and downstream appear sound, I have taken a precautionary approach and set conditions, requiring the proponent to monitor and take appropriate action if any adverse impacts on adjacent lands are observed. In Condition 10, Schedule C, Appendix 1 prior to the commencement of Principal Construction Works, the proponent must prepare and implement a Groundwater Monitoring Network Plan. Monitoring bores must be installed within the alluvium downstream from the dam wall and ongoing monitoring undertaken to determine annual and seasonal changes in water levels and water quality due to the Project, stream flow events and rainfall. Monitoring bores must also be installed adjacent to the reservoir to assess any impacts on local groundwater resources due to inundation. If the monitoring and associated required assessments demonstrate that adjacent landholders are experiencing adverse groundwater impacts due to the Project, the proponent must implement mitigations to make good those impacts.

Water quality

Key water quality issues raised in submissions that I considered along with other relevant matters included the impacts on water quality of construction, filling and operations, the relationship between changes in downstream flows and water quality, and the resulting potential impacts on the Mary River, the estuary and the Great Sandy Strait and the suitability of impoundment water for drinking.

The Mary River catchment drains an area of some 9,700 km^2 of land predominantly used for cattle grazing, dairy farming and some small crops. The EIS reported that these land uses have resulted in water quality ranges from slightly to moderately impacted within the Mary River.

Environmental Values (EVs) for water are the qualities of water that make it suitable for supporting aquatic ecosystems and human water uses. These EVs need to be protected from the effects of pollution, waste discharges and deposits to ensure healthy aquatic ecosystems and waterways that are safe for community use. Water quality objectives (WQOs) are long-term goals for water quality management. They are numerical concentration levels or narrative statements of indicators established for receiving waters to support and protect the designated EVs for those waters.

WQOs for the Mary River catchment are regulated under the EP Act, and the subordinate Environmental Protection (Water) Policy 2009 (EPP [Water]) and specified in the Mary River Environmental Values and Water Quality Objectives (EPA March 2007). Noting that relevant WQO may change over time, the current WQO that must be observed by the Project are as follows:

WQOs for the Mary River and other tributaries upstream and downstream of the inundation area:

(From EPA March 2007 for Lowland freshwater in a slightly to moderately disturbed aquatic ecosystem)

- turbidity: <50 NTU
- suspended solids: <6 mg/L
- chlorophyll α: <5 µg/L
- total nitrogen: <500 µg/L
- oxidised N: <60 µg/L
- ammonia N: <20 µg/L
- organic N: <420 µg/L
- total phosphorus: <50 µg/L
- filterable reactive phosphorus (FRP): <20 µg/L
- DO: 85% – 110% saturation

- pH: 6.5 – 8.0

WQOs for the inundation area

(From *EPA March 2007 for Freshwater lakes/reservoirs in a slightly to moderately disturbed aquatic ecosystem*)

- turbidity range: 1 – 20 NTU
- median chlorophyll α: <5 µg/L
- median total nitrogen: <350 µg/L
- oxidised N: <10 µg/L
- ammonia N: <10 µg/L
- organic N: <330 µg/L
- total phosphorus: <10 µg/L
- filterable reactive phosphorus (FRP): <5 µg/L
- DO: 90 – 110% saturation
- pH: 6.5 – 8.0

While a full description of these WQO is provided in EPA 2007, it is noted that:

- DO objectives apply to daytime conditions. Lower values may occur at night but these should not be more than 10% –15% less than daytime values. DO values <50% are likely to significantly impact on the ongoing ability of fish to persist in a waterbody. DO values <30% saturation are toxic to some fish species. These DO values should be applied as absolute lower limit objectives for DO.
- DO values for freshwaters should only be applied to flowing waters. Stagnant pools in intermittent streams naturally experience values of DO below 50% saturation.
- During flood events or nil flow periods, pH values should not fall below 5.5 or exceed 9.
- Nutrient objectives do not apply during high flow events.

Additional WQOs for the inundation area if primary recreation is proposed:

(From EPA March 2007 for Suitability for primary contact - freshwaters)

- median faecal coliforms <150 organisms per 100 mL or median enterococci organisms <35 organisms per 100 mL
- Secchi depth >1.2 m.
- intestinal enterococci: 95th %ile ≤40 organisms per 100mL (for healthy adults)
- <20,000 cells total cyanobacteria/mL or <10 µg/L chlorophyll-a with dominance of cyanobacteria

However, the National Health and Medical Research Council (NHMRC), *Guidelines For Managing Risks In Recreational Water*, February 2008, suggest that the above intestinal enterococci levels are an upper limit and much lower levels are desirable to protect children, the elderly or immunocompromised. I have therefore required, at Condition 9(l), Schedule C, Appendix 1 that a health risk assessment must be undertaken by the proponent and any required actions taken or restrictions introduced before any recreational water usage is allowed within the reservoir.

WQOs in the vicinity of off-takes for drinking water supply before treatment.

(From EPA March 2007 for Priority WQOs for drinking water supply in the vicinity of off-takes, including groundwater, before treatment)

Indicator	Hazard and critical control point (HACCP) rating
Suspended solids	• Level 1: 25 mg/L • Level 2: 100 mg/L
Blue-green algae (cyanobacteria)	• 2,000 cells/mL
Algal biomass	• Level 1: > 30,000 cells/mL Cylindrospermopsin or Microcystin • No Level 2
Algal toxin	• Level 1: 0.1 µg/L Microcystin or 0.2 µg/L Cylindrospermopsin • Level 2: 4 µg/L Microcystin or 1 µg/L Cylindrospermopsin
Taste and odour	• Level 1: 5 µg/L Geosmin or 10 µg/L MIB or 10 µg/L combined Geosmin & MIB • Level 2: > 30 µg/L of both Geosmin & MIB combined
Cryptosporidium	• Level 1: > 0 cyst • Level 2: 10 cysts per 10 L
Giardia	• Level 1: > 0 cyst • Level 2: 10 cysts per 10 L
E coli	• Level 1: > 60 cfu/100mL • No Level 2
Total coliforms	• Level 1: > 800 cfu/100mL • No Level 2
Manganese (soluble)	• Level 1: 50 µg/L • Level 2: 200 µg/L
Iron (soluble)	• Level 1: 50 µg/L • Level 2: 200 µg/L
Turbidity	• Level 1: 25 NTU • Level 2: 100 NTU
Colour	• Level 1: 50 Hazen Units • No Level 2
Conductivity	• Level 1: > 50% change from long term median • Level 2 same as Level 1 (no treatment options to remove salt)
Dissolved oxygen	• Level 1: < 4 mg/L at surface • No Level 2
Pesticides	• Level 1: Above detection limits specified by Qld Health Scientific Services • Level 2: Notification of spills or illegal dumping

Hydrocarbons	• No Level 1 • Level 2: Notification of spills or illegal dumping

Notes:

1. "Level 1" means Level 1 Hazard and Critical Control Point (HACCP) response rating, namely – Treatment plant process change required to ensure water quality and quantity to customers is not compromised.

2. "Level 2" means Level 2 Hazard and Critical Control Point (HACCP) response rating, namely –Treatment plant process change required but water quality and quantity to customers may still be compromised

I have specified the above WQOs and the monitoring and non-compliance response requirements, relevant to the above WQOs, in Condition 9, Schedule C, Appendix 1.

I have further conditioned that metals and pesticides must be monitored and assessed against the Aquatic Ecosystems Toxicants Guidelines for metals and metalloids, and pesticides, herbicides and fungicides set out in the Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand publication entitled the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000)* (or future updates). Items that are not detected after one year of post operation monitoring, or are assessed as being of insignificant risk to ecological and human health requirements, may be removed from the monitoring on the approval of Coordinator-General in consultation with DERM and the Office of the Water Supply Regulator (Condition 9).

The water quality in the Mary River catchment shows impacts typical of agricultural areas, with high levels of nutrients and bacteria, and elevated turbidity at least partially associated with erosion.

Nutrients can affect the aquatic environment by stimulating plant and algal growth, which can in turn cause a significant change in the composition of aquatic habitats and hence species diversity. An abundance of plants can decrease the DO content of water through both night-time respiration and oxygen consumption by bacteria decomposing dead plants. Some species of algae produce toxins that can affect the health of terrestrial and aquatic animals and cause taste and odour problems in drinking water. High concentrations of ammonia and nitrate can have direct toxic effects on aquatic animals.

The EIS found that total nitrogen, nitrate and nitrite median concentrations from historical records exceeded aquatic ecosystem WQOs in the Mary River downstream of the inundation area, and suggested that this may be due to intensive agricultural land use upstream. Total nitrogen, ammonia and organic nitrogen were generally higher than ecosystem protection WQOs in tributaries within and adjacent to the inundation area. Long-term monitoring median total phosphorus measurements exceeded WQOs downstream of the inundation area, but not within, upstream, or in any of the tributaries, and it was suggested that this might be associated with dairy farming in the area. Monitoring undertaken for the EIS found however, that total phosphorus was often higher than WQOs in tributaries.

Water clarity is a major determinant of the condition and productivity of an aquatic system as increased turbidity reduces light available for photosynthesis and, therefore, plant growth. Suspended sediment can smother benthic organisms and habitats, and cause mechanical and abrasive impairment to the gills of fish and crustaceans. Suspended sediment can also transport contaminants, promote the growth of pathogens and waterborne diseases, and can lead to DO depletion in the water column if it is caused by particulate organic matter. High turbidity levels can lead to a reduction in productivity and diversity.

The EIS reported that long term historical data indicated that total suspended solids (TSS) were higher than both drinking water and aquatic ecosystem protection WQOs, both upstream and downstream of the inundation area in the Mary River, however, turbidity measurements were lower than WQOs.

Most aquatic animals need adequate DO levels for respiration. DO concentrations are affected by:

- photosynthesis, which produces oxygen as a by-product
- oxygen consumed by aerobic respiration, nitrification and chemical oxidation within the water environment

- exchange of oxygen with the atmosphere

Low DO concentrations can lead to mortality of aquatic organisms, or cause reducing conditions in the sediment that may allow the release of nutrients and toxicants into the water body.

The EIS reported that historical data indicates that DO levels were generally high in all reaches of the Mary River and its tributaries, while surveys undertaken as part of the EIS indicated that DO tended to be well below WQOs at most tributary sites. Maroochy Shire Council data reported in the EIS indicated that the DO concentrations in the main channel are highly variable, which the EIS suggested was probably due to dense, but patchy, stands of macrophytes.

Excessive phytoplankton growth often leads to poor water quality, noxious odours, oxygen depletion, human health problems and fish kills (due to oxygen depletion). Phytoplankton levels are measured as chlorophyll-α. Generally, low levels suggest a healthy ecosystem, even though higher levels of phytoplankton growth may support larger heterotroph (e.g. fish) populations. Long-term persistence of elevated levels of chlorophyll-α, however, can indicate adverse impacts and a likelihood of harmful (toxic) algal blooms. EIS studies found that high algal counts and chlorophyll-a concentrations were loosely correlated with nutrient concentrations, and that chlorophyll-α concentrations exceeded aquatic ecosystem WQOs in several tributaries.

Iron and manganese are both essential elements for aquatic organisms, but acute and chronic toxic effects can occur above certain concentrations. Acute toxic effects generally cause mortality in a group of organisms, whereas chronic toxic effects may cause changes in growth (weight and length), reproduction and behaviour. The EIS reported that historical short-term and long-term monitoring data show that soluble iron exceeded both WQOs in tributaries, while manganese did not. Levels of dissolved iron in particular may be related to the relatively anoxic conditions present in the tributaries during the period under study and may not represent typical conditions. Increased elevations in iron and manganese levels have been reported in the hypolimnion of Baroon Pocket and Borumba dams and in Lake MacDonald when stratification occurs, indicating the geology of the area possibly has high iron and manganese levels that become mobile under conditions tending towards anoxia.

Overall water quality tends to deteriorate immediately downstream of the proposed dam site but improves further downstream until the river waters reach the Maryborough region. In addition, the extensive macrophyte beds within the river channel may be acting as a sink for nutrients and suspended solids, filtering the water as it travels downstream.

In response to these existing water quality issues, and the need to ensure the Project's catchment contributes a high degree of water quality, I have required in Conditions 4, 5, 9 and 31, Schedule C, Appendix 1 a range of requirements targeted at improving water quality within the catchment and particularly within the inundation area. These requirements include specifications for a Catchment Enhancement Program (CEP) and an integrated Project Water Quality Program (PWQP). These requirements affirm the proponent's commitment to being active in the catchment and working in cooperation with land owners and community groups to assist in improving the water quality of the Mary River. The PWQP is further described below.

Construction

Possible construction impacts on water quality include increased turbidity downstream of the works and the accidental release of pollutants. There is a risk that without adequate mitigation sediment runoff may occur from a range of construction activities and I have therefore conditioned at Condition 16 that, detailed erosion and sediment control procedures are prepared, documented and implemented before and during Project construction activities.

On-site sewage and grey water arrangements must be in accordance with the relevant regulatory requirements. I note that once on-site sewerage and greywater arrangements are determined by the proponent, the proponent may need development approval of the relevant environmentally relevant activity (ERA), which if approved will contain relevant conditions or comply with legislative requirements. I note that where required mobile ablution facilities must be provided for construction staff and toilet wastes must be disposed of in accordance with regulatory requirements. I further recommend that grey water should be re-used where feasible to both reduce any potential impacts on the water quality of the Mary River and its tributaries, and to conserve water generally.

Filling

The EIS found that water quality is expected to degrade within the inundation area during the filling phase, and that while the duration of the filling phase is dependent upon river flow at the time it is highly probable that the dam will reach FSL within two years. During this initial filling there is a potential risk that the impounded water may become enriched with nutrients as submerged terrestrial vegetation rots, possibly leading to oxygen depletion. The proponent has committed in the SREIS to managing these impacts by the staged clearance of plant material prior to filling, land use controls and catchment management activities, as well as monitoring and adaptive management of the dam as it fills. As committed to in the SREIS, the following controls will be implemented during construction:

- restriction of the construction area footprint to minimise areas of disturbance
- timing of construction to coincide with low rainfall periods
- use of directional bunds and grades to direct runoff water to appropriately sized sediment retention ponds
- implementation of a water quality management plan and revegetating construction footprint
- removal of vegetation debris material
- removal of floating noxious or exotic species from the Project Area
- preventing cattle access and therefore encouraging macrophyte growth around the fringes of the dam
- water quality monitoring and selective release of water downstream, to minimise the risk of poor water quality release on aquatic fauna
- stabilisation of dispersive soils
- implementation of best practice erosion and sediment control measures.

In view of the potential downstream impacts from these effects, I have conditioned at Condition 7, Schedule C, Appendix 1 that these measures must be implemented, and as far as possible terrestrial vegetation material must be removed from the inundation area prior to filling except for material deliberately placed for habitat reasons and riparian vegetation required by conditions. Sediment and erosion control management may require the retention of low lying vegetation within the inundation area such as grasses and ground covers but every effort should be made to minimise the volume of vegetation material to be inundated including the slashing and removal of vegetation ahead of the advancing inundation line.

The proponent has committed to developing a Vegetation Clearance Management Plan. Commitments include mulching suitable terrestrial vegetation for use in construction site rehabilitation, landscaping. 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. I have imposed these measures at Conditions 4, 7 and 27, Schedule C, Appendix 1. In addition, I require that in Condition 27(d) Schedule C, Appendix 1 that burning be least preferred option. Disposal of weeds must comply with Condition 27(c) Schedule C, Appendix 1.

Floating macrophytes present in the buffer and inundation area may remain, but all floating noxious or exotic species must be eradicated and controlled as set out in Condition 21(k), Schedule C, Appendix 1.

Release of water from the inundation area must occur during filling to meet EFOs and WASOs set out under the WRP, and downstream flow requirements as per Condition 8, Schedule C, Appendix 1. Releases must achieve the relevant WQOs during both the filling phase and operation to minimise impacts on aquatic fauna and downstream water users. I recognise that this will require thorough preparation of the inundation area before filling as discussed above, and may require the use of temporary mechanical aeration within the inundation area and the establishment of an agreement with SunWater to secure dilution flows from Borumba Dam.

Reservoir during operation

The SREIS notes that that nutrients were the major analytes that exceeded the WQOs within and adjacent to the dam site. The SREIS anticipated that effective catchment management upstream of the dam and appropriate land-use management to reduce erosion on the edges of the dam would potentially reduce the nutrient input into the impoundment from current levels in the upstream catchment. The EIS commits to mitigation measures for managing nutrient enrichment within the impoundment including:

- maintain, when possible, stable water levels in the reservoir to encourage macrophyte growth around the fringes of the dam as a sink for nutrients
- re-vegetate proponent-owned former agricultural land abutting the inundation area to minimise potential runoff
- assist with catchment management upstream of the dam through such actions as the rehabilitation of riparian vegetation, restricting access by cattle to the riparian zone and providing farm planning advice on sustainable land management practices to improve runoff water quality
- targeted remediation of existing erosion and protection of the areas of greatest erosion risk as determined from monitoring upstream to assess bed erosion / deposition and changes in bed substrate within the upstream reaches of the inundation area
- provide support for sewering Kandanga to reduce the potential impacts of septic disposal systems on nutrient levels within the dam

I have considered these commitments in designing my conditions and have taken the view that both inflows from upstream and controls around the inundation area need to be carefully managed and implemented to protect inundation area water quality, especially when considering drinking water extractions and environmental impacts downstream. These measures are comprehensively set out in Conditions 4, 5, 9 and 32(m) Schedule C, Appendix 1.

I have conditioned requirements for vegetated buffers and a Catchment Enhancement Program at Conditions 4 and 5 Schedule C, Appendix 1. These requirements are explained in detail in section 3.1 of this Evaluation Report.

I have required, in Condition 9 Schedule C, Appendix 1 that before dam operations commence, an integrated Project Water Quality Management Plan (PWQP) be prepared to address water quality in the storage, diffuse and point sources of pollution in the catchment and downstream of the dam and that responsibility for required actions should be committed to by the relevant parties. I note that a range of stakeholders would need to be involved in the development of a suitable WQMP to achieve optimal outcomes for all land uses in the catchment, to ensure that WQOs are achieved throughout the life of the Project. The WQMP must include the commitments made by the proponent to sustainable ecological catchments.

In addition, the proponent has committed to contributing $4 million to assist with the sewering and upgrade of the water supply of Kandanga, and I have imposed this commitment in Condition 32(m) Schedule C, Appendix 1.

The EIS found that the dam would probably experience stratification to some extent with the potential to adversely impact on water quality both within the inundation area and for downstream releases.

I have conditioned at Condition 8(j) Schedule C, Appendix 1 that the Project must have a multi-level offtake to allow water to be selectively extracted during stratification events, and that under non-flood conditions water must be released downstream through outlet works to aid oxygenation (apart from water required for turtle and fishway transfer devices). If further action is required to achieve reservoir WQOs mechanical destratification or oxygenation within the reservoir may need to be undertaken.

Turbidity during operation may be caused by dispersive soils present on the edges of the inundation area, catchment inflows; and waves generated from craft used in recreational activities. Waves and fluctuating water levels will exacerbate these effects. I have conditioned at Conditions 15 and 16 that dispersive soils are to be stabilised, controlled and protected before filling of the inundation area occurs.

Experience at nearby storages indicates that algal blooms are likely from time to time. I am requiring, at Conditions 9(i) and 9(n), that monitoring must be undertaken to detect the presence and required management strategies if toxin-producing blue-green algae species do occur.

I note that blue - green algae is best managed through both the prevention of relevant nutrient flows into the reservoir and water treatment. This highlights the importance of the measures I have set out in Conditions 4, 5, 9 and 32(m).

Downstream impacts during operation

Water quality downstream must be of a satisfactory quality to protect aquatic species. There is a risk that the Project could cause at least temporary reductions in water quality manifested by low DO, high turbidity and high algae growth. Low DO levels have the potential to generate fish kills. There is some evidence that many species, such as Lungfish, may respond to any such reduction in water quality by attempting to move out of the area and that they may require adequate DO levels to facilitate breeding.

Poor water quality in the inundation area may lead to poor water quality downstream, however water downstream quality will be protected by the requirements set out in Condition 9, particularly in relation to WQO requirements as discussed above. This will require: implementation of the WQMP as required by Condition 9 Schedule C, Appendix 1; the implementation of vegetated riparian buffer zones as required by Condition 4 Schedule C, Appendix 1; and possibly the use of mechanical aeration during filling. Additionally the outlet works are to be equipped with a multi level offtake and outlet works to assist with the re-oxygenation of released waters (as conditioned in Condition 8 Schedule C, Appendix 1).

Modelling studies predicted that the Mary River would see a large reduction in fine sediment load for the post-dam compared to existing scenario immediately downstream of the dam. Total suspended solids immediately downstream of the dam footprint currently exceed aquatic ecosystem protection WQOs, although current turbidity levels do not. The decreased sediment loading immediately downstream of the dam has been predicted in the EIS to result in an improvement in water quality in terms of the suspended solid WQO.

Modelling predicts up to a 20% reduction in total sediment volumes reaching the river mouth. Water quality in the mouth of the river currently consistently exceeds the aquatic ecosystem protection WQOs, and the potential decrease in sediment loading due to the sediment trapping capacity of the dam may improve the water quality in terms of turbidity, suspended solids and associated nutrients downstream from the dam. However, historical monitoring indicates that the water quality in the area downstream of the Mary River Barrage deteriorates rapidly in terms of suspended solids, turbidity, and nutrients and this may indicate that most of the poor water quality in this area is a localised effect of urban activities in the Maryborough region rather than upstream activities. If this is the case, reduction of sediment from the upstream reaches of the Mary River due to the impoundment will have little impact on the water quality at the mouth of the river.

Estuary

Analysis of the EIS flow models demonstrate that the Project's proposed release regime will have only a minimal impact on the flows to the Mary River Estuary when compared to the existing situation. Mean total flow volumes to the Estuary will reduce by 4%. The peak daily flows during floods at the Estuary will reduce between 4-17%, however this represent only 1% of the volume of flood water. The impact of additional zero flows to the Estuary is also negligible with only 7 extra days identified during the 109 years of the data modelling. Furthermore, the proposed flow regime will also result in slightly increased flows during the low flow months.

The Project will result in improved water quality, through reduced sediment loads and subsequent nutrient levels. However, 208km downstream at the Estuary this impact will be very minor. Even the expected reduction in fine sediments of 20% will be difficult to detect as tide, wind and wave action causes re-suspension. Additionally, the Mary River's sediment loads will still be well above its natural state.

The Mary River and Tinana barrages, which block the upstream movement of the tidal salt wedge, have truncated the estuary and eliminated brackish-water habitats upstream. Downstream of the barrages, the EIS indicates that the Mary River Estuary is classified as a tide-dominated estuary, with positive annual hydrodynamics, meaning that on an annual basis freshwater input from the catchment to the estuary exceeds evaporation. During the low-flow winter months, however, it is highly likely that the estuary exhibits negative hydrodynamics, where evaporation exceeds freshwater input. The SREIS found that during wet periods when positive hydrodynamics prevail, fresh water flows out of the estuary on the surface while a tidal salt wedge moves up and down the estuary on the bottom. In negative hydrodynamic conditions during the dry season, flows of fresh water into the estuary are too low to form a fresh water layer on the surface, and the evaporation of seawater that enters on flood tides produces water of slightly elevated salinity that tends to flow out along the bottom on ebb tides. Salinities are controlled primarily by tidal exchange. Reduced fresh water input due to the Project is predicted to have little influence on salinity because the volumes of fresh water input are much lower than the volume of the tidal wedge.

The most likely effect of the dam on salinity on Hervey Bay and the Great Sandy Strait, as in the Mary River estuary itself, is a possible slight attenuation of low-salinity events during floods. The effects of fresh water flow reductions on salinity in Great Sandy Strait and Hervey Bay are predicted to be imperceptible.

Monitoring

<u>I require that</u> water quality monitoring be undertaken throughout the inundation area and immediately upstream and downstream at Condition 9, Schedule C, Appendix 1. <u>I note</u> monitoring is a key element of the mitigation strategy for reservoir water quality, and will provide an assessment of the ongoing performance of the reservoir, determine the need for mitigation measures and inform the development of further measures if required. <u>I therefore</u> require in Condition 9, the proponent develop a Water Quality Monitoring Program. This program is to understand storage water quality, sediment nutrient recycling and reservoir stratification, as well as water quality of inflows and outflows.

This monitoring must be carried out at a range of sites and focus upon the WQO requirements set out in Condition 9, these include temperature, speciated (and total) nutrients, suspended solids, heavy metals (especially manganese and iron), chlorophyll-a (including speciation and cell counts), pathogens (potentially using E Coli as an indicator), and herbicides and pesticides. In addition to the routine water quality monitoring requirements, <u>I require</u> that additional monitoring be triggered by specified higher flow events or environmental incidents.

In time, the appropriate frequency of monitoring will be determined through risk assessment based on the water monitoring trends and the characteristics of the project and its catchment, in accordance with the *Australian Guidelines for Water Quality Monitoring and Reporting 2000* or documents that supersede these as per with regulator requirements. However, the initial routine monitoring program <u>I require</u> once filling commences is:

- weekly monitoring of algae (blue green and diatoms if appropriate); DO, turbidity at depth
- monthly monitoring of nutrients, physio-chemical parameters including iron and manganese levels at a variety of depths

- monthly monitoring of metals, pesticides and herbicides that may be present within the impounded water
- the monitoring of real time temperature with depth at a depth interval and number of locations to provide a suitably accurate description of reservoir temperature
- the recording of ambient air temperatures, wind speed and direction, rainfall and inflow (via a weather station and gauging stations) and
- event-based monitoring to measure the water quality of inflows into the dam site to monitor the impacts of catchment management practices.

I am satisfied that through compliance with my conditions, including the proponent's proposed mitigation measures, the proponent will be able to suitably manage and mitigate the impacts of the Project on water quality.

3.3. Terrestrial environments

Introduction

Submissions on the EIS raised a number of issues in relation to terrestrial environments. I have considered each of the submissions and how the SREIS has responded to the issues raised in those submissions. Key issues that I considered warranted particular elaboration in my evaluation included:

- the extent and impacts of historical clearing of vegetation
- the need for substantive and sustained vegetation offset activities by the proponent
- impacts on EVR species such as the Giant Barred Frog
- habitat connectivity
- errors in descriptions relating to various species.

For over 150 years, this Catchment has been modified through the timber, horticulture, gazing, and river mining (originally gold but in recent years sand and gravel) industries. Additionally, an ever growing portion of its catchment has now been covered in rural-residential development. These intensive industries and housing development have all had a significant impact on the Mary River and its catchment, principally through vegetation clearing. The terrestrial environment in and around the Project Area has similarly been subject to significant development. At the time of European settlement the area contained dense subtropical rainforest and eucalypt woodlands. The high rainfall, deep soils and habitat complexity contributed to a significant abundance and diversity in terrestrial life. Since European settlement, while economic development has supported the wellbeing of the greater community, the impact of timber gathering, agriculture development and other activities has significantly altered the landscape and significantly diminished the area's biodiversity values.

A 1997 Land Use, Vegetation Cover and Land Disturbance Survey of the Mary River Catchment (Pointon 1998) was conducted for the then Department of Natural Resources. The study concluded that, in terms of vegetation coverage, only 1% of the Mary River Catchment was still in its natural state whilst a further 5% was largely intact (some impacts from seasonal gazing). A further 10-15% had vegetation of a quality that would meet the requirements of remnant vegetation. Non remnant vegetation equated to a further 24-29% of the catchment, and 50-60% of the catchment had been extensively to completely cleared by that time.

Within the EIS study area, the cleared area is even greater, with the EIS reporting clearing of 85% of the area.

The present local environment has a rural character and supports many small agricultural and residential landholdings. The original pre-European vegetation has been largely cleared with the exceptions of some narrow remanent strips along waterways and in high sloping areas. Rural and residential development has brought with it exotic species, some of which are now significant weeds and pests. The development of this land has led to vegetation fragmentation. The resulting limited connectivity means wildlife is vulnerable to disease, bushfire, and inbreeding.

The Project Area does not include any protected areas or land tenures that are managed for conservation. There are no National Parks, State Forests, or any local government conservation parks.

However, there are over 38,000 ha of protected areas which extend to within 5-10 km of the study area, as follows:

- to the south-west, Imbil State Forest and Imbil Forest Reserve collectively cover 23,327 ha
- to the south or south east, West Cooroy State Forest covers 1,150 ha, and Mapleton Forest Reserve another 369 ha.
- to the West, Amamoor State Forest and Amamoor National Park involves 7,049 ha of protected areas
- to the North, 537 ha are protected within Traveston State Forest and Woondum State Forest and another 4,050 ha are protected in the North-East within Woondum Forest Reserve
- to the East, the combination of Mount Pinbarren National Park, Six Mile Creek Conservation Park, Tuchekoi Forest Reserve, and Yurol State Forest equates to 2,180 ha of protected land.

Despite the level of disturbance within the Project Area as described above, some EVR species are still present within the area. Four EVR plants were identified or considered highly likely to be present, including the vulnerable slender milkvine (marsdenia coronate) and ball nut (floydia praealta) species. Most of the identified or potentially present EVR fauna are likely to be only occasional visitors to the Project Area venturing out from better preserved habitats outside of the Project Area. The notable exceptions are the:

- Giant Barred Frog (also sometimes incorrectly referred to as Southern Barred Frog)
- Tusked Frog
- Three-toed Snake-tooth Skink
- Grey-headed Flying Fox
- Elf Skink
- Challenger Skink
- Little Pied Bat
- Grey Goshawk
- Square-tailed Kite

All species, including native fauna species in the Project Area, depend on and are part of complex ecosystems. The preservation of native species, especially threatened species, requires the protection of their supporting ecosystems. A number of Queensland Government policies and legislative requirements recognise this need. <u>I have aligned</u> my conditions with those policies and requirements, while targeting species protection. <u>I have imposed</u> conditions directed at the creation, preservation and restoration of habitat. In the following section of this Evaluation Report, <u>I have considered</u> in the context of the potential impacts on terrestrial species from the Project, the current degraded and worsening ecological situation in the Mary River catchment, what actions are required to stabilise the current ongoing ecological decline, and what further actions would reverse that decline and address uncertainty that may remain in terms of the future viability of EVR species.

The Project Area includes endangered riparian regional ecosystems. In this locality, the riparian vegetation types have demonstrated, given appropriate protection and support, an ability to regenerate despite around 150 years of ongoing disturbances. Furthermore, fragmented wildlife corridors that could be augmented through actions as part of the Project to more fully restore connectivity between areas of fauna habitat are present within the Project Area.

The development of the Project would result in further landscape change and increased pressures that would, without mitigation and offsetting vegetation and other activities, lead to the further diminution of some local ecosystems and species. Conversely, the Project also provides an opportunity to offset and to some extent reverse previous environmental degradation in order to address uncertainties in the mitigation of potential adverse impacts on environmental values, especially in regard to native species. As a result, some species are likely to benefit from the development of the Project, particularly given the habitat restoration activities that I am requiring the proponent to implement as part of the further development of the Project.

Remnant regional ecosystems and offset requirements

The EIS identified nine Regional Ecosystems (REs) within the Project Area. These REs were all identified by the proponent during the development of the EIS from the then current Certified Regional Ecosystem Map (interpreted from 1:40 000 1996 aerial photography) produced by the then EPA's Queensland Herbarium. EIS studies reviewed the Herbarium RE mapping using source data from 1:25 000 aerial photography (May 2006) and ground-truthing at over 140 survey sites. This resulted in proposed revisions to the RE extent and composition across the Project Area, presented in the EIS.

Several submissions registered concern about the proposed changes to RE classification and suggested the then EPA's certified maps were accurate. In Section 18.3.1.2 of the SREIS, the proponent responded to these submissions. The response indicated the additional EIS work presented a higher level of interpretation and accuracy than the certified RE mapping for the Project Area as at the time of the EIS. This new data set was submitted to the then EPA during 2008. The EPA accepted the validity of the data but only partially accepted the proponent's interpretation of the categorisation of the various REs in producing an updated certified RE Map. This updated RE mapping results are referred to as the Herbarium 2008 results. Table 9 provides a comparison of the two different sets of analysis results.

Table 9 Comparison of the Herbarium 2008 and the EIS results in regards to areas of Endangered, Of Concern, or Not of Concern but Riparian Remnant Vegetation Categories Likely to be lost to the project.

Remnant Vegetation Offset Classification		Inundation ha		Dam Wall / Construction ha	Local Road Corridors ha	TOTAL ha	
		EIS (EIS Table 7.7)	Herbarium *	EIS (EIS Table 7.24)	EIS (EIS Table 7.27)	EIS (SREIS Table 18-4)**	Herbarium ***
12.3.1	Endangered	59.87	184	0.52	0.02	60.41	184.54
12.3.2	Of Concern	54.85	14	0	0.13	54.98	14.13
12.3.11	Of Concern	14.55	15	2.22	0.2	16.97	17.42
12.11.14	Of Concern	14.67	7.6	2.02	9.45	26.14	19.07
12.3.7	Riparian	100.45	23	1.4	0.39	102.24	24.79
TOTAL ha		**244.39**	**243.6**	**6.16**	**10.19**	**260.74**	**259.95**

Table Notes:

* source is correspondence from 3D Environmental to the proponent dated 5 December 2008 at Appendix E.

** Minor variation of values to source reference is due to SREIS Table including REs due to the independent delivery of the Bruce Highway realignment.

*** Total Herbarium data includes Dam Wall / Construction and Local road corridors data sourced from EIS.

As indicated in **Table 9**, the proponent and DERM (formerly the EPA) agree that the total remnant endangered, of concern and not of concern riparian vegetation (i.e. REs 12.3.1, 12.3.2, 12.3.11, 12.11.14, 12.3.7) to be lost as a result of the Project works totals approximately 260ha (proponent identifies 260.74 ha compared to 259.95 ha for the Herbarium). The proponent and DERM essentially disagree on the extent of 12.3.1 compared to 12.3.7 and 12.3.2 within the agreed total mapped RE figure of approximately 260 ha. Despite the disagreement, the important point is that an appropriate offset to clearing ratio must be applied to the agreed total of lost REs and normal processes associated with the production of Property Maps of Assessable Vegetation, by the chief executive administering the VM Act, will be able to resolve the categorisation of different REs within the total. The proponent is able to apply to the chief executive administering the VM Act to produce such maps in the key areas in dispute and therefore receive a definitive categorisation.

I consider, on the basis of the proponent's analysis, particularly as set out in the correspondence to the proponent from its adviser (3D Environmental), dated 5 December 2008 at Appendix 3 to this Evaluation Report, that the appropriate offset to clearing ratio (based on the Policy for Vegetation Management Offsets) for each relevant RE should be at least 3:1. Even though the proponent recommends a ratio of 2:1 for RE 12.3.7, I consider that the higher ratio of 3:1 is applicable given the differing views about 12.3.7 classifications outlined above and the importance of riparian habitat to frog and aquatic species in the Mary River as detailed in section 3.3 of this Evaluation Report (in relation to aquatic species).

- **Table 10 Comparison of the Herbarium 2008 and the EIS analysis results in regards to areas to the application of a Minimum 1:3 Offset for all Endangered, Of Concern, or Not of Concern but Riparian Remnant Vegetation Categories Likely to be lost to the Project.**

Remnant Vegetation Offset Classification		TOTAL REha to be Offset		CG minimum applicable Offset Ratio	Minimum REha Required for Offsets	
		EIS (Table 18-4)**	Herbarium ***		EIS	Herbarium ***
12.3.1	Endangered (and Riparian)	60.41	184.54	1:3	181.23	553.62
12.3.2	Of Concern (and Riparian)	54.98	14.13	1:3	164.94	42.39
12.3.11	Of Concern (and Riparian)	16.97	17.42	1:3	50.91	52.26
12.11.14	Of Concern	26.14	19.07	1:3	78.42	57.21
12.3.7	Not of Concern (Riparian)	102.24	24.79	1:3	306.72	74.37
TOTAL ha		**260.74**	**259.95**	1:3	**782.22**	**779.85**

Table Notes:
** Minor variation of values to source reference is due to SREIS Table including REs lost to the Bruce Highway corridor
*** Total Herbarium data includes Dam Wall / Construction and Local road corridors data sourced from EIS.

Condition 13(b) of Schedule A, Appendix 1 (Operational Works for clearing native vegetation) requires the proponent to address the requirements of the Policy for Vegetation Management Offsets. In relation to RE 12.3.1, this Condition 13(b) means that, the proponent is required to develop and implement a Vegetation Offset Proposal, which includes the restoration and/or protection of between 181.2 ha and 553.6 ha of RE 12.3.1, with the final quantity within this range to be determined by the chief executive administering the VM Act depending on the outcome of any future Property Map of Assessable Vegetation. .

Both sets of analysis indicated approximately 90% of the RE lost to clearing will be riparian vegetation types. 92% (EIS data indicates 84%) of Endangered and Of Concern REs that will be lost are riverine or wetland ecosystems (the exception is 12.11.14 - open eucalypt and grass forest). An additional 25 ha (EIS indicates 102 ha) of Not of Concern is also riparian vegetation (RE 12.3.7).

Losses of gallery rainforest (notophyll vine forest) on alluvial plains (RE 12.3.1) are of the greatest concern. According to the EIS, there is only approximately 8,300 ha of this endangered RE left in the SEQ Bioregion, and only 1,339 ha of this RE 12.3.1 is within protected areas. The corresponding figures for other REs requiring offset action are considerably larger.

The then EPA, through its use of Biodiversity Planning Assessment (BPA), has identified areas of endangered RE 12.3.1 within the Mary Valley that have special biodiversity values and are therefore considered to be of State Significance. One such area is adjacent to Six Mile Creek between Lake McDonald and the confluence with the Mary River. The examples of RE 12.3.1 within the Project Area are not classified as being of State Significance using the BPA.

On the basis of the above analysis, I understand that high quality examples of this RE are rare, partially due to their susceptibility to weed invasion. The EIS indicates that 27.2 ha of the RE that would be affected is "well preserved and high quality", including particularly notable tracts close to the limit of inundation at Belli Creek. Furthermore, this RE may play an important role in support of the conservation of the Mary Valley's EVR fauna species.

The EIS indicates that some affected areas adjacent to the Mary River and tributary creeks upstream of the inundation area will only be subject to periodic inundation and in these locations, and with time, the RE may be able to recover with limited intervention. The dominant species - Waterhousea (Syzguim floribunda) has the capability to respond to changing waterway conditions. Whilst many mature Waterhouseas will eventually perish and fall into the rising water, they do heavily seed as well as shoot from vegetative suckers which should result in high levels of recruitment above the new water level on and above the existing bench. The "up bank" migration of the RE 12.3.1 could be further assisted through planting/transplanting lomandra and removing cat's claw creeper and other weeds. Re-establishment of the Waterhousea would help stabilise the bank and thereby potentially protect the less-inundation tolerant rainforest vegetation that is growing behind the Waterhousea in the flood plain. Some of the larger and less adaptable rainforest trees will not survive the rising water level. However, as the trees are generally located higher on the bank edge or on the floodplain, many will be outside of the inundation area, particularly in locations such as Belli Creek. These trees can be expected to not only survive but provide local seed to naturally assist in expanding and filling the proposed dam edge buffer zones and wildlife corridors. As a result, I do not believe that all the RE 12.3.1 in the inundation area will be irreversibly lost. With time, the various species of RE 12:3:1 will again find their optimal locations to form the RE's distinctive riparian structure. Planting of additional flood plain rainforest species as well as excluding cattle will help enhance the diversity.

Therefore, there is scope to take positive actions to preserve significant portions of the RE 12.3.1 and the species that depend upon the ecosystem. In the longer term, this ecosystem is likely to exceed the current volume and diversity given my imposed requirements to restore and protect vegetation, actively control weeds and constrain cattle access and otherwise manage the areas surrounding the impoundments as identified below.

The detailed specifications and related requirements are provided in Schedule A, operational work for clearing of native vegetation, and throughout the habitat protection and creation requirements at Conditions 2, 3, 4, 5 and 21, Schedule C, Appendix 1. It is important to note that a particular area of restored and protected vegetation may address both of the separate requirements of Schedule A and Schedule C. I have set conditions that require all lost (or potentially lost) riparian ecosystems to be restored and/or protected through new protection and restoration efforts within the Mary River Valley which have the potential to develop (within 20-30 years) into ecosystems of an overall quality that in many places are better than presently occur. In effect, my conditions require that the proponent actively contribute to increasing the percentage of protected 12.3.1 within the bioregion. I am confident that these conditions will ensure that the Project will not result in any further deterioration in the Mary catchment's terrestrial ecosystems, but will lead to a net gain in terms of protected remnant vegetation.

Essential habitat and connectivity

In addition to remnant vegetation, there is non remnant vegetation within the Project Area that will be lost to inundation. As the areas of non-remnant vegetation have been subject to historic clearing and severe disturbance, the non-remnant vegetation is heavily degraded and in many cases dominated by exotic species (including weeds) and plantations. The non remnant vegetation may, however, provide some limited connectivity value in terms of linking areas of remnant vegetation and the more distant surrounding forested areas, as well as to waters within the Mary River.

The EIS indicates that the Project Area did not include any State Wildlife Corridors or mapped Essential Habitat, as at the time of the EIS. These designations relate to land identified by DERM as being critical for one or more EVR species. Principally, the lack of recognised essential habitat is due to the historic clearing and regrowth suppression that has occurred related to agricultural activity. The proponent is obliged by the VM Act to ensure that any future identified areas of regrowth and/or restoration and/or mapped Essential Habitat within the Project Area must be suitably protected. This includes mapped Essential Habitat for koalas that has been finalised subsequent to the EIS and SREIS. The requirements for offsetting impacts on fauna habitat are discussed below.

The EIS indicated that with few exceptions the vegetation within the Project Area is too fragmented to provide quality terrestrial fauna EVR habitat.

Areas of remnant and non remnant vegetation are generally isolated. Only the riparian environment offers any wildlife corridor values. Local Government-recognised wildlife corridors within the study area are largely focussed on the Mary River and its tributaries. However, in many cases these are compromised through limited width or truncated by either clearing up to the stream margin or by intersections with roads.

The most valuable corridor is along Belli Creek. Excepting a handful of minor roads, the well-developed vine forest communities in the vicinity are connected by narrow strips of non remnant riparian forest which provide linkage between the Mary River and rangeland habitats to east. Fortunately, as Belli Creek is positioned in the upstream reaches of the inundation area, a reasonable portion of this corridor should remain.

Limited continuity is offered by riparian corridors along Coles, Kandanga, Skyring and Yabba Creeks. Without restoration works, the previously important but now limited wildlife corridor values associated with these creeks would be further reduced by the inundation.

Outside of the Project Area there are wildlife corridors of significance. The then EPA's Biodiversity Assessment and Mapping for the bioregion identifies quality tracts of vegetation adjacent to the site. This includes vegetation that is part of a State Wildlife Corridor. It is in this context, that existing spurs of vegetation and the proposed revegetation of large parts of the inundation area buffer (defined in section 3.1 and Condition 4, Schedule C, Appendix 1, of this Coordinator-General's report) provide, or have the potential to provide enhanced connectivity between the site's permanent water and the adjacent forested slopes.

The condition that I have imposed at Condition 4(f), Schedule C, Appendix 1, requires the proponent to design its VMO and revegetation efforts so as to re-establish effective wildlife corridors around the perimeter of the inundation area and link at least two of the surrounding State protected areas/forests.

Weeds and feral animals

The Project Area and surrounding areas suffer significantly from weeds and feral animal infestations.

One hundred and twenty-three of the plants recorded during the EIS surveys were exotic species. Fifteen of these (including aquatic plants) are declared under the *Land Protection (Pest and Stock Route Management) Act 2002*. This represents a very large presence of weeds throughout the Project Area and the broader study area examined within the EIS. Declared plants have infested remnant, non remnant and cleared sites.

Seven declared weeds (class 3 weeds) are known to be prevalent throughout the catchment's riparian vegetation, these being:

- cats claw (Macfadyena unguis-cati)
- madeira vine (Anredera cordifolia)
- narrow leaf/small leafed privet (Ligustrum sinense)
- broad leaf /large leafed privet (Ligustrum lucidum)
- chinese elm (Celtis sinensis)
- camphor laurel (Cinnamomum camphora) and
- balloon vine (Cardiospermum grandiflorum).

Additionally, the EIS Survey identified six additional weeds that are declared under the *Land Protection (Pest and Stock Route Management) Act 2002*, these being:

- groundsel bush (Baccharis halmifolia) - class 2
- giant rat's tail grass (sporobolus pyramidalis) - class 2
- fireweed (senecio madagascariensis) - class 2
- lantana (lantana camara V ar. Camara) - class 3
- dutchmen's pipe (Aristolochia elegans) - class 3 and
- broad-leaved pepper (Schinus terebinthifolia) - class 3.

Besides being declared under State legislation, lantana is also listed as a Federal Government Weed of National Significance (WONS).

The Project Area and surrounding vicinity also included three class 2 declared pests, these being:

- feral cat (felis cattus) - class 2
- dog (canis familiaris) - class 2 and
- red fox (vulpes vulpes) - class 2.

In particular the EIS noted that packs of wild dogs were common at the commencement of the survey. Non declared pests such as brown hares and cane toads were also readily observed at the site. Whilst not identified during the EIS survey, there is some suggestion that class 2 pest feral pigs (Sus scrofa) are or have been in the area.

I consider that the likely focused prevention and control of terrestrial weeds and pests that the proponent is committed to implement in the Project Area will generate a major improvement to the vicinity. The conditions that I have imposed, at Condition 21(k), Schedule C, Appendix 1, require an active and effective eradication and control program to be implemented for the life of the Project.

The weeds and pest management condition applies to all land within the inundation area buffer and waterways within the Project Area and requires the proponent to cooperate with surrounding land holders.

EVR species - introduction

The EIS identifies that the EVR flora species potentially impacted by the Project as being four vascular plants that are confirmed or highly likely to be present. In relation to fauna, I understand that one EVR invertebrate, four EVR amphibians, three EVR reptiles, three mammals and seventeen EVR birds that are likely, or confirmed, within the Project Area or immediate surrounds. These various categories are listed and discussed below. All but one of these EVR species is listed within the *Nature Conservation (Wildlife) Regulation 2006* (NC Reg). Ten of the species are listed in the EPBC Act.

In assessing the EIS information, in terms of identifying the likely impacts and required mitigations for EVR species, and setting conditions of approval, I have carefully considered the potential for the Project to degrade essential habitat areas that would interfere with an EVR taxa's life cycle or survival strategy (e.g. concentrated migration rest point, seasonal foraging site, breeding colony site etc) and to limit the prospects that the Project could result in an irreversible reduction to an EVR taxa, significant at the scale of the Mary River Valley.

EVR plants

The EIS field survey recorded a total of 579 (of which 109 were exotic) vascular plants representing 352 genera from 106 families. Compared with forested parts of SEQ, there are very few endangered, vulnerable or rare (EVR) flora species within the Project Area and immediate surrounds as surveyed in the EIS.

Of the flora species identified in the EIS survey, only one plant Slender Milkvine (Marsdenia coronata) is listed under the EPBC Act. However, another plant Ball Nut (Floydia praealta) was found outside the inundation area and it is possible that it could occur within the inundation area. Both these plants are listed in the EPBC Act as vulnerable.

The NC Reg lists both the Slender Milkvine and Ball Nut as vulnerable. In addition, Giant Ironwood (Choricarpia subargentea) was found on the site and it is listed as rare under the NC Reg. Picris conyzoides (no common name) is also listed in the NC Reg as rare but it was not found during the survey. However, based on its characteristics, the EIS states it is highly likely to be within the Project Area, particularly as there are two historic records of it in the vicinity of the Project. As a result, it is assumed to be present and it must be accommodated through the offset and mitigation measures that I have imposed as discussed elsewhere in this section of the report. For example, the requirements within Conditions 21(e) and 21(f), Schedule C, Appendix 1, obliges the proponent to monitor, record and report the Project-related net loss and net gain of protected species and to ensure that any necessary habitat creation, translocation and other activities occur to ensure that no net loss of any EVR species occurs as a result of the Project.

EVR plants that are highly likely or confirmed to be present in the EIS study area (wider than Project Area) are listed in Table 11 below.

- **Table 11: EVR plants highly likely or confirmed in the EIS study area**

Common Name	Species Name	NC Reg	EPBC	Presence in Study Area
		Status		
Slender Milkvine	Marsdenia coronata	Vulnerable	Vulnerable	Confirmed. Adjacent to Yabba Creek & Skyring Creek
Ball Nut	*Floydia praealta*	Vulnerable	Vulnerable	Highly Likely
Giant Ironwood	*Choricarpia subargentea*	Rare	Not Listed	Confirmed Adjacent to Mary River, Yabba Creek & Kandanga Creek
Picris conyzoides	*Picris conyzoides*	Rare	Not Listed	Highly Likely

Figure 7.1 of SREIS demonstrates the locations of known EVR plants in and around the Project Area.

Slender Milkvine can be found in various locations in South East Queensland and Northern NSW. A few individuals were found at two sites: one site would be inundated, whilst a second site is just outside of the inundation area. Despite targeted searches, very little Slender Milkvine was found in the broader study area as described in the EIS. However, the Project does result in the loss of approximately 7.5 ha of potential habitat (stands of 12.11.3 or 12.11.11 on hill-slopes and foot-slopes). Some habitat will not be affected including, for example, areas near Gibber Creek and Yabba Creek. The proponent is committed to develop an active Translocation Plan and I have conditioned at Condition 21(f), Schedule C, Appendix 1, that suitable translocation and/or propagation plans must be documented and implemented to ensure no net loss of the species.

Despite targeted searches, no individuals of Ball Nut were found within the broader study area containing the Project Area. However, the Project would result in the inundation of 7.36ha of potential habitat (RE 12.11.10 and 12.11.11) for this species. Ball Nut is a tall tree growing to 30m with rough, brown bark. Following the release of the EIS several individuals of Ball Nut were found close to the periphery of the Project Area within a remnant vine forest - RE 12.11.10. These individuals will not be impacted by inundation, the Dam wall or road infrastructure. There are 26 historic records of Ball Nut being identified in the Mary Valley (in the vicinities of Kenilworth, Amamoor and Imbil).

Giant Ironwoods were recorded at six locations adjacent to the Mary River and the western creeks within the Project Area. It is located in a range of regional ecosystems (12.3.7; 12.3.11, 12.11.10, 12.11.11). Over 100ha of these regional ecosystems will be lost to inundation. This area of 100ha includes three known sites containing Giant Ironwood. The proponent indicates that this tree is relatively widespread and its status as an EVR species is to be reviewed by 2010. Even if this tree is more common than currently thought, I have conditioned (Condition 21(g), Schedule C, Appendix 1) that this taxa be well represented in the Vegetation Management Offset areas (required by Schedule A, Appendix 1) and/or the protected riparian habitat areas to be created in accordance with Condition 4 of Schedule C, Appendix 1.

Picris conyzoides is a small flowering plant that occurs in grassy open eucalypt forest and disturbed areas. Potentially, this species could occur across the Project Area in the many disturbed areas. However, any initial loss of possible habitat for this species within the inundation area and road corridors is not expected to have a significant impact on this species, as possible habitat is abundant across the Mary Valley and it should also readily re-establish within the areas to be restored to vegetation within the Project Area in accordance with Condition 4 and Condition 21(f), Schedule C, Appendix 1.

Following the EIS release, an independent survey report within a submission on the EIS to the Coordinator-General indicated that Hairy Hazelwood (Symplocos harroldii) was located at a site upstream from the inundation area. I understand that the land owner will not allow the EIS botanist access to confirm this finding. Regardless of this unverified finding, the Project Area is out of the known range (coastal and hinterland areas) of the species. Further, as with up to 14 other EVR plant species assessed in the EIS as being of low likelihood to be present within the Project Area, Condition 21(f), Schedule C, Appendix 1 obliges the Proponent to offset any loss of the plant if it is identified as being present in the future.

Despite the possible loss of habitat for particular individuals, it is expected that all the present EVR flora species will remain within the Project Area since viable habitat will remain and the proponent is committed to appropriate offset and mitigation activities, which I have also imposed via various requirements within Condition 21, Schedule C, Appendix 1 and Schedule A.

That is, I have set conditions that require that these EVR plants are successfully integrated into the extensive VMO and riparian habitat restoration works that are required, particularly through Condition 4, Schedule C. Appendix 1. If additional EVR plants are found during the works, the priority is to protect the plants, and if that is not possible, to undertake propagation and/or translocation activities on land to be restored to vegetation to ensure no net loss of individuals from the Mary Valley.

EVR invertebrates

The only EVR invertebrate species that may potentially be present in the vicinity as per the following table, extracted from information presented in the EIS and SREIS.

Common Name	Species Name	NC Reg	EPBC	Presence in Study Area
		Status		
Richmond birdwing	*Ornithopera richmondia*	Vulnerable	Not Listed	Likely (low)

The EIS survey did not identify any signs of the Richmond Birdwing butterfly or its food *plant (Pararistolochia pravenosa)* within the Project Area.

However, the SREIS includes a response to a submission from the Mary River Catchment Coordination Committee that is based on the proponent's discussions with a member of the Richmond Birdwing

Recovery Network Association. The submission and reported discussions indicate that the butterfly has been sighted in the vicinity, there is a major breeding population of Richmond Birdwing close to the inundation area and the population is being monitored by the Richmond Birdwing Recovery Network. Further, parts of Belli Creek (subject to inundation) are suitable habitat for Pararistolochia praevenosa (the larval food plant for the butterfly).

The SREIS indicates that the proponent considers that it is highly likely the Pararistolochia pravenosa is present in the broader study area. The requirement for VMO as well as riparian restoration, presents an opportunity to work with the Richmond Birdwing Recovery Network to develop habitat to augment and provide a wildlife corridor from the existing breeding area downstream towards the proposed Dam wall along Belli Creek. Therefore, my conditions at Condition 21(d), Schedule C, Appendix 1 require the areas of protected and restored habitat in the vicinity of Belli Creek include Pararistolochia praevenosa to provide habitat for a colony of Richmond Birdwing that is known to be in the vicinity.

In addition, it is probable that riparian restoration work to support the Richmond Birdwing would also benefit local amphibians.

EVR reptiles and amphibians

Four EVR reptiles were identified as present, or likely to be, within the Project Area or immediate surrounds. However in each case it appears the impact on the conservation of these species would be minor. The EVR reptiles are **listed below.**

Common Name	Species Name	NC Reg	EPBC	Presence in Study Area
		Status		
Three-toed Snake-tooth Skink	*Coeranoscincus reticulates*	Rare	Vulnerable	Likely (Low)
Elf skink	*Eroticoscincus graciloides*	Rare	Not Listed	Present
challenger skink	*Saproscincus rosei*	Rare	Not Listed	Present
Common death adder	*Acanthophis antarcticus*	Rare	Not Listed	Likely (moderate)

Of the four, only the Three-toed Snake-tooth Skink (Coeranoscincus reticulates) is listed in both the Commonwealth EPBC Act (vulnerable) and the Queensland NC Reg (rare). This species is better known in mountainous rainforest habitat within southern Queensland, including the Conondale Ranges. However, it has also been found in forest on sand dunes at Cooloola.

The Three-toed Snake-tooth Skink is a cryptic species and may be found in well-mulched, loose, rainforest soil in leaf litter, often immediately adjacent to fallen tree trunks.

The EIS survey included targeted but unsuccessful searches for the three-toed snake tooth skink. However, after the release of the EIS documents, the remains of a Three-toed Snake-tooth Skink were found in a property just outside of the Project Area.

Threats to this species include loss of leaf litter and soil compaction through overgrazing by stock, clearance of habitat for agriculture and grazing, removal of fallen logs and leaf litter through frequent fire and fragmentation of habitat. Most of these processes have already occurred within the study area. The EIS indicates that, if this species is present at the Project Area, it will probably be on the hill-slope vine forest. As there is less than 7.5 ha of this habitat is in the inundation area and considerably more outside of the inundation area it is unlikely to have a significantly impact should the species be present.

Similar to the Three-toed Snake-tooth Skink, the Common Death Adder (Acanthophis antarcticus) was not found within the Project Area but there is a record of one being found outside the study area near

Imbil. Potentially, it may occur in small patches of eucalypt forest and adjoining riparian forest areas within the inundation area, particularly where these are in relatively close proximity to more extensive suitable habitat (i.e. areas associated with the eastern tributaries).

The three-toed snake tooth skink and the Common death adder are likely to benefit from my requirements (at Condition 4(f), Schedule C, Appendix 1) for the proponent to create a wildlife corridor linking the vegetation to be restored within the inundation area buffer to its preferred eucalypt forests outside of the Project Area.

In contrast, the EIS survey found the Elf Skink (Eroticoscincus graclioidies) to be relatively common and widely distributed throughout the Project Area's wet sclerophyll rainforests. The EIS indicates that, despite the NC Reg listing as “rare”, it is relatively common and widespread in the Sunshine Coast region.

While the inundation area includes reasonable riparian and vine forest habitat for the Elf Skink, the Proponent suggests that the loss of habitat under the proposed inundation would not have a noticeable impact for the species. As the Elf Skink prefers shaded forest habitats, I consider that the requirements for the creation of protected riparian habitat at Condition 4, Schedule C, Appendix 1 (e.g. aimed primarily at benefiting frogs and aquatic fauna) will also benefit the Elf skink and many other terrestrial fauna thorough the restoration of REs to the vicinity.

A few Challenger Skinks (Saproscincus rosei) were captured during the fauna survey. It is considered that this species occurs extensively throughout the inundation area in vine forest and riparian gallery forest. The EIS includes a calculation indicating that approximately 136 ha of quality habitat will be lost to inundation.

The Challenger Skink is known in NSW and southern Queensland. The occurrence of the Challenger Skink within the inundation area appears to be the northernmost known occurrence of this species in lowland habitats, and thus inundation of this habitat is likely to have a significant impact on the known range extent.

The size of the local population and therefore proportion of the regional population to be impacted is not known. However, the Challenger Skink has been encountered in more elevated habitats in the Conondale and Jimna Ranges and is also likely to occur in riparian gallery forest surrounding the inundation area. Furthermore, as with the Elf skink restoration of riparian habitat within the inundation area buffer will provide future habitat opportunities for the Challenger Skink. Given my vegetation offset conditions at Schedule A and conditions 21(c), 21(e) and 21(h), Schedule C, Appendix 1 (particularly that there must be no net loss of habitat for EVR species) the proponent is obliged to offset the loss of habitat for the Challenger Skink within its VMO areas and/or created areas of protected riparian habitat arising from Conditions 4 and 5 of Schedule C, Appendix 1.

There are four EVR amphibians that are, or are highly likely, to be within the study area. The potential impacts on a population of the Giant Barred Frog (Mixophyes iterates) raise the most significant concerns. The EIS submissions demonstrated the community has substantial concern over the future of the EVR frogs at the Project site.

Listed below are the four EVR frog species identified as likely or present within the broader study area.

Common Name	Species Name	NC Reg	EPBC	Presence in Study Area
		Status		
Tusked Frog	*Adelotus brevis*	Vulnerable	Not Listed	Present
Giant Barred Frog	*Mixophyes iterates*	Endangered	Endangered	Present
Cascade Treefrog	*Litoria pearsoniana*	Vulnerable	Not Listed	Likely (High)
Green-thighed Frog	*Litoria brevipalmata*	Rare	Not Listed	Present

Fragmentation of habitat is a significant risk for all four of these frogs generally. Given that extensive clearing has already occurred in the Project Area, the Project Area is already affected by this threatening process. Despite this common issue, the micro-habitat requirements do differ for each of these species. The Tusked Frog, Giant Barred Frog, and Cascade Tree Frog all require moist riparian forests with permanent water, however they are thought to differ in that (for example) the:

- Tusked Frog requires static (or very slow moving) water pools
- Giant Barred Frog requires riparian rainforest vegetation along permanent and slow moving streams/pools with steep banks up to an altitude of 700 m and
- Cascade Treefrog requires rocky flowing streams in rainforest of an altitude between 100 - 1000 m

The Green-thighed Frog is more mobile and breeds in ephemeral or semi-permanent water bodies. Whilst the Green-thighed Frog may be found in wet forests and swamps, it is best known for breeding in flooded paddocks or temporary waterholes bordering open woodland.

As a result of the above differing habitat requirements, the Project will impact on these species to varying degrees.

The EIS indicates the Tusked Frog is widely distributed in the study area but should be able to successfully recolonise as it prefers static waters. Based on past colonisation of man-made dams and drains, the frog is expected to do well in the upstream inundation area within existing creeks and Mary River.

In the case of Cascade Treefrog, I understand the impact will be minor since there is very limited habitat, if any, within the inundation area.

It is also unlikely that the inundation area contains significant habitat (as described above) for the Green-thighed Frog.

However, without extensive mitigation and habitat offset action, the Project would almost certainly have a detrimental impact on the Giant Barred Frog population in the vicinity. The Giant Barred Frog is a comparatively large frog with a length of up to 115 mm. Its size and mixtures of browns and olive colours can lead the public to mistaking it for the introduced cane toad.

Since the 1970s there has been a significant decline in Queensland stream dwelling frogs. Giant Barred Frogs (and Cascade Tree Frogs) have been part of this overall decline. While the cause of the decline is not certain; it is thought to be associated with infection from the Chytrid fungus. However, it may also be related to a combination of changes to habitat associated with water quality changes, clearing, and/or the impact of introduced animals.

The Giant Barred Frog's abundance has declined throughout its entire range (particularly NSW), including local extinctions from localities where it was once well known. In Queensland it appears to have disappeared from Bunya Mountains and Cunningham's Gap. It was once thought to have disappeared from the Conondale Ranges, however, a few specimens were found in 2001.

The occurrence of Giant Barred Frogs within the broader study area surrounding the inundation area and the Mary River catchment area are described in Section 18.4.2.1 of the SREIS. The combined findings of surveys by Mary River Catchment Coordinating Committee and to inform the EIS identified 12 Giant Barred Frogs within the study area, with only two of these being outside of the inundation area. The survey sites where the species was recorded within the study area were stream sites within both remnant and non remnant riparian vine forest and gallery forest adjacent to Belli Creek, Happy Jack Creek, Skyring Creek, Mary River and Coonoon Gibber Creek. It was located adjacent to the Mary River at only two locations, at the confluence with Happy Jack Creek and with Belli Creek. A number of submissions advised me that the surveys may underestimate the true importance of the area to frogs since the surveys were conducted in drought conditions.

The Mary Valley is clearly of significance for the Giant Barred Frog. There are many Wildnet records of the frog in the Valley, in part due to the dedicated record-making efforts of the Mary River Catchment Coordinating Committee. Records of the frog include areas well upstream of the Project. At the time of the EIS, the proponent considered that the Skyring Creek-Belli Creek vicinity in the study area around the inundation zone represented the most northern point of the frog's range. However, on the basis of advice from submitters, the proponent has now identified that there are Giant Barred Frogs present to the north in the Mary River catchment and outside of Maryborough in the Burrum River Catchment. Additional information obtained from the then EPA indicates that there is a substantive presence of the species within Blackfellow Creek, Kilcoy Creek and (to a lesser extent) Yabba Creek. I do not consider that the identification of these additional areas of presence diminish the need for substantive mitigation and offset effort by the proponent in relation to the habitat in the proximity of the Project. However, it is a potentially significant development in terms of providing some additional areas for habitat enhancement activities to be applied to via the Catchment management program required by Condition 5, Schedule C, Appendix 1.

There is limited scientifically-verified information relating to the microhabitat used by this species. However, eggs are thought to be thrown out of the water by the female onto overhanging or steep banks (Knowles et al. in prep cited in Patterson et al. 2002) and daytime shelter positions are either under leaf litter or under vegetation (Lemckert and Brassil 2000). Eggs take several weeks to develop, with tadpoles hatching and falling or wriggling down to the water below. The species has an extended larval (tadpole) stage which may last up to 18 months (Anstis 2002). Metamorphosis has been observed in summer and autumn.

It would appear that the Giant Barred Frog prefers small stream areas involving permanent or semi-permanent shaded pools with particular features (e.g. undercuts, exposed roots and/or fallen branches) on the banks.

Given that Giant Barred Frogs use overhanging banks, steep banks, and deep pools, the retention of these micro-habitat structures within the creeks they inhabit is likely to be important.

Whilst experience has shown that the Giant Barred Frog is sensitive to disturbance in its habitat, the frog does seem able to exist in narrow bands or riparian vegetation surrounded by cleared paddocks of livestock. There is also anecdotal evidence indicating it has returned to locations restored after logging activity.

A preliminary tracking study suggests that the Giant Barred Frog rarely ventures far from the stream, but will move short distances up and downstream. The proponent's analysis within section 5.3.1.1 of the Response to Reviewers Report indicates that the Giant Barred Frog has adapted to periodic flooding over its preferred habitat and is therefore likely to disperse from inundated locations if there is suitable adjacent riparian vegetation and survive the initial inundation. However the proponent does concede the Project may result in a loss of a number of individuals within the lower reaches of Coonoon Gibber, Skyring, Happy Jack and Belli Creek after initial inundation. The proponent has committed to translocate as many individuals as possible from these areas to the protected and rehabilitated habitat upstream (as indicated on the Habitat Rehabilitation Area map in Schedule F). The Upstream Riparian Protected Habitat Area must be established prior to Principal Construction Works in accordance with

Conditions 4(b) and 4(i), Schedule C, Appendix 1. In addition, Conditions 21(j)(ix) and 21(j)(x), Schedule C, Appendix 1 require the proponent to document baseline population's statistics and monitoring-based-thresholds that will trigger a requirement for specific mitigation measures to address adverse population changes.

A total of approximately 116.6 ha (proponent estimate in the Response to Reviewers' Report) of the Giant Barred Frog's riparian habitat will be impacted by the Project at FSL (100% full) along the creeks identified above. However, it should be noted that riparian zones below 1.5 m FSL will not be cleared within the inundation area and that the inundation area will only be 100% full 23% of the time; and the water level will be below approximately 2 m of FSL approximately 80% of the time. Therefore, shallower water depths (similar to those currently existing) will be prevailing in most of the key tributary areas for large periods of time. The proponent has indicated that in some of the locations where the Giant Barred Frogs were found close to FSL, and the existing riparian vegetation will continue to extend above and below FSL, some of the frogs may be able to persist, close to, or within their current range.

I requested the proponent to consider whether the calculation of the habitat area to be offset should be larger due to the fact that two Giant Barred Frogs were recorded from two sites on the Mary River during the baseline surveys conducted for, and reported in, the EIS. DERM suggested to me that a patch of remnant vegetation of 114.5ha in area associated with these sites should be considered for inclusion in the calculation of habitat for the Giant Barred Frog. The proponent advised in response to my query that these patches should not be included in the calculation of existing quality habitat for the Giant Barred Frog because it is located on the main channel of the Mary River in an area which does not contain habitat attributes such as slow moving water and likely breeding pools, and is highly fragmented in relation to the identified patches of high quality habitat.

Breeding sites for the Giant Barred Frog are typically located on, or near, permanent deep pools on slow moving reaches of streams. These areas are also characterised by steep, overhanging and undercut banks and relatively intact riparian vegetation (providing cover and leaf litter inputs). These sites primarily occur on the tributaries of the Mary River and not the main stream of the Mary River itself.

As discussed in the proponent's Habitat Restoration Plan, the Giant Barred Frog has been recorded within remnant riparian vine forest and gallery forest (including REs 12.3.1, 12.3.2 and 12.3.7) on Belli Creek, Happy Jack Creek, Skyring Creek, Mary River and Coonoon Gibber Creek. I accept the proponent's view that the relevant patches of potential habitat on the Mary River are of considerably lower quality than the habitat adjacent to the creeks mentioned above.

Fortunately upstream of the inundation area within the creeks, suitable Giant Barred Frog habitat would remain and the proponent has produced a detailed plan (as per Habitat Restoration Plan within the Response to Reviewer Report) including identified priority areas for rehabilitation, to enable the recovery of the local population of the species.

The proponent is committed to rehabilitating habitat along Belli Creek, Happy Jack Creek, Skyring Creek, Coonoon Gibber Creek and some parts of the Mary River. A principal outcome of this work will be to increase the connectivity of habitat between the known habitats adjacent to the creeks. In the areas that are subject to only moderate levels of inundation, this restored riparian habitat is likely to be suitable habitat (particularly with the establishment of the Waterhousea and Lomandria).

At Condition 21(c), Schedule C, Appendix 1, I am requiring the proponent to offset the quantity of lost habitat that the proponent has estimated. This offset is to be created through the rehabilitation and protection of suitable microhabitat in areas approved by the agency responsible for the NC Act and adjacent to current habitat used by the species. These offset areas are to total at least 174.89 ha (i.e. 1.5 x 116.6 ha) reflecting a loss to offset ratio of 1:1.5, consistent with the ratio required by the VM Act for mapped essential habitat. In relation to the DERM suggestion that additional sites be considered in the calculation of habitat to be offset, I note that the more extensive areas of protected riparian habitat to be created and protected adjacent to the Mary River and tributaries, in accordance with Conditions 4 and 5 of Schedule C, Appendix 1, will mean that considerably more potentially suitable habitat, will be available for the Giant Barred Frog in the future. I consider that suitable quantities of offsetting habitat will be generated as a result of my conditions which extend the commitments already provided by the proponent. This view has been reached having regard to:

- The additional benefits (i.e. extended areas of potential habitat in the Project Area) that are likely to arise due to the vegetation creation and protection requirements of Conditions 4 and 5 as mentioned above

- the arguments presented by the proponent in its Response to Information Requests, relating to my information request about DERM's suggestion that the creation and protection of new habitat should be on lands totalling more than 174.89 ha

- the additional benefit to the species that will arise from the research imposed at Condition 11 Schedule C, Appendix 1 as mentioned below

- the required implementation of a monitoring program and a management plan with the specific aim to assist the Giant Barred Frog as detailed in the Habitat Restoration Plan within the Response to Reviewer Reports. I have required at Condition 21 (j) (x) the specification of monitoring based thresholds that will trigger further specific mitigation measures to address adverse population changes.

In addition, the EIS and my conditions at Condition 11 Schedule C, Appendix 1 commits the proponent to fund and otherwise support research into the captive husbandry of frogs and mitigation measures involving the translocation of at risk individuals and the maintenance of genetic diversity in isolated populations if monitoring reveals this to be a problem. Based on the opinions of Dr Hero (as quoted in the Response to Reviewer Report) and DERM advice as to the appropriate extent of research and restoration, I expect the applied research program and other requirements to greatly aid the long-term viability of Giant Barred Frog.

I acknowledge a number of the submitters to the EIS were sceptical about the potential for mitigations involving activities such as captive husbandry or translocation. One submitter advised me there has been no previous example of a successful program of adaptive management strategies and captive husbandry for Giant Barred Frog. However, the proponent has cited (in its Response to Reviewer Report) the use of such programs elsewhere and has developed a comprehensive set of impact mitigation measures relating to the relevant formal recovery plan (Recovery Plan for Stream Frogs of SEQ). I am confident that such measures will only be implemented in conjunction with suitable oversight of DERM as per its involvement in the research program required by Condition 11, Schedule C, Appendix 1.

It is important to note that the Recovery Plan for Stream Frogs of SEQ identifies that the majority of the known populations for the Giant Barred-Frog in south-east Queensland occur on unprotected private land. The Giant Barred Frog mitigation program to be implemented as part of this Project would result in populations of Giant Barred Frogs receiving protection through the creation of substantial new protected areas.

I also draw attention to the importance of the proponent's commitment to ensure the project's environmental management plan prevents works leading to increased sedimentation, erosion, weed invasion and nutrient and chemical pollution that could otherwise harm Giant Barred Frogs and their habitat.

In conclusion, there are risks to Giant Barred Frogs arising from the Project and ongoing threatening processes that warrant substantial habitat creation and other activities (e.g. the funding and other support for necessary research into the characteristics of the species). Without suitable mitigation, existing land uses and inundation associated with the Project will place favoured habitat at risk and may further fragment the lowland population. Maintaining a sustainable population of Giant Barred Frogs in the vicinity of the Project site is a significant challenge requiring substantial resources. However my conditions, particularly at Conditions 4,5,11 and 21, Schedule C, Appendix 1, bind the proponent to the necessary substantial mitigation actions that focus on habitat enhancement and completing necessary research. I consider that these actions have considerable potential to play a major role in the recovery of the Giant Barred Frog in the longer term.

EVR mammals

The EIS confirmed two EVR mammals are within the study area; a flying fox species and the koala. In addition, the proponent considers it highly likely that an EVR micro bat is at least foraging in the area and that a second EVR micro bat and the Spotted tailed quoll's presence cannot be ruled out, but are of a low likelihood.

Common Name	Species Name	NC Reg	EPBC	Presence in Study Area
		Status		
Grey-headed flying fox	*Pteropus poliocephalus*	Not listed	Vulnerable	Present
Koala (SEQ)	*Phascolarctos cinereus*	Vulnerable (SEQ)	Not Listed	Present
Little pied bat	*Chalinolobus picatus*	Rare	Not Listed	Likely (high)
Large-eared pied bat	*Chalinolobus dwyeri*	Not Listed	Vulnerable	Likely (low)
Spotted-tailed quoll	*Dasyurus maculates maculates (SE mainland)*	Vulnerable	Endangered	Likely (low)

Only the Spotted-tailed quoll (Dasyurus maculatus maculatus) is listed under both the NC Reg (vulnerable) and EPBC (endangered). Of the remaining four species mentioned above, two are listed under the EPBC and two under the NC Reg only.

The Spotted tailed quoll is the largest species of quoll and will feed on rabbits, possums, gliders, bandicoots, and birds. Its population is in decline and there have been many localised extinctions within their range.

There is a Wildnet record of the Spotted tailed quoll close to the study area, and a submission claimed they are known at Chinaman's Creek. Additionally, they can be found in a range of forest types including riparian forests. However, despite the deployment of elliot and nose hair traps, the Spotted tailed quoll was not identified during the field study. It seems highly unlikely that the current site could support a population of spotted tailed quolls. The EIS concludes that, at best, that Spotted tailed quoll would only be a transient visitor to the Project Area.

The quality and quantity of the present habitat within the Project Area is unlikely to sustain a Spotted tailed quoll. In the longer term, the rehabilitation measures I have imposed and VMO requirements may improve the habitat for quolls. One crucial step in returning the quolls to this site is re-establishing wildlife corridors to the upland habitat (which possibly does support the quoll). Furthermore appropriate feral animal management program would be important for this animal.

The conditions relating to the VMO, riparian restoration and fauna corridors will be a small but positive mitigation for the Spotted tailed quoll. The installations of logs and log piles in the VMO areas could provide micro habitat for the quoll. Furthermore feral management (with no, or highly controlled use of poisons that can be used for this purpose) will also be of benefit.

Little is known about the habitat needs of the Large-eared pied bat (Chalinolobus dwyeri). There is no evidence that the Large-eared pied bat is in the study area, as it was not identified in the EIS study (through analysis of bat calls) nor are there records of this bat in the study area. Consequently the likelihood of this bat utilising the site is considered low. However, the proponent does indicate that the rocky areas surrounding the Project Area may provide appropriate roosting and the Project Area and may provide foraging opportunities.

The EIS concludes that if the Large-eared pied bat exists at the site, it is at very low densities and should be able to sustain itself on alternative foraging areas. I also note that DEWHA report that some of the (few) recent reports of the Large-eared pied bat in South East Queensland have emerged from areas within the vicinity of constructed dams - Wivenhoe Dam and Moogerah Dam.

The Little pied bat (Chalinolobus picatus) is probably present in the study area. Whilst there are no records of the Little pied bat in the study area, the EIS analysis of bat calls indicated they may be present at a number of sites within the Project Area. This is surprising as generally this species is known in dryer inland areas. If confirmed, the EIS findings would provide the most eastern known location for the bat. It is also known to depend on ready access to free standing water and may roost in buildings and hollow trees close to the water. It may also be roosting in caves which will not be affected by the inundation.

The EIS concludes that if the Project Area is able to sustain the Little pied bat then the similar habitat outside of the Project will also provide suitable habitat. The Project will impact on approximately 150ha of Eucalypt dominated forest containing hollow prolific species such as Grey Gum, Tallowwood and Northern Grey Ironbark that could contain hollows that would suit the bat.

I have set conditions, at condition 21(e), (h) and (i), Schedule C, Appendix 1, that will ensure that, that if present, the Little Pied Bats will not be harmed and that adequate roosting alternatives are available. Conditions include a pre-assessment of tree hollow availability and the erection of appropriate hollow structures to at least equal the hollow habitat that will be cleared. The conditions also require pre clearing inspections to ensure no fauna are present within trees prior to cleaning.

Grey-headed flying fox (Pteropus poliocephalus) is a vulnerable species under the EPBC Act since the species population is believed to have decreased by roughly 30% during the 1990s. The species forages on a wide variety of flowering plants and fruits (including exotic).

The EIS submissions identified a colony of Grey-headed flying fox (several thousand individuals) within the study area. Whilst the colony is located outside of inundation area, the project would lead to a loss of foraging grounds for the flying foxes. The colony is also located around 250 metres from the proposed Gympie-Brooloo Road

The EIS indicates that the loss of the inundated feeding areas are unlikely to have a significant impact on this species as it feeds on a wide variety of plants and is capable of flying up to 50km on occasions to feed. The proponent proposes to implement noise controls during the breeding season to reduce the risk to colony. Furthermore, the Grey-headed flying fox has demonstrated an ability to cope with traffic noises close to its colonies.

The Grey-headed flying fox are highly mobile and the loss of 302ha of remnant forest within the inundation area will only represent a small portion of their potential foraging area and is unlikely to significantly diminish the size of the colony. Unless and until more precise accounting of the net gain situation for this species emerges as required by Condition 21(e), Schedule C, Appendix 1, my vegetation creation conditions (Schedule A and conditions 4 and 5, Schedule C, Appendix 1) will oblige the proponent to include at least 453ha of broadly suitable remnant forest habitat for the species within the areas it has to restore to satisfy VMO requirements and my conditions 4 and 5, Schedule C, Appendix 1. As a result I am satisfied that the Grey-headed flying fox will not be significantly affected by the Project works.

My requirements at condition 21(i), Schedule C, Appendix 1 also prohibits road works or placing of stockpiles in the patch of vine forest occupied by the colony to ensure roosting and breeding habitat is protected. Further, works in this vicinity must not occur in the key breeding months of the year.

Koalas (Phascolarctos cinereus) were sighted in a three locations within the inundation area. The Koala is relatively common in most of Australia, however the NC Reg lists it as “vulnerable” principally due to pressures on Koala habitat in South East Queensland.

The EIS suggests there is unlikely to be a large number of Koalas within the Project Area. Nor does the proponent consider it likely the highly fragmented habitat could support a stable breeding population. However, the Project will lead to a loss of food trees from the inundation area..

The proponent indicates in the EIS that extensive forests in the surrounding hills provide considerably greater quantities of habitat of higher quality compared with the fragmented patches of habitat in the Project Area.. These forested areas will continue to act as the prime breeding areas for Koalas in the Mary Valley. It is likely that in the longer term, my requirements for considerable new areas of restored and protected vegetation to be created in the Project Area will substantially increase the extent and quality of suitable vegetation in the Project Area and will create beneficial wildlife corridor linkages between the upland habitat and food trees that surround the Mary Valley. The increased extent of vegetation coverage arises from the requirements of Conditions 4 Schedule C, Appendix 1 and the conditions within Schedule A (Operational Works for Clearing Native Vegetation).. In terms of quality, the specific requirements of Condition 21 (b), Schedule C, Appendix 1 will act to maximise the use of species preferred by the Koala within the new areas of vegetation to be created, and the requirements of Condition 21(k) are designed to ensure that feral animals, which can injure or kill Koalas, will be eradicated and excluded from the inundation area buffer. As a result, these relevant conditions taken together will ensure that the Project delivers a net gain outcome for the species. I am satisfied that with these habitat creation and pest control measures, the Project's overall impact on Koalas will be positive.

EVR birds

As listed in the below table, seventeen EVR bird species are present or are likely to be present within the study area. Four of these, including the Coxen Fig Parrot, are rated as having only a low likelihood of being present. All the EVR birds are listed within the Queensland NC Reg. Four are also listed as either endangered or vulnerable within the EPBC Act.

Common Name	Species Name	NC Reg	EPBC	Presence in Study Area
		Status		
Coxen's fig-parrot	*Cyclopsitta diophthalma coxeni*	Endangered	Endangered	Likely (low)
Regent honeyeater	*Xanthomyza Phrygia*	Endangered	Endangered, (migratory)	Likely (low)
Swift Parrot	*Lathamus discolor*	Endangered	Endangered	Likely (low)
Red goshawk	*Erythrotriorchus radiates*	Endangered	Vulnerable	Likely (moderate)
Painted Snipe	*Rostratula benghalensis s. lat.*	Vulnerable	Vulnerable	Likely (moderate)
Powerful owl	*Ninox strenua*	Vulnerable	Not Listed	Likely (low)
Glossy black-cockatoo	*Calyptorhynchus lathami*	Vulnerable	Not Listed	Likely (high)
Plumed frogmouth	*Podargus ocellatus plumiferus*	Vulnerable	Not Listed	Likely (moderate)
Black-chinned honeyeater	*Melithreptus gularis*	Rare	Not Listed	Likely (moderate)
Black necked stork	*Ephippiorhynchus asiaticus*	Rare	Not Listed	Likely (moderate)
Lewin's rail	*Rallus pectoralis*	Rare	Not Listed	Likely (moderate)
Red-browed treecreeper	*Climacteris erythrops*	Rare	Not Listed	Likely (moderate)
Sooty Owl	*Tyto tenebricosa*	Rare	Not Listed	Likely (moderate)

White-rumped swiftlet	*Collocalia spodiopygius*	Rare	Not Listed	Likely (moderate)
Australian cotton pygmy-goose	*coromandelianus albipennis*	Rare	Not Listed (migratory)	Present
Square-tailed kite	*Lophoictinia isura*	Rare	Not Listed	Present
Grey goshawk	*Accipter novaehollandiae*	Rare	Not Listed	Present

There are four EVR waterbirds that may utilise the study area; Lewin's rail (Rallus pectoralis), Black-necked Stork (Ephippiorhynchus asiaticus), Australian cotton pygmy-goose (coromandelianus albipennis) and Painted Snipe (Rostratula benghalensis australis). The Painted snipe is vulnerable under both the EPBC and NCR, whilst the other three are rare under the Queensland NCR only. I do not believe any of these species will be significantly impacted by the Project, and given my extensive requirements (e.g. Condition 4, Schedule C, Appendix 1) detailed above for the creation and protection of new areas of vegetation, there is a strong possibility that the Project will be beneficial for these species. The Lewin's rail is susceptible to predation from feral animals and tends to avoid locations subject to grazing. As a result, it should benefit from the feral animal control and land use controls that will apply in the inundation area buffer. The Australian cotton pygmy-goose utilises deep water and as such may inhabit the additional ponded habitat provided by the Project, particularly given my requirements for the control of water weeds such as water hyacinth in Condition 21(k), Schedule C, Appendix 1.

The only EVR bird identified as having a high likelihood of utilising the study area was the Glossy-black cockatoo. The Glossy-black cockatoo is not listed under the EPBC Act. This bird was not identified in the EIS survey, noting that the survey was undertaken outside of the bird's winter breeding months and the Project Area contains many relevant food trees for the species. It is therefore conceivable that the cockatoo would utilise the area for feeding and breeding. As a result, I am specifically requiring in Condition 21(c) and 21(h) that impacts to its habitat are offset in the areas of protected and restored vegetation required in Condition 4.

The EIS lists six non waterbirds that are considered to have moderate likelihood of utilising the site. None of these birds were identified during the survey. Only one is listed in the EPBC, the Red goshawk (Erythrotriorchus radiatus) it is also listed as endangered under the NCR. At best, the Red goshawk would be a seasonal visitor during winter when it moves into coastal plains. A breeding pair may have a territory as large as 20,000 hectares and they will hunt in a variety of habitats such as open forests, rainforest edges, rivers, swamps, grazing areas and wetlands. As a result, the Project is unlikely to have a significant impact upon its habitat.

Another EVR bird described as having moderate likelihood to utilise the site is the vulnerable (NCR) Marbled frogmouth (Podargus ocellatus plumiferus). It is likely that the principal roosting and foraging habitat in the vicinity of the Mary Valley is outside the Project Area, but it is likely to gain from the required restoration and protection of vegetation within the inundation area buffer. There were also four rare (NCR) birds rated moderate likelihood to be present. These include the Red-browed treecreeper (Climacteris erythrops), Black-chinned Honeyeater (Melithreptus gularis), Sooty Owl (Tyto tenebricosa), and the White-rumped swiftlet (Collocalia spodiopygius). In each case these EVR birds would not find their primary habitat within the proposed Project Area. At best, they may roost/forage in the surrounding areas and occasionally venture into the Project Area. Alternatively, they may have territories that are on the periphery of the broader study area.

Two raptor species listed as rare in the NCR were identified during the survey, these being the Grey goshawk (Accipter novaehollandiae) and the Square-tailed kite (Lophoictinia isura). I note that some EIS submissions included concern over the continued survival of these raptors (and the Red goshawk). However, these birds have large territories and the presence of the Project will not substantially affect the viability of overall habitat. Furthermore, in the longer term the mitigation actions may enhance the habitat within the study area for these birds.

The EIS confirms there are no records of these species in the broader study area but acknowledges it is possible that these species may be occasional visitors to the Project Area. On this basis, I consider that the Project Area does not provide any notable habitat values for these species and therefore these species will not be significantly impacted by the Project. Given my extensive requirements (e.g. Condition 4, Schedule C, Appendix 1) for the creation and protection of new areas of vegetation endemic to the local area, there is a possibility that the Project will be beneficial for these species.

A number of submitters raised concerns about the Coxen's Fig Parrot and Swift Parrot, that are endangered listed threatened species under the EPBC Act. Particularly, concerns have been raised about the proponent's view that the Project would not have any substantial impact on the Coxen Fig Parrot. These concerns are based on a view that the number of potential food trees (i.e. native fig trees) that may be lost to inundation has been under-estimated by the proponent to date.

Regardless of the accuracy of the proponent's estimates to date of the number of potential food trees that may be affected, I am satisfied that my requirements within Condition 21 (g), Schedule C, Appendix 1 together with Condition 4, will ensure that an accurate estimate of food trees is developed before clearing and that the loss of these trees will be offset over time.

I do not believe the Project will adversely impact on the conservation of any of the EVR birds of moderate or high likelihood to be present within the vicinity. In most cases, the mitigation and offset is likely to result in better habitat within the Project Area for these birds, particularly in relation to my requirements in Conditions 4, 21(c), 21(e), 21(h) and 21(i), Schedule C, Appendix 1 that require the proposed of suitable habitat (including establishment of riparian vegetation endemic to the region and artificial hollows where necessary) for any EVR birds that are assessed as being present or (moderately) likely to be in the Project Area as summarised in the above table relating to EVR birds. It is important to note that in providing vegetation management offsets, and attaining the benchmarks for protected riparian habitat the proponent, the relevant endemic species are listed in the Response to Reviewer Reports (at Appendix H of Appendix G). These conditions also require that suitable checks of vegetation to be cleared is undertaken before clearing and that, as necessary, action is taken to ensure any identified fauna is relocated and otherwise protected.

I consider the provision of habitat for the abovementioned likely-to-be-present-EVR-birds is an important objective to be addressed as part of the proponent's vegetation creation and habitat restoration work, particularly in response to my VMO and riparian habitat requirements. Condition 21(c) specifically requires the achievement of an overall net gain in habitat for the various species. In addition, in order to maximise the effectiveness of the VMO and riparian restoration works, the proponent is also required by Conditions 4 and 21(k), Schedule C, Appendix 1, to eradicate and control weeds and feral animals and prevent agricultural animals from accessing protected areas within the inundation area buffer.

Conclusion

I consider that the impacts of clearing and construction and operation of the Project will not have an irreversible effect on terrestrial biodiversity as the impacts are able to be mitigated and/or offset.

I am satisfied that the broad strategies and specific mitigation and compensatory measures identified in Chapters 7 and 18 of the EIS and SREIS, respectively, and within the Response to Reviewers' Report along with the conditions that I have imposed, will reduce identified terrestrial flora and fauna impacts to levels that will not cause permanent harm to significant ecosystems or flora and fauna populations.

The conditions that I have placed on the Project, and that the proponent is bound to implement are detailed within this report, within both Schedule A and Conditions 4, 5 and 21, Schedule C of Appendix 1.

3.4. Aquatic environments

Potential Project impacts on aquatic habitat and fauna will include the inundation of existing riverine habitat and its replacement with lacustrine habitat, potential flow and water quality changes downstream that will diminish with distance from the Project due to tributary inflows, and the potential barrier to species movement presented by the dam itself. I have considered these impacts in the context of the potential impacts on aquatic species from the Project, the current degraded and worsening ecological situation in the Mary River catchment, what actions are required to stabilise the current ongoing ecological decline, and what further actions would reverse that decline and address uncertainty that may remain in terms of the future viability of EVR species. These matters are discussed in the following sections.

I consider that, without mitigation, the Project would impact on the aquatic environment both within the inundation area, and in the Mary River downstream of the dam wall with those downstream impacts diminishing with distance from the dam as downstream tributaries contribute to river flows. Changed flow regimes have the potential to cause environmental impacts downstream. Key issues to be considered when seeking a suitable balance between water extraction and environmental requirements include impacts on riparian vegetation, impacts on river geomorphology, connectivity and depth of water for aquatic species and impacts on nesting sites. These matters are discussed further in section 3.1 of this report, especially my requirements for flow targets to support aquatic habitat requirements.

All species including native aquatic fauna species in the Project Area depend on and are part of complex ecosystems. The preservation of native aquatic species necessarily requires the protection of their supporting aquatic ecosystems. I consider that in part the protection and enhancement of aquatic habitat can be achieved through the creation, establishment and protection of riparian vegetation accompanied by associated in-stream habitat creation activities. I have previously noted in section 3.1 that woody vegetation buffers in riparian areas provide inputs of large woody debris and smaller organic matter. These inputs provide a basis for aquatic food webs as well as food in the form of fallen insects and shelter for fish species. Shading of streams by riparian vegetation keeps water temperature down increasing DO concentrations and providing conditions for a greater diversity of aquatic invertebrates and vertebrates. Riparian vegetation also provides bank stability, sediment removal and protects aquatic water quality. I have therefore imposed conditions as set out in Condition 4, Schedule C, Appendix 1, directed at the preservation and restoration of habitat, including aquatic habitat.

Numerous issues were raised by submitters in relation to aquatic environments. I have considered each of the submissions, the Commonwealth Reviewer Reports and how the SREIS and the proponent's Response to Information Requests Report have responded to the issues raised. Key issues that I considered warranted particular elaboration and/or explanation in my evaluation included:

- habitat loss and related risks and uncertainties that apply to several EVR species, particularly Mary River Cod, Mary River Turtles and Lungfish
- the water quality, flow, movement and juvenile-to-adult recruitment and other needs of the abovementioned and other species and the related likelihood of success of impact mitigation measures applying to these key needs
- the habitat requirements for Mary River Turtles
- the methodology applied to describing macroinvertebrates and project impacts on macroinvertebrates
- macrophyte responses to post project construction conditions
- the ability of the proponent to control weeds and a lack of detail about proposed management arrangements for aquatic weeds

These matters are discussed further below in this section of this Evaluation Report.

Aquatic habitats

Section 8.3.1 of the EIS indicates that a range of natural habitats exist in the main channel of the Mary River and its tributaries, including waterfalls, cascades, rapids and riffles in the steeper headwater areas and more glides, runs, pools and backwaters in the lower gradient regions. Pools are generally the dominant feature in the main channel, with the middle and lower reaches characterised by long pools interspersed with bedrock and/or sand and/or gravel controls.

Pools are deeper water sections with low flow rates; runs are faster flowing and shallower water without exhibiting any breaking of the surface water; and riffles are again fast flowing water but with turbulence evident through the breaking of the surface water.

The exact quantity of each kind of hydraulic habitat will, in part, depend on the flow rates (as well as associated depths), hence there will always be some fluctuation in the proportions of the various types of hydraulic habitat. As indicated in Table 12, there are greater proportions of riffle habitat upstream and downstream relative to the inundation area. Conversely, there is proportionately more run habitat within the inundation area, which will cover approximately 4% of the Mary River. When the dam is full, all existing riffle and run habitat within the inundation area will be converted to pool habitat, as has occurred upstream of the Mary Barrage. However, as discussed further below, the fringe areas of the inundation area may maintain some of the characteristics of the lost habitat types.

The Mary River flows over 300 km from the headwaters to the estuary. The Project is located on the Mary River at AMTD 207.6 km. 78.5% of the catchment lies downstream of the Project which leaves 21.5% of the catchment upstream. At FSL the inundation area will cover 36.5 km or approximately 4% of the Mary River, included in the 21.5% of the catchment upstream. The loss of the hydraulic habitat set out below within the inundation area requires mitigation in terms of enhancement of aquatic habitat within the Project Area and elsewhere in the catchment to improve species connectivity.

- **Table 12: Existing hydraulic habitat**

Hydraulic habitat	Upstream of Inundation Area	Inundation Area Pre Project	Downstream of Inundation Area (Gympie Zone)	Barrage Backwater Zone
Pools	38%	43%	49%	100%
Riffles	16%	9%	12%	0%
Runs	36%	43%	33%	0%
Run-Pool Sequence	0%	<1%	0%	0%
Run-Riffle Sequence	10%	5%	6%	0%

Similar habitat types exist within the tributaries, although pools are generally shorter and narrower, reflecting the stream size. Tributaries on the western side of the catchment rise in mountainous areas and are characterised by high-energy conditions, while those on the eastern side flow over more gentle relief resulting in lower energy conditions. The eastern tributaries (e.g. Belli Creek, Coles Creek and Skyring Creek) and Kandanga Creek are much narrower than the Mary River main channel and the larger western tributaries. Riparian vegetation is more extensive in these creeks and stream shading is stronger in comparison to the main channel of the Mary River which has limited and patchy riparian vegetation due to extensive land clearing.

The EIS indicates that there are no significant off stream wetlands in the vicinity of the inundation area because channel capacities are largely sufficient to contain floodwaters and some farm dams have been created by bunding a natural wetland in the past. There have been substantial reductions in fringing and aquatic vegetation which has substantially reduced the general habitat value of the Project Area.

I require as discussed in section 3.1 of this Evaluation Report, at Condition 5, Schedule C, Appendix 1, that the proponent causes the establishment, protection and maintenance of further protected riparian habitat and associated in-stream aquatic fauna refuge areas outside the Project Area throughout the catchment via a Catchment Enhancement Program. The Catchment Enhancement Program must be funded by the Proponent to a total of at least $10 million and be designed and implemented to create protected riparian habitat areas preferably be distributed across all, but in at least 2, of the following locations:

- Mary River Turtle nesting areas on the banks of the Mary River as verified by the chief executive administering the *Nature Conservation Act 1992*

- both banks of the Mary River from one km downstream of the Project dam wall to the Amamoor Creek confluence

- priority Mary River Cod recovery areas[29] (which may also be relevant to Queensland Lungfish recovery) selected from the following: Six Mile Creek from Lake McDonald to Mary River Junction, Tinana Creek from the mouth of Goomboorian Creek (Anderleigh Road) to Teddington Weir, Coondoo Creek from Windsors Road to the junction with Tinana Creek, Obi Obi Gorge from Lake Baroon to Skene's Creek (or Baxter Creek), Amamoor Creek from McGills Creek to Amamoor.

- areas within the Mary River Catchment occupied by the Giant Barred Frog as verified by the chief executive administering the *Nature Conservation Act 1992*

The protection and enhancement of aquatic habitat downstream is also dependent on the optimisation of flows to enhance important dependent aquatic ecological outcomes. These matters are discussed in section 3.2 of this report. I have set at Condition 8(b), Schedule C, Appendix 1, FPIs to be observed at Dagun Pocket based on the understanding of the species requirements and an analysis of the flow regimes before water resources development and under current extractions. In general, statistics closer to pre-development conditions have been set to improve the existing flow regime.

The outcomes of optimisation modelling with the FPIs implemented further support the conclusions made within the EIS and SREIS regarding the capacity of the Project to successfully manage environmental flows across all months and seasons and will improve upon conditions currently experienced within Dagun Pocket section of the Mary River.

In my view, implementation of the FPIs at Dagun Pocket, as demonstrated by the modelling undertaken by the proponent, will mean that flows during July, August, September, and October will improve from the current situation and enable a return towards the larger winter and spring flow patterns experienced prior to agricultural development in the Mary River catchment. I consider that there will be an enhanced ability to manage releases to produce greater water level stability in the Mary River from Dagun Pocket to Fisherman's Pocket during the key lower flow months of July through to January. This part of the Mary River contains breeding habitat for species such as Lungfish and nesting sites for the Mary River Turtle. Sustained lower and more stable flows during winter and spring, along with ongoing periodic large flows in summer/autumn, are particularly important for sustaining and generating macrophyte coverage and hence general aquatic life. Stable base flows and minimal extraordinary large flows during winter and spring are desirable factors in relation to Lungfish, Mary River Cod and the broader fish community. In addition, the reduced overall flows (i.e. on a whole of year basis) in the most impacted section of the River downstream of the Project will also result in an increased percentage of combined riffle and pool habitat, at the expense of some run habitat.

The proponent has committed to undertaking further optimisation of flows during the detailed design and ROP submission phases (see 15.1.3.1 of the SREIS). I have required at Condition 8(d), Schedule C, Appendix 1 that alternatives to the FPIs in Condition 8(b) may be permitted only if it can be demonstrated to my satisfaction that the alternatives will achieve enhanced outcomes, having regard to riparian habitat and the flow conditions that support the Mary River Cod, Queensland Lungfish and Mary River Turtles.

[29] As set out in Table 4.5, Mary River Catchment Coordinating Committee "*Mary River and Tributaries Rehabilitation Plan Implementation Edition*" 19 July 2001

Aquatic flora

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

Macrophytes are the aquatic plants within waterways or in fringing margins below the riparian zone that can be seen with the naked eye. Macrophytes provide various functions for aquatic fauna (e.g. shelter, food source, egg laying sites, nursery areas) and also exert controls on water quality that can affect aquatic fauna.

Macrophytes were a major focus for many submitters. The submissions had three key themes relating to the potential of the Project to alter the viability and mix of macrophytes leading to:

- loss of shelter (particularly for breeding) and feeding, resources essential for the continued survival of aquatic fauna (particularly EVR fauna)
- an infestation of aquatic weeds that reduces water flow, diminishes visual amenity, cause odours, and/or prevents recreational activity
- reduced water quality which is unsuitable for aquatic fauna and/or costly to treat to ensure suitable drinking water standards.

The focus and general commentary within submissions about aquatic weed issues suggests that there is substantive awareness and concern within sections of the community about aquatic weed related problems within SEQ. It is clear that aquatic weeds have caused problems within the Mary River, particularly in locations that have been artificially ponded. The submissions also demonstrated scepticism that the proponent would be capable / willing to manage the macrophyte weed infestations that may occur as a result of the Project. These matters are discussed further below in the subsection entitled exotic and declared pest species.

During the EIS survey 38 macrophyte species were identified, with 10 species accounting for over 90% of mean macrophyte cover. Nine of these 10 most abundant species are native species. That is, only one exotic species (*Egeria densa*) was identified as being present and representing 7% of total macrophyte cover.

None of the macrophyte species identified during the EIS within the Mary River, including *Vallisneria nana* (ribbon weed), are listed in the EPBC Act or the NC (Wildlife) Regulation 2006 as EVR species.

While ribbon weed is abundant in the Mary River, and can be commonly found throughout many Australian rivers, I consider that it does have special conservation significance. Ribbon weed's ongoing presence in the vicinity of the Project is of high importance. Ribbon weed is considered a primary food source and habitat provider for a range of fauna. Notably, ribbon weed is a food source for the Mary River Turtle and Lungfish lay their eggs on the plant's leaves. It will grow in water less than 1.3 m deep but shows a preference for water level to be between 400 mm and 800 mm. The EIS survey confirmed this species preference for moderately flowing water habitat (runs) but it was observed in all hydraulic habitats. High light penetration (i.e. limited shading and low turbidity) along with low nutrient levels are essential for this species. It also has a preference for sandy soils.

Another species with some conservation significance (*Aponogeton elongates*) has previously been identified in the upper reaches of Yabba Creek. *Aponogeton elongates* was not found during the EIS survey, and the habitat within the Project Area and downstream of the Project Area is not considered suitable for this species.

After ribbon weed, the next two most abundant native macrophytes found during the EIS surveys were *Hydrilla verticillata* (Hydrilla) and *Spirodela species* (Duck Weed). Hydrilla is a submerged macrophyte that grows in long strands in ponded water to a depth of 2 m (in ideal conditions even deeper). It is very fast growing and is commonly found in both oligotrophic (low nutrient) and eutrophic (high nutrient) waters.

Spirodela (Duckweed) are small floating plants (less than 20 mm long) that are often concentrated in backwaters. It is an important food source for birds, amphibians, and aquatic animals. In high nutrient conditions it can form thick mats that block out light.

The vitality and mix of macrophyte communities can vary with the seasons and with changes in flow rates. However, the EIS survey did not identify substantive differences between two distinct seasons targeted by the survey efforts. The proponent suggests that the prolonged drought at the time of the survey may have suppressed some macrophytes, their distribution, and their seasonal variation. Despite the drought, however, the proponent suggests that there is consistency between the EIS survey and past findings from previous studies.

Exotic and declared pest species

Exotic macrophyte species are those that are not native to an area. In the EIS survey, 10 exotic species were recorded (see table 8.3 of section 8.4.2.2 of the EIS). These 10 species include the declared floating macrophytes, Water Hyacinth and Salvinia. Water Hyacinth can form dense mats that may double in size within a few weeks and low oxygen conditions can develop underneath the mats thereby reducing habitat suitability for aquatic fauna. Management techniques (e.g. use of certain types of weevils and moths) can be applied to control this species.

Salvinia is easily spread and grows extremely quickly, with infestations able to double in size every two to three days. It has been implicated in fish kills observed in the vicinity of the Project. Biological, manual and chemical controls can be used to target salvinia but are currently not applied within the Mary River in a systematic manner.

Exotic species were present in nearly all sites sampled within the Mary River and western tributaries but were largely absent from eastern tributaries. Consistent with previous studies, it was common for exotic species to represent more than 10% at a site and at times up to nearly 40% of the species encountered.

The highest level of exotic macrophyte cover was within the river between Kenilworth and the proposed upstream limit of the dam. Some pools and runs within this area had nearly 100% cover of exotic macrophytes, comprised of dense beds of waterweed grown over by floating Salvinia and fringed by para grass. Relevant features in this area included reduced riparian vegetation cover and slow flowing conditions.

While the submerged exotic macrophytes, Cabomba and Elodea, and the emergent Water Primrose species, are not currently present in the vicinity of the Project, they have the potential to become established. For example, Cabomba is present within the nearby Lake MacDonald on Six Mile Creek and a monitoring and eradication program is being implemented by CSIRO in relation to that vicinity.

The potential spread of new weeds to the Project Area will represent an ongoing risk requiring proactive management by the proponent. There are many pathways that could allow weeds to become established in the vicinity and, as explained further below, I am requiring, particularly in Condition 21(k) Schedule C, Appendix 1, that the proponent ensures that all these pathways are identified and addressed through specific, comprehensive and relevant management measures discussed in more detail below.

Estuarine habitats and vegetation

Downstream from the proposed Project, the Mary River flows into the Great Sandy Strait Ramsar Wetland. A further 10 km off the mainland coast is the Fraser Island World Heritage Area. Both these protected areas feature outstanding biodiversity values providing critical habitat for migratory and EVR species. They also have significant economic, recreation and aesthetic values for the local community, and the State of Queensland.

The Great Sandy Strait Ramsar Wetland is particularly important for its shallow seagrass beds, mangrove forests, salt marshes and saltpans. The Wetland is fully contained within the Great Sandy

Marine Park. The majority of the wetland receives additional protection under the *Fisheries Act 1994* as a Fish Habitat Area and a Dugong Protection Area.

Fraser Island is the largest sand island in the world. It is known for its diverse vegetation communities including swamps, heaths, woodlands, and rainforest, as well as pristine freshwater lakes. Its World Heritage listing recognises its diversity in species and its unusual and dynamic geological processes. Almost all of Fraser Island is protected through the Great Sandy National Park.

The submissions demonstrated the environmental values of the Mary River Estuary, Great Sandy Strait and Fraser Island are of great interest to the community.

The core concern within the submissions is essentially is that the Project would detrimentally affect both flows and water quality with resulting adverse impacts on the environmental values of the Estuary, Great Sandy Strait and/or Fraser Island.

As part of this, the survival of the dugong and impacts on fish stocks were particular focuses of concern within submissions.

A number of submissions did not accept the EIS modelling-related conclusion that the Project would only result in a 4% mean annual flow reduction. Furthermore, some submissions challenged the modelling's focus on meeting the WRP rather than a full assessment of the estuary's environmental flow needs.

Some submitters dismissed the commitments in the EIS regarding the suitable maintenance of environmental flows, indicating that it was doubtful the Project would meet its flow commitments as potable water supply for Brisbane would always get priority.

Another major issue related to turbidity and sediment loads. Concerns were expressed about increased sediment loads causing sand and mud bars at the river mouth or destroying the sea grass beds. Alternatively, concerns were raised about potential reductions, or changes to, sediment load particle sizes, and the resulting detrimental effect on Fraser Island. A number of submissions highlighted potential bank erosion impacts due to the Project.

Other water quality issues included changes to nutrients or increasing salinity.

Often the Mary River Barrage was raised as an example of the environmental consequences of damming the Mary River. A few thought that the cumulative impact of the Project would mean the impacts from the Mary Barrage were significantly worse. Besides water quality issues these impacts were described as weed issues and advancement of mangroves into the River channel.

These issues are addressed in detail in the Geomorphology, Water Resources and Water Quality sections of this report.

In summary, the imposed sediment and erosion controls will suitably mitigate impacts upon water quality during construction thereby ensuring that the construction of the Project will not impact on the Estuary, Great Sandy Strait or Fraser Island.

Any impact on the Estuary during Project operations, relating to changes in water quality or flow, is unlikely to be of sufficient magnitude to be detectable due the comprehensive conditions relating to these matters within Conditions 8 and 9, Schedule C, Appendix 1.

Analysis of the EIS flow models demonstrate that the Project's proposed release regime will have only a minimal impact on the flows to the Mary River Estuary when compared to the existing situation. Mean total flow volumes to the Estuary will reduce by 4%. According to the EIS, the peak daily flows during floods at the Estuary will reduce between 4-17%, however, this represent only 1% of the volume of flood water. The impacts of additional zero flows to the Estuary are also negligible with only 7 extra days identified during the 109 years of the data modelling. Furthermore, the required flow regime that I have imposed will also result in slightly enhanced flows during the typical low flow months.

The Project will result in improved water quality, through reduced sediment loads and subsequent nutrient levels. However, 208 km downstream at the Estuary this impact will be very minor. Even the expected reduction in fine sediments of 20% will be difficult to detect as tide, wind and wave action causes re-suspension. Additionally, the Mary River's sediment loads will still be well above its natural state.

Concerns that the Mary River sediment and nutrients loads are necessary for Fraser Island are disputed by the proponent. The proponent indicates that the Island's sediment is sourced from longshore drift up the east coast not the Mary River. Sediment plumes from the river move towards Hervey Bay and eventually flow over the continental shelf.

The minimal reductions in sediment and nutrients are not expected to have any perceptible impact on seagrass, mangroves, and saltmarsh communities. Similarly, macro invertebrate communities are unlikely to be impacted. Nor is it likely that the Project would have any impacts on Bay coral.

There may be some salinity increase in the upper estuary due to the reductions in flow mentioned above. However, the impacts will be negligible since the Mary River Barrage and the natural tidal influences are the dominant factors in determining Estuary salinity.

As the Project will not have a significant impact on medium to high flood flows, the commercial and recreational catches, which are largely dependent upon floods for fishery production, are not likely to be affected.

Summer and autumn flows can also be important as a cue for the migration or reproduction of fisheries species. Even with the development of the Project, Summer and Autumn mean daily flows will only reduce to 92% and 93%, respectively, compared to the relevant predevelopment daily flow statistics. This is not expected to cause additional significant impacts.

As these abovementioned impacts on the Estuary will be negligible, the Project will not have any significant impact on the marine vegetation, macro invertebrates, coral, fish communities, and therefore, any impact upon the EVR or migratory bird, mammals, reptiles and sharks that depend upon the Estuary is likely to be insignificant.

Macroinvertebrates

The EIS involved a survey of macro invertebrates. Macroinvertebrates are aquatic organisms without back bones that are large enough to be visible to the naked eye. They may be wholly aquatic or only spend a portion of their life cycle associated with water.

Only one known EVR macroinvertebrate species occurs within the catchment; the Queensland spiny mountain crayfish (*Euastacus hystricosus*). This crayfish is listed as vulnerable under the EPBC Act. However, within the Mary Catchment, the known habitat for this species is limited to the Conondale Ranges, well upstream and at a higher altitude than the Project Area. The species was not identified during the EIS survey, nor are there any historic records of its presence in the Project Area.

The EIS survey revealed a total of 509,912 individuals belonging to 81 families, 29 orders, 12 classes and 7 phyla.

The level of taxonomy for macro invertebrates was questioned in a number of submissions, which argued that further genus and species level definition needed to be identified to enable an appropriate appreciation of the impact of the Project. However, as explained in section 19.4.1 of the SREIS, the level of taxonomy utilised is consistent with the standard approach within the AusRivAS process, which is a nationally recognised framework. Furthermore, the output of this framework has provided a valid assessment of the likely impact of the Project on macro invertebrates. I am therefore satisfied that the EIS meets the ToR requirements to identify the "diversity and abundance (where feasible and practicable) (of) ... macro invertebrates".

The EIS reviewed macroinvertebrates in terms of taxa richness for various habitats. Riffles were found to have the greatest taxa richness, followed by edge and tree root habitats. Deep pools were found to contain the least variation in taxa. Tree root habitat (particularly in spring), followed by Riffle and macrophytes were the three largest categories in terms of numerical abundance. The edge and benthic habitat categories had the least numbers.

The dominant taxa found at each habitat site is listed in Table 13. Only Hydropsychidae is considered to be a specialist to one habitat type.

- **Table 13: Dominant taxa at each habitat site**

Habitat types	Predominant Taxa
Benthic	*Chironominae* and *Oligochaeta*
Edge	*Copepoda, Cladocera,* and *Ostracoda*
Macrophyte	Copepoda, Cladocera, and *Ostracoda*
Riffle	Baetidae, *Hydropsychidae*, and *Chronominae*
Tree Root	*Cladocera* and *Copepoda*

The impact of the Project upon the macroinvertebrates within the inundation area will be significant. It will result in complete changes of habitat type and therefore changes in present taxa towards those which suit the newly created lacustrine habitats. However, there is already a diverse range of macroinvertebrates within the area, and the upstream river and creek areas will provide feedstock to assist the rapid recolonisation once the impoundment begins to fill. Furthermore, the EIS indicates that the nine most abundant taxa (collectively accounting for over 94% of individuals found) of macro invertebrates were all generalists and capable of occupying a number of habitats.

The greatest impact for macroinvertebrate diversity and abundance will be from the loss of riffles (and possibly runs and glides) within the inundation area. This is the habitat in which the greatest proportion of taxa are specialists. Therefore, those species dependent on flowing water or riffles are likely to retreat to upstream and into tributaries. However their range may cycle into the inundation area in times when the water level drops below FSL, particularly during winter and spring. Furthermore, it is probable that with the flow regime and expected improved water quality immediately downstream of the Project, the abundance and diversity of riffle habitat macroinvertebrates will improve.

The reduced woody roots available in the inundation area, particularly closer to the dam wall, may also reduce the abundance of tree root macroinvertebrates. However, the conditions within Condition 7, Schedule C, Appendix 1, limiting clearing of vegetation between FSL and 1.5 m below FSL, as well as the Condition 21 requirement for the introduction of snags, will enable these macroinvertebrate habitat types to survive within the inundation area. Furthermore, the required riparian and dam edge restoration work (as per Condition 4) will provide further opportunity for woody root macroinvertebrates.

The Project will result in expanded edge habitat. Once the macrophytes start to colonise the periphery of the dam, the macroinvertebrates will inevitably follow. Similarly, as the macrophytes develop within the shallow water habitat (less than 2 m) which accounts for about 25% of the impoundment, so will the macroinvertebrates. It is possible that the macrophytes, and therefore the relevant macro invertebrates, may colonise deeper waters up to 5 m.

Benthic macroinvertebrates are expected to do well in the impoundment environment. However, the area of the impoundment (approximately 40%) which is greater than 5 m deep is unlikely to be utilised by most macroinvertebrates, particularly if stratification develops.

The analysis within the EIS indicates that it is unlikely that any of the fish species which graze on macroinvertebrates, and are likely to be present in the inundation area, will be highly selective of which macroinvertebrates they feed on. Therefore it is not expected that the changed macroinvertebrate variety within the reservoir will significantly impact on the predator fish.

<u>I consider</u> that there is a sound basis for confidence that the proponent will succeed in maintaining a healthy abundance of macroinvertebrates. The proponent has committed to a range of actions and

project design features that will benefit macroinvertebrate abundance and diversity. These include initiatives to develop and maintain complexity of habitat to provide good breeding and shelter for macro invertebrates. The proponent is also committed to measures to enhance water quality and maintain a healthy variety of macrophytes. Furthermore, the fishway and turtle transfer systems may add to the diversity, as it may be that some macroinvertebrates spread through attaching to migrating fish.

A native macroinvertebrate that will find habitat within the impoundment is the mosquito. A number of submissions raised concerns that nearby residents would suffer from swarms of mosquitoes that will breed in the impoundment. However, the proponent has committed to the development and implementation of a Mosquito Control Plan in accordance with the Code of Practice for Mosquito Management. I am ensuring compliance through Condition 21(k), Schedule C, Appendix 1.

Some of the other actions to minimise mosquito breeding relate to the riparian vegetation and erosion control commitments and related conditions explained in section 3.1 of this Coordinator-General's Report. Erosion and nutrients from erosion can lead to excessive algae growth which provides protection for mosquito larvae. The riparian revegetation measures imposed in Condition 4, Schedule C, Appendix 1, will encourage the development and maintenance of abundant stock of native fish that eat the mosquito larvae as well as control the algae mentioned above. I am therefore confident that the proponent will be able to satisfactorily control mosquito breeding.

Macrophyte responses

The Project, without mitigation, has the potential to cause substantial changes to the macrophytes present within the inundation area and immediately downstream.

The key factors that are likely to facilitate changes to the species mix of macrophytes within the inundation area are in relation to:

- hydraulic habitat changes, particularly the conversion of runs to pools and the deepening and extension of pools
- the extent of water level fluctuations and associated changes in wetting and drying regimes in different areas and seasons
- the creation of new large areas of shallow ponding habitat
- any nutrient and sediment rich inflow and turbidity relating to adjacent land-use and bank conditions
- changes in the extent of shading arising from changes in riparian vegetation
- the extent of any cattle access to the margins of the inundation area.

Section 19.3.1 of the SREIS and section 8.4 of the EIS provide extensive discussion of the expected post project construction outcomes in relation to these factors and similar factors relating to the area immediately downstream of the Project.

While most of the present macrophyte species can tolerate a range of habitat types, there will be significant changes within the inundation area, particularly favouring species preferring pool type habitat. Within this area, the maintenance of an ecologically healthy variety of native macrophytes (based on as much diversity of habitat type as possible) will be important in terms of encouraging the presence of aquatic fauna, and assisting the recovery of EVR fauna within the Mary River from their current endangered or threatened status. In this regard, while much of the existing dominant hydraulic habitat category will effectively be lost (e.g. 43% of the river section is currently categorised as run type habitat), this particular inundation area will have characteristics that will encourage habitat greater diversity than might otherwise be anticipated. For example, the inundation area will have several significant tributaries directly entering it, creating a range of flow related habitats near tributary entry points. The inundation area will also have a considerably contorted shape which will create diversity through backwaters and embayments, open areas and islands with a range of depth and wind profiles.

The now locally common and important habitat providing EVR species, ribbon weed, will effectively move to the margins of the inundation area. That is, once the inundation area fills, ribbon weed is unlikely to remain within the majority of the inundation area. However, I concur with the proponent that its "migration" to the impoundment's fringe areas of less than about 1m depths is likely to coincide with the proponent's key riparian vegetation rehabilitation target areas particularly at tributary entry points within the impoundment. That is, it is likely to persist in locations where the stream and river inflows meet the inundation area's periphery. It is also likely that ribbon weed's prospects may improve immediately downstream of the dam wall. I consider that the measures that I am imposing (e.g. cattle access restrictions and improved flow regularity in certain periods) will lead to improvements in water quality and other factors that enhance habitat conditions for this macrophyte species.

This view is supported by the situation within the Brisbane River, where beds of ribbon weed are abundant downstream of the Wivenhoe Dam and the persistence of ribbon weed within Yabba Creek below Borumba Dam. Given the current low water quality and significant historic disturbance to the Mary River immediately downstream from the dam wall site, there is significant opportunity improve the vitality of native macrophytes. The design of the Project and the proposed regime of the releases should minimise the negative impacts. Overall, I consider that there are good prospects for beds of ribbon weed to become well established. As per Conditions 8 and 9 of Schedule C, Appendix 1, I have set flow and water quality requirements that will increase the frequency of relevant flow depths and otherwise generate water quality improvements to create conditions consistent with native macrophyte, fish and turtle species habitat requirements. For example, I am requiring the proponent to ensure that flows in the stretch of river immediately downstream of the Project (represented by results at Dagun Pocket) must be above 10cm at least 97% of the time and above 30 cm 55% of the time. The longest spell of flows with depth less than 10cm is not to exceed 103 days, with the extent to which the spell is greater than 40 days to be minimised, and the longest spell relating to depths below 30cm will fall from 312 days under current arrangements to not exceed 300 days, with the extent to which the spell is greater than 180 days to be minimised. These are key indicator statistics for the maintenance of water quality which will be substantially improved through the operation of the Project based on my Condition 8 flow requirements, supported by the comprehensive Water Quality Program requirements of Condition 9. The proponent's Response to Information Requests report clearly demonstrates that the achievement of the flow requirements will represent an improvement on current in-stream conditions in relation to supporting aquatic flora and fauna.

A range of native submerged and floating macrophytes are likely to populate and thrive in the inundation area. With suitable bank restoration work and related management measures, as per Condition 4, it should also be possible for native emergent, and semi aquatic species to readily re-establish.

I consider that aquatic weeds represent the largest threat to the situation outlined above. In the absence of a properly constituted, resourced and implemented monitoring and control program, there would be a risk of aquatic weed infestations that could have adverse consequences for native macrophyte and fauna species. A range of exotic macrophytes are present within the Mary River catchment, and without suitable management, the post Project construction conditions could promote infestations.

Despite the risks, I am persuaded by the proponent's arguments that aquatic weeds do not present major problems in SEQ storages given the application modern management techniques (see discussion on page 8-26 of the EIS).

I consider that it is appropriate for the proponent to always assume that the inundation area will suffer outbreaks of exotic macrophyte infestation. In adopting this attitude, the proponent must focus substantial resources to enable a rapid response approach involving the early deployment of effective control techniques to ensure that the outbreaks are suitably controlled when such controls are likely to be effective in maintaining habitat and amenity values.

The Project must be considered in the context of the extensive riparian and weed management programs that I am imposing and therefore will become intrinsically embedded as part of the Project. I particularly draw attention to Conditions 4 and 21(k), Schedule C, Appendix 1 in relation to the creation of protected riparian habitat and the requirements for ensuring that there will be no sustained presence of weed species in and around the inundation area. The proponent's Response to Information Requests demonstrates how the creation of a protected riparian habitat (with widths of at least 60m) will improve the quality of inflows, particularly in terms of nutrients. This work around the inundation area will be extended to other areas within the Mary catchment by the requirements of Condition 5, Schedule C, Appendix 1 and therefore must necessarily involve increased efforts to manage weeds throughout the Mary River, building on work that has already been started by community organisations.

The proponent has recognised that the encouragement and/or control of native (as appropriate), and the control of exotic macrophytes, requires the implementation of significant ongoing management measures. It is important to consider that, in relation to Borumba Dam and Cedar Creek Dam, it is native species that can dominate non-beneficial macrophyte blooms. In some circumstances, controls may need to be applied to native species as well as the identified exotic species.

My conditions, as mentioned above, requiring no sustained weed occupation of the inundation area means that vigilance, and an adherence to a philosophy of early intervention, must be applied by the proponent. I am seeking the development and application of a best practice approach for managing weeds, which improves on the approaches that have been applied in the past to storages in Queensland. In addition to making meaningful contributions to catchment management activities, the proponent has identified a range of tools to use in the direct management of pest macrophytes, including riparian restoration works, mechanical harvesting, chemical control (when appropriate) and plastic shading. I consider that the achievement of ongoing suitable control is effectively a function of resources. Put another way, the ability to control weeds is not limited by a lack of available techniques. When appropriately controlled, I am confident that future weed infestations will not occur and will therefore not threaten the habitat values of the area.

I consider that there can be confidence that the lessons learnt in relation to control techniques at Lake MacDonald, within the Wivenhoe/Somerset water supply storages and elsewhere can be readily applied in relation to the Project and that compliance can be suitably monitored, particularly as detailed in the proponent's Response to Information Requests report. The proponent has effectively committed to ensure controls are applied prior to infestations taking hold. Given these considerations, I am of the view that the past weed problems experienced Lake MacDonald or Mary River Barrage are not likely to occur in relation to the Project. Importantly, Lake MacDonald has a uniformly shallow dam impoundment area and no systematic controls have in past years been applied at the Mary River Barrage. In the case of the Cabomba species, I consider that an invasion of the inundation area would be unlikely to lead to a sustained infestation as the prevailing conditions would not usually allow such an infestation.

Freshwater fish

A total of 35 species belonging to 22 families are thought to be native to the Mary River and to be currently present in the catchment. A further 11 exotic fish are known to occur within the catchment. This range of species is broadly similar to those found in other SEQ catchments, with the exception of the relatively lower amount of exotic species and the presence of some threatened and endangered species as discussed below.

The core fish species are thought to be fairly uniform throughout the Project Area and to be dominated by 10 small-bodied species, which comprised more than 90% of the total fish abundance in EIS surveys. Only one of these species, eastern gambusia, was an exotic species and it was the fourth most abundant species recorded in the surveys. The presence of exotic fish is a symptom of habitat disturbance. They also represent a threat to native species through predation and competition for space and food. The exotic species, Tilapia, was not found but it has successfully invaded neighbouring catchments and the risk of it spreading into the Mary catchment is considered to be high. The risks largely relate to direct translocation by people.

There is considered to be limited seasonal variation in fish species composition. Deep-water pool habitat is thought to host a greater range of large-bodied species than shallow stream sections, although the EIS survey did not generate any strong evidence to support this expectation. Large-bodied fish were recorded mainly in the larger streams within the catchment. Areas with undercut banks, large woody debris and root masses are considered to be important refuges for large-bodied fish species, particularly Mary River Cod.

The EIS indicates that species richness is positively correlated with macrophyte cover.

Macrophytes act as shelter for a range of fishes, particularly small bodied species and juvenile Lungfish. While macrophytes may also provide food resources for some species, it is estimated that approximately three quarters of the fish species found during EIS surveys feed mainly on macroinvertebrates. It is considered that most of these fish species are generalists in terms of their choice of macroinvertebrates species as prey items. Many macroinvertebrates take advantage of the presence of macrophytes and/or be closely associated with macrophytes.

Potential impacts of the Project are listed in section 8.8 of the EIS. These include, for example:

- changes in river flow regimes with the inundation area being changed from a river to a lake environment
- direct removal and modification of bank and in stream habitats
- potential changes in water quality
- loss of riffle, run and glide habitat as described above
- the creation of a barrier to movement in the form of the dam wall
- indirect impacts arising from on macrophytes and macroinvertebrates

There is a risk that the Project, without suitable mitigation, could cause at least temporary reductions in water quality manifested by low DO, high turbidity and high algae growth. This risk would be exacerbated should the impoundment fill slowly during the initial filling phase.

Low DO levels have the potential to generate fish kills. <u>I understand that</u> some species, including Lungfish, may respond to any such reduction in water quality by attempting to move out of the area and <u>I therefore consider</u> that maintaining conditions to facilitate fish movement during high risk periods (e.g. first filling) is essential as required by my Schedule A, Appendix 1(fishway barrier operational works) conditions. This will be supported by the transitional flow regimes explained in the Response to Information Requests report and imposed via Condition 8, Schedule C, Appendix 1. Based on the proponent's modelling, there is a 98% probability that the Project will be capable of achieving full downstream environmental flow compliance during the filing or transitional phase of the Project prior to the commencement of the breeding season of EVR fish and turtle species. <u>I consider that</u> the proposed and imposed contingency strategies (e.g. installation of pumps for water below dead storage) for ensuring downstream flows are adequate in relation to the residual 2% probability. This would enable flows commensurate to the flows that would occur during such times even in the absence of the Project.

In addition, the proponent is required by Condition 7 (b), Schedule C, Appendix 1 to remove most of the vegetation that would otherwise immediately break down during the initial inundation, thereby minimising the related potential for increased nutrient loads. Furthermore, the filling is expected to be relatively rapid (as indicated above) with a potentially available contingency strategy involving the release of water from Borumba Dam to dilute poor quality water within the inundation area during filling.

As discussed in the above macrophyte and macroinvertebrate sub-sections of this Evaluation Report, <u>I consider</u> that there is a sound basis for confidence that the proponent will succeed in maintaining a healthy abundance and variety of macrophytes and macroinvertebrates.

Sections 8.5.2 and 8.6.3 of the EIS discuss existing impacts and the condition of fish communities and their habitat. In summary, a range of important negative impacts have arisen in relation to the conditions for native fish and turtle species over the years since the mid-1800s. These negative impact factors include:

- increased ponding within streams

- modifications to flows
- constraints to fish passage
- stocking of predatory fish
- unsustainable harvesting (i.e. over-fishing) of certain species (now thought to have ceased)
- gold mining (now ceased)
- habitat disturbance through in-stream sand and gravel extraction activities.

In addition, as discussed below in relation to EVR fish species, I consider that past large-scale riparian vegetation clearing and ongoing large-scale cattle access to waterways (and associated increases in sedimentation, pool habitat infill, nutrient level increases and reductions in DO) have had considerable adverse impacts over many years. These factors have undoubtedly caused major adverse changes in the abundance, diversity and composition of the fish community through altered food and habitat availability and other impacts. For example, in terms of shelter, the availability of woody debris appears to be particularly important, with Mary River Cod usually found within metres of large woody debris. Continued supply of large woody debris requires riparian vegetation cover to be maintained. In my view, efforts to substantially improve the degraded nature of the riparian zone is the key to improving the health of the fish community and the prospects for threatened aquatic species generally in the Mary River catchment.

I consider that the Project represents a unique opportunity to substantially improve riparian vegetation and therefore the in-stream habitat conditions for aquatic species in general as well as EVR species such as the Mary River Cod, Lungfish and the Mary River Turtle. The need for substantial actions to improve the condition of the Mary catchment riparian zone has been known at least as far back as the 1990s when the Mary River Cod Recovery Plan was developed. While some notable and commendable community rehabilitation efforts have ensued, there is no reason to support confidence that the large-scale action that is required has any real prospect of being initiated in the absence of this Project. I consider that such large-scale action is warranted in the vicinity of the Project by the threats to the species that the Project would generate in the absence the proposed mitigations and the requirements of my conditions, particularly after having regard to the accumulated pre-existing threatening processes and limited achievement of recovery actions to date.

In this regard, I am requiring (particularly at Conditions 4, 5, 8, 9, 11, 21(j), 22, 23 and 31(d)(ii) and (iii) of Schedule C, Appendix 1) a series of interconnected and extensive risk mitigation and habitat improvement measures that will lead to:

- the revegetation, rehabilitation and protection of high quality riparian and in-stream habitats via the creation of protected riparian habitat areas (Condition 4 and 5)
- improved flow conditions downstream of the Project, particularly in terms of improving water quality outcomes and aquatic fauna movement capabilities (condition 8 and 9) to coincide with 2 new fishways and 2 new barrier bypass systems for turtles (Condition 22, 23 and Schedule A (Operational works that is constructing or raising of a waterway barrier works)
- an applied research program to help resolve residual scientific uncertainties relating to the biology of EVR fish, frog and turtle species and mitigation measures that may aid their recovery within the Mary Catchment (Condition 11).
- specific and targeted measures to treat and reduce injury, disease and other Project risks for fish, frogs and turtles (Condition 21(j))
- the application of active aquatic weed control activities to ensure no sustained aquatic weed outbreaks throughout the Project’s inundation area, which extends for over 30km in relation to the main Mary River channel (Condition 4 and 21(k))

- the development of individual property managements systems and funding for associated capital investments targeted at properties within the Mary River Valley to optimise catchment water quality and riparian vegetation outcomes (Condtion 31)

The research arising from condition 11 could generate information that will aid continuous improvements in the design and implementation of threat mitigation measures required by condition 21 (j) (particularly 21(j)(x)) and potentially beneficial refinements to the operation of facilities to be developed in response to conditions 22 and 23.

EVR fish species – Lungfish and Mary River Cod

The **Lungfish** (Neoceratodus forsteri) and Mary River Cod are the only two EVR fish species in the Project vicinity within the Mary River.

Both species attracted considerable comment and advice in the submissions on the EIS.

For over a century the Lungfish species has had an iconic status and it is clear that sections of the community view potential threats to its sustainability as cause for serious alarm.

The species has benefited from legislative protection since 1914. Today it is protected under the *Fisheries Act 1994*. It is also listed as vulnerable under the EPBC Act. Protection is achieved through the implementation of requirements such as those relating to fishing restrictions and for the installation of fishways on new in-stream barriers. The Lungfish is also listed in relation to the Convention of International Trade in Endangered Species of Wild Fauna and Flora.

I concur with the proponent that the Lungfish listings as an EVR species essentially arise from the limited extent of its geographic distribution and potential threats to habitat and recruitment, rather than because there is a small population size in its geographical range. There appears to be a sound basis upon which to describe Lungfish as being quite common within many of the freshwater reaches of the Burnett, Mary and Brisbane River catchments.

The EIS indicates that Lungfish are quite abundant in and around the inundation area. It would appear that the site's range of hydraulic habitats and macrophyte species provides habitat value for Lungfish.

The understanding of the Lungfish lifecycle and habitat needs have significantly developed over the last decade, although the species has characteristics which appear to make it difficult for researchers to reach firm conclusions about its biology. The Lungfish species is characteristically slow growing with a potential life span of 50 plus years and individuals are thought to reach sexual maturity in around 15 years. Juveniles older than a few weeks are notoriously difficult to find. Collectively, these factors mean that it is difficult to monitor and determine the recruitment success of a Lungfish population.

It is well accepted the Lungfish have a preference for sites with good availability of submerged macrophytes, (e.g. Ribbon Weed) both for feeding and breeding. They are known to feed on Ribbon Weed and Hydrilla, which are two of the most common native plants in the Mary River, as at the time of the EIS. They are opportunistic omnivores and will also feed on the macroinvertebrates that colonise the macrophytes. Importantly, they also adhere their eggs to Ribbon Weed and other aquatic plants and in some cases submerged terrestrial plants.

It is thought that the hatched juveniles remain close to their spawning location, depending upon the macrophytes for cover from predators, potentially including mature Lungfish.

As discussed above in the section entitled aquatic habitats, well over half of the inundation area is currently comprised of run and riffle habitats inter-dispersed with pools. Macrophytes (e.g. ribbon weed) favoured by Lungfish are well represented within the inundation area. Even given the habitat degradation associated with the loss of much of the riparian vegetation in the area, the current mix of hydraulic and macrophyte habitat is at least reasonably supportive of Lungfish. At FSL almost all of the other in-stream habitat types within the inundation area will be converted to ponded habitat. However, as around a quarter of the inundation area will be less than 2m depth at FSL, I consider that it is highly likely that ribbon weed will continue to be present in substantive quantities around the shallower parts of the inundation area's periphery.

While adults appear to have successfully colonised a variety of in-stream hydraulic habitats, they are thought to prefer deeper pools particularly if there is opportunity to shelter under partially submerged riparian vegetation, woody debris, undercut banks, or amongst rocks. There is anecdotal evidence of Lungfish in good condition living within ponded storage, particularly in the Brisbane and Burnett Rivers. I am advised that DEEDI researchers, who have been undertaking well focused data collation exercises about Lungfish in the Burnett catchment since the mid-1990s, consider that no discernible changes have occurred to the population structure following the development of new water storages during this period.

The annual spawning season can commence as early as July and continue until January. However, the majority of spawning occurs between August and November. The eggs which are attached to vegetation may be lost if water levels change and the eggs are exposed above the water line or inundated at unsatisfactory depths. Ideally, water levels should periodically remain relatively stable through the abovementioned spawning months, at depths favourable to ribbon weed, noting that this tends to only naturally occur in a minority of years reflective of the natural variability of flows in the system. It is also believed that high turbidity, low DO, or algae will also compromise the viability of the eggs/hatchlings. I have set flow related conditions to address these matters at Condition 8, Schedule C, Appendix 1.

Some researchers believe successful recruitment is dependent upon Lungfish finding appropriate vegetated, flowing, and shallow water for breeding. In addition to the depth requirements, the EIS suggests there is sufficient evidence to support a view that that Lungfish can breed in appropriately vegetated ponded habitat.

Advice from the then DPIF (now DEEDI) is not inconsistent with the proponent's view about ongoing Lungfish presence in impoundment areas. However, it is important to recognise that, in terms of impoundments generally, I consider that it is appropriate to emphasise the likely less-than-optimal breeding conditions that are usually present. The following is a key extract from the advice from the then DPIF on the matter:

> "*Australian Lungfish have highly specialised spawning requirements characterised by shallow water and submerged aquatic vegetation. Lungfish breeding predominantly occurs in shallow river margins where eggs are laid between August and December amongst dense beds of submerged macrophytes. Suitable breeding habitat is often widespread during this period after low, stable winter flows have provided opportunities for aquatic plant communities to flourish. Lungfish breeding habitat is highly susceptible to flow changes and current evidence from the Burnett River suggests that breeding rarely in occurs in the deep, steep-sided pools created by dams and weirs*."

Further, the then DPIF (now DEEDI) provided me with a confidential draft of the Survival Strategy for the Australian Lungfish for my consideration. In assessing the potential impacts and mitigation measures for the Project, I have considered the draft Survival Strategy, and particularly the identified risks and management measures for the Lungfish.

I believe that the conservation management of the Lungfish would benefit from a species specific management plan. I recommend that DEEDI work with the proponent and operators of other infrastructure in the Burnett and Mary River Catchments to prepare a management plan for the Lungfish. The management plan for the Lungfish should include consideration of the draft Survival Strategy for the Australian Lungfish and should also include mapping of habitat, monitoring (tagging, tracking, surveys etc) as well as research priorities as outlined in Appendix 1, Schedule E.

I consider that there is little doubt that with appropriate controls and upstream habitat enhancement activities, Lungfish will survive within the inundation area. However, I further consider that there is likely to be a reduction in optimal breeding conditions and other factors could impact sustainability of the local population following Project construction. It is therefore appropriate for the purposes of my assessment to assume that breeding conditions within the inundation area will not be optimal.

It is also important to emphasise that there has been considerable degradation to shallow and macrophyte habitat throughout the catchment. To reverse degradation it would be essential to at least partially constrain the numerous causes including livestock trampling, desnagging, erosion, increased sedimentation and land clearing in some key areas. Livestock watering is widespread throughout the distribution of Lungfish. According to the then DPIF's advice, livestock drinking in the shallows have been observed trampling Lungfish eggs and breeding habitat. Reduced habitat availability is likely to expose juvenile Lungfish to increased predation.

Given these important factors, I consider it essential that a precautionary approach is taken in the form of rehabilitation efforts being applied to actual and potential breeding habitat. It is clear that there has been considerable degradation to these habitats over a long period of time and there are ample opportunities for rehabilitation given the dedication of substantial resources as required by my conditions.

The extensive requirements for the riparian vegetation restoration and the creation of new protected riparian habitat (i.e. areas of protected and restored vegetation and associated in-stream habitat creation) at Conditions 4 and 5, Schedule C, Appendix 1 are designed to mitigate risks to Lungfish (and other species). These matters, as well as flow and movement requirements associated with Lungfish, are discussed further below.

The **Mary River Cod** (macculochella peeli mariensis) species is endemic to the Mary River. Based on the EIS, I consider that Mary River Cod populations are largely restricted to sub-catchment refuges including Tinana/Coondoo Creek, Six Mile Creek and Obi Obi Creek with possibly other self reproducing populations in Amamoor, Widgee and Munna Creeks. There is anecdotal evidence to support a conclusion that populations in the Mary River main channel are likely to be relatively small and that these populations may have been generated through the stocking of hatchery reared cod.

The EIS indicates that the Project will have no direct impact on the recognised core populations nor will it directly affect the flow regime in the relevant locations as they are on tributaries.

Mary River Cod populations in Tinana/Coondoo, SixMile and possibly in Amamoor, Widgee and Munna Creeks, are on downstream tributaries. The Obi Obi Creek population is on a tributary upstream of the inundation area. The potential further separation of the Obi Obi Creek population from the Six Mile Creek population by the Project is to be addressed as discussed below.

I consider that it is particularly notable that, according to the Mary Cod Recovery Plan, that the Tinana-Coondoo Creek system (which is not linked in any direct way to the other populations) provides the best refuge for cod in the Mary River catchment. Importantly, the subcatchment is well forested (including extensive areas of exotic pine trees), and human population density is low. Significant riparian buffer strips of tall, native vegetation remain intact in most areas. These are considered to be important because they provide abundant shading of the streambed, a diversity and abundance of instream cover (logs, logjams, branches, overhanging vegetation) and help to maintain bank stability. Further, large, deep, permanent pools are present throughout Coondoo Creek, and Tinana Creek below its junction with Coondoo Creek. According to Simpson (1994), streams in this area have not been affected by siltation to the extent seen in many parts of the Mary catchment. Simpson also indicates that 75% of the sites throughout the broader Mary River catchment where cod habitat can be rated as very good were bordered by State forest reflecting the importance of riparian forest and large woody debris they produced. The main channel of the Mary River is described as having no habitat in the good or very good categories and approximately 70% in the poor to very poor categories. However, I consider that is likely that the Mary River once contained good habitat for the species and it contains areas that can be rehabilitated. The Mary River Catchment Coordinating Committee (MRCCC) has identified in advice provided to me that up to 10 locations represent "known cod holes" in the Mary River between approximately Yabba Creek and Amamoor Creek.

It seems commonly accepted that riparian zones throughout the 9,600km^2 catchment have been significantly degraded by 150 years of intensive utilisation of the floodplain for forestry and agricultural purposes, combined with a lesser period of mining of instream resources.

A consideration of the history of land uses and riverine changes that have occurred since the 1840s leaves a clear impression of enormous degradation to main channel habitats that would have otherwise been favoured by the Mary River Cod.

As summarised in the MRCCC's Mary River and Tributaries Rehabilitation plan of 2001 a local historian summarised the extent of the historic impacts in 1994 when he wrote, that the river; "Changed beyond comprehension of those who knew it even 50 years ago. It has changed from a deep clean stream guarded by shaded scrub (rainforest) which reached back to the ranges, or by the open forest flats saddle high in the native kangaroo grass, to a sand clogged watercourse fighting for its life between eroded banks held by thinly scattered trees."

On the basis of these accounts, and advice from the proponent and the then DPIF, I consider there is a sound basis to conclude that the Mary River main channel has become so degraded that it retains minimal useful habitat for the Mary River Cod and, if the recovery of the species is to occur, there is a clear need to initiate large-scale efforts to partially reverse this degradation. This view underpins, and is reflected in, the conditions I have established and explain further in the aquatic fauna refuge section below. I consider that the priority that I am affording such action has already been well-justified and emphasised by the Mary River Cod Recovery Plan, particularly given that the yet-to-be-initiated required action 5 from the Recovery Plan is to restore cod habitats through a large-scale program for riparian habitats.

While it is likely that historic overfishing and de-snagging actions have also had substantial adverse effects over time, I consider that there is a high probability that the past loss of vegetation and the related infilling and loss of pools through siltation in response to land clearing and associated agricultural practices are the key issues affecting the sustainability of Mary River Cod and constraining the recovery of the species. These threatening processes appear to be the most common reason given in the literature for the decline of the species, particularly in the main Mary River channel. I have established comprehensive precautionary requirements relating to the key threatening processes for the species, particularly loss of habitat and water quality. These requirements are specified at Conditions 4, 5, 8, 9, 11, 21(j), 22, 23 and 31 (d) (ii) and (iii), Schedule C, Appendix 1, as summarised above.

I do not consider that barrier effects on the Mary River itself have played a significant role in the decline of the Mary River Cod in the past as the main channel is largely free of such barriers above the Mary River Barrage. However, barrier effects on tributaries may be important issues of at least second order importance and I consider that the measures outlined below suitably address risks relating to flows, barrier effects and movement. I consider that the inclusion within the Project of substantive measures targeting large-scale revegetation and addressing tributary barrier effects as part of the Project, not only represents reasonable and necessary measures to address Project-related risks but also a valuable opportunity to catalyse and enhance the Mary River Recovery Plan and at least partially reverse the ongoing threats to the sustainability of the Mary River Cod.

There have been past successes associated with the Mary River Cod Recovery Plan. However, many required actions, particularly relating to habitat restoration, research and monitoring, have not been able to be implemented. The advent of this Proposal provides the opportunity to attract additional resources and initiate and substantially advance the outstanding required measures.

In the absence of this catalyst investment that I am requiring through conditions to be embedded within this Project, based on the past ability to attract resources, I am not confident sufficient resources will be otherwise be forthcoming for the community to deliver on the intentions set out in the recovery plan.

I consider that DPIF advice identifies what actions need to be implemented in relation to treating risks associated with the Project while also advancing the recovery of Lungfish and Mary River Cod.

Fish spawning, movement and flow requirements

Many species (e.g. Lungfish) require moderate or low flow conditions and/or stable water levels to spawn on macrophytes or in shallow habitats. Spawning in response to rising temperatures in spring is common. Mary River Cod spawn in spring when water temperatures rise above 20 degrees. Up to 9 fish species are likely to be catadromous migratory species in that they spend most of their life cycle in freshwater and migrate to estuaries or the sea to breed. Up to 13 species may be potamodromous in that they are expected to undertake migrations within rivers to move between feeding and breeding areas. The proponent indicates that Lungfish and Mary River Cod are regarded as facultative potamodromous species in that large scale movements are not required for spawning but may be undertaken in certain circumstances, such as to move between good quality habitats or away from areas where water quality is deteriorating. I therefore concur with the proponent that the opportunity for Lungfish and Mary River Cod to pass the Project's in-stream barrier should be provided for.

Within my conditions at Schedule A (Operational works that is constructing or raising of a waterway barrier works), Appendix 1, I am requiring that the proponent to construct and operate a fishway in accordance with performance criteria to be refined in consultation with experts from DEEDI. The performance criteria must be finalised in accordance with comprehensive design process requirements as specified in Schedule D. Within Fishway Design Documentation that must be developed and approved prior to the commencement of the Principal Construction Works, the proponent must identify how non-compliance with necessary performance criteria will need to be rectified. This must include the identification of triggers for the initiation of rectification to ensure compliance with performance criteria.

There are currently some dam and weir structural barriers to fish passage in the Mary River catchment, mainly on tributaries. Two major barrages exist in the upper estuary, one is on the Mary River downstream from Tiaro and the other is on Tinana Creek. The two barrages have fishways that provide some but not optimal passage opportunities for fish. Tinana Creek passage is also affected by Teddington Weir and Tallegalla Weir. The Borumba Dam (Yabba Creek), Imbil Weir (Yabba Creek) Lake MacDonald (on Six Mile Creek), Cedar Pocket Dam (Deep Creek), Kandanga Weir (Kandanga Creek) and Baroon Pocket Dam (Obi Obi Creek) structures all form barriers to fish movement in tributaries within the upper catchment. The impact of Baroon Pocket Dam is probably minimal given that there is a waterfall downstream of the dam that forms a natural barrier. None of these structures have effective fishways, although Imbil Weir, along with the Gympie Control Weir (on the Mary River) and Jimna Weir (Yabba Creek) are likely to be barriers to fish movement only during very low flow periods.

I am requiring the proponent to work with the chief executive administering the *Fisheries Act 1994* to select the most problematic existing barrier (in terms of constraining ecologically important fish movements) and construct or otherwise arrange the retrofitting of an effective fish transfer device.

Given the risk of the new dam introducing reduction in movement opportunities into the catchment, I consider it is appropriate for the proponent to construct at least one fishway retrofit project on a barrier in the catchment in consultation with the chief executive administering the *Fisheries Act 1994*. This has been imposed at Condition 23, Schedule C Appendix 1.

In the absence of analysis that there is a better candidate(s) on ecological and/or technical practicality grounds, I consider that Imbil Weir should be targeted for the retrofitting of a fishway that is capable of moving Lungfish and Mary River Cod. This is based on its location close to the inundation area and on a stream which is known to contain habitat values for Mary River Cod and Lungfish. It is also recognised that it is possible one or more smaller projects may be identified as being preferable.

This fishway requirement is in addition to ensuring that Lungfish, Mary River Cod and Gudgeon (which I consider to be likely to be suitably representative of the requirements of all present species) are able to move upstream and downstream from one side of the Project dam wall to the other in most flow conditions above 10 cm flow modelled at a gauging station at Dagun Pocket. I have conditioned at Schedule A, Appendix 1 (operational works that is constructing or raising a waterway barrier works) and Condition 8, Schedule C, Appendix 1 that these low flows are to be achieved or exceeded at least 97% of the time during the operation of the Project, and that fish passage across the dam wall must be provided during these times, with some limited exceptions as outlined below:

- during a period of no more than 15 days per calendar year, when equipment needs to be temporarily decommissioned to allow structural improvements or maintenance activities required or approved by the chief executive administering the *Fisheries Act 1994*
- during large floods when infrastructure may be at risk

- for a single period of up to 60 days for initial commissioning

Given characteristics of adult Lungfish, including their relatively large size and slow moving nature, if the fishway can accommodate Lungfish, it is highly likely to be able to accommodate all other native species in the Mary River. I understand that smaller fish species within the Mary River and neighbouring catchments have been found to readily utilise fishways.

In terms of Lungfish movement, while there is variation between the habits of individual fish, tracking of movement has revealed the Lungfish are capable of travelling many kilometres. However, it would appear that the majority of Lungfish remain within a contained range, when appropriate shelter, feeding and breeding habitats are close. In optimum territory adult fishes are found congregating together.

Advice from the then DPIF indicates that:

> *In flowing river sections, Australian Lungfish exhibit largely localised movements around a distinct home range typically 1-1.5km in length. The home range is typically centred on a small number of regular refuges, where individuals shelter during the day. Movements outside of the home range are rare and only observed in a small proportion of the population. In contrast, Lungfish in impounded waters can be highly mobile. During late autumn and winter Lungfish tagged by Brooks and Kind (2002) moved out of instream impoundments on the Burnett River to seek out suitable spawning habitat in shallow pools and glides. This included sections upstream of the impoundments and in tributary streams, up to 35km from the impoundment. Following the spawning period, return movements occurred on a staggered basis with individuals often utilising small flow events to assist their downstream passage (Brooks and Kind 2002). Berghuis and Broadfoot (2004) reported that Lungfish downstream of Ned Churchward Weir also made upstream movements during minor flow events, taking advantage of increased connectivity to move between pools*.

In order to accommodate the movement requirements of Lungfish, Mary River Cod and other fish species, the proponent is committed to developing a fishway. This commitment to design and construct a functioning fishway is imposed along with functionality requirements within my conditions as discussed further below in this section. The design involves water flowing almost continuously through the fish passage down the Mary River to attract fish.

I note that the EIS indicates that storage volume will need to be at minimum of 30% capacity for the fish passage to work. However, I am requiring at Schedule A, Appendix 1, that fish passage be made possible in both directions for all native species present in the Mary River when releases are being made in accordance with the requirements in Condition 8, Schedule C, Appendix 1, less the specified small allowances of time for fish transfer downtime during large floods and for temporary decommissioning for structural improvements, maintenance and/or equipment failure.

I acknowledge that the provision of upstream fish passage for large-bodied species (>1m) has been problematic worldwide. However, on balance, I consider that there is a strong likelihood that the proposed fishway will be capable of being designed to enable some of the relatively uncommon larger scale movements undertaken by Lungfish. This is based on my understanding that:

- Lungfish do utilise fishways on existing dams and weirs (e.g. Paradise Dam, Ned Churchward weir and Claude Wharton Weir)
- the rate of advancement in knowledge about fishways through practical application over the past decade
- substantial resources will be deployed in relation to developing the fishway, informed by specific trials as per Condition 23, Schedule C, Appendix 1, prior to commencement of Principal Construction Works
- DEEDI experts will be closely involved in the development of the detailed fishway design.

No information is currently available on use of fishways by Mary River Cod. Of the existing man-made barriers to fish passage in the Mary River Catchment identified above, only two are fitted with operational fishways. The fishways are located at tidal barrages on the main river channel and Tinana Creek and, because of their position in the catchment, cod would rarely if ever encounter these fishways.

However, there is information available on movements of other closely related freshwater cod species in Australia, particularly Murray Cod and to a lesser extent Trout Cod. According to advice from the then DPIF, there are also a growing number of studies examining movements of these species through fishways within the Murray-Darling Basin. For example, I understand that Lock 8 on the Murray River passed 29,500 fish over a 55-day period, and on average 500 fish use the fishway daily, ranging from large Murray cod over 900 mm in length to small Australian smelt around 30 mm. Other fishways further upstream on the Murray River are also helping reconnect native fish populations, with the Denil fishway at Euston weir passing Murray cod up to 1 m long and the fishway at Torrumbarry Weir passing Trout cod.[30]

I note that Professor Walker (within his Commonwealth Reviewer Report) also considers that, based on the Murray Cod, it is likely that adult Mary River Cod will be able to use the fish passage, although he is concerned that they may not utilise the device in sufficient numbers to overcome adverse genetic isolation impacts.

The operation of the fishway needs to be considered in the context of other Project outcomes supporting improved connectivity, including large-scale riparian habitat restoration and protection and reintroduction of snag habitat (Conditions 4 and 5, Schedule C, Appendix 1), improved flow conditions (Condition 8, Schedule C, Appendix 1) and the retrofit of a fishway on an existing barrier in the catchment (Condition 23, Schedule C, Appendix 1).

I consider that the fishway, in combination with these requirements, will improve the movement opportunities for Mary River Cod (between its strongholds in Obi Obi Creek and Six Mile Creek) and other native aquatic species, relative to the pre-Project situation.

As a result of the above considerations, I conclude that it is likely that native fish species including Lungfish and Mary River Cod will be able to move as necessary between the upstream and downstream rehabilitated riparian and in-stream refuge areas that I am requiring to be secured in key areas within the catchment. The proponent is also required to, in conjunction with DEEDI, monitor the use of the fishway by Lungfish and Mary River Cod and make adjustments as necessary to ensure native fish species, particularly Lungfish and Mary River Cod, are able to move from one side of the dam barrier to the other so as to remove any substantive prospect of genetic isolation arising.

In addition, given approval conditions reflecting the optimised flow scenario presented in the SREIS, I consider that the Project's impact on the seasonal flow pattern of the Mary River has the potential to benefit aquatic fauna such as Lungfish in the most heavily impacted area immediately downstream of the Project's dam wall.

As summer and autumn flows tend to have much greater volumes, the trend in these months overshadow the trends in winter and spring in relation to reported annual results. However sustained lower and more stable flows during winter and spring, along with ongoing periodic large flows in summer/autumn, are particularly important for sustaining and generating macrophyte coverage and hence general aquatic life. As depicted in figure 15-14 of the SREIS, stable base flows and minimal extraordinary large flows during winter and spring are desirable factors in relation to Lungfish, Mary River Cod and the broader fish community. In addition, the EIS and SREIS indicate that the reduced overall flows (i.e. on a whole of year basis) in the most impacted section of the river downstream of the Project will also result in an increased percentage of combined riffle and pool habitat, at the expense of some run habitat.

This means that the more regular winter and autumn flows that are proposed in the proponent's Optimised Flow Scenario are likely to provide improved conditions for ribbon weed and therefore a range of native fish, particularly Lungfish.

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[30] Murray Darling Basin Commission Native Fish Strategy Annual Implementation Report 2004–2005

In my view, implementation of key elements of the Optimised Scenario, detailed in the Response to Reviewer Reports and the Response to Information Requests Report, will mean that flows during July, August, September, October and November will improve from the current situation and enable a return towards the larger winter and spring flow patterns experienced prior to agricultural development in the Mary River catchment. In conjunction with this increased winter and spring flow pattern and overall increase in pool/riffle habitat, I consider that there will be an enhanced ability to manage releases so as to produce greater water level stability in the relevant stretch of river during the key lower flow months of July through to January, which contains the majority of the breeding season for fish species such as Lungfish and the majority of the Mary River Turtle nesting season.

I have conditioned default flow measures that must be adhered to unless research and/or optimisation in the future demonstrates an alternative set of measures that will better protect ecological values such as those depicted in figure 15-14 of the SREIS and explained further in the Response to Reviewer Reports and the Response to Information Requests Report. The default flow measures are specified within Condition 8, Schedule C, Appendix 1.

Protected aquatic fauna habitat areas

As discussed above, I consider that the changes resulting from 150 years or so of riverine habitat degradation as a result of vegetation removal and surrounding land use has had significant adverse impacts on the quality of aquatic environments. The recovery of the EVR species, particularly Mary River Cod, Lungfish and Mary River Turtles, is dependent on at least partially reversing this degradation.

A riparian buffer zone containing severely degraded native vegetation substantially affects the quality of the in-stream conditions for native fauna. A healthy riparian zone improves water quality by filtering runoff into streams and limiting erosion by stabilising waterway banks. It also provides food and shading at the waterway edge and, importantly, generates large woody debris within adjacent waterways.

Large woody debris provide a vast range of environmental values to waterways, including the provision of:

- physical habitat diversity and structural complexity for aquatic organisms;
- hotspots of energy flow and nutrient cycling
- stream channel and bed sediment stabilisation
- fine particulate organic matter for biological processing
- substrate stablisation to assist colonisation by biofilm (algae, bacteria and fungi) and invertebrates
- refuge areas for fish to avoid predators, sunlight, high water velocities, and also for use as spawning sites or territory markers
- re-oxygenation of water flowing over large woody debris and prevention of stagnation
- resting, perching, foraging, lookout and crossing points for terrestrial organisms

A series of studies, quoted in the EIS, indicate that the poor condition of the riparian zone in the Mary Catchment, as a response to a range of historic and current disturbance factors, generally manifests as very poor riparian width containing high percentages of exotic species. One of these quoted studies (Johnston, 1997) found that the riparian zone had undergone very high disturbance and degradation with the average vegetated riparian zones in the catchment being 17 m in width and ranging from 0.5 m in the main Mary River to over 50 m in a number of sub-catchments.

Furthermore, erosion was recorded along 85% of the stream length with at least 13% of the banks being considered unstable (Johnston, 1997).

When considered in the context of existing threatening processes, the Project must not only mitigate predicted impacts but also improve the resilience of the existing environment by addressing the existing degradation and thereby provide greater certainty about the mitigation and offset measures for EVR species.

The Project will directly affect up to 36.5km of the length of Mary River. In addition, up to a further 58.8km of tributaries will be affected, including:

- Kandanga Creek (11.9 km)
- Yabba Creek (10.2 km)
- Coles Creek (8.0 km)
- Skyring Creek (10.6 km)
- Happy Jack Creek (6.3 km)
- Belli Creek (5.7 km)
- Coonon Gibber Creek (4.0 km)
- Chinaman's Creek (2.2 km)

While this equals total of 95.4km of stream length affected by inundation, the proponent has demonstrated (in the Habitat Restoration Plan contained within the Response to Information Requests Report) that only 34.8km and 70.3ha of good quality habitat for EVR aquatic species (i.e. Lungfish, Mary River Cod and Mary River Turtle), including riparian vegetation of suitable quality, is adversely affected by the Project.

Condition 4, Schedule C, Appendix 1 requires that the majority of the perimeter of the impoundment zone must be actively rehabilitated, protected and managed (including replanting to encourage suitable regrowth of native vegetation, cattle exclusion and weed and pest control as necessary). This means that ongoing management measures must be applied so as to cause the majority of perimeter to contain native vegetation to eventually (e.g. within 20-30 years) reach remnant status. Cattle and other livestock must be excluded permanently from the large areas around the perimeter of the impoundment (i.e. within an inundation area buffer). I have identified outcome specifications within condition 4 for four separate riparian restoration zones within the inundation area buffer (i.e. the Kybong, upstream, eastern and western zones). I estimate that this will potentially result in over 2,000ha of restored and protected remnant vegetation adjacent to in-stream areas that must be treated in many instances to deliver newly created snag habitat as per Condition 21(j)(i), Schedule C, Appendix 1 noting that, as some of this protected riparian vegetation will be created on the banks of smaller tributaries such as Belli Creek and Happy Jack Creek, not all the area will be directly inhabited by Lungfish and Mary River Cod but will have a benefit in terms of food chains relevant to these species.

Condition 4, Schedule C, Appendix 1 requires the proponent to cause all the restored and protected riparian habitats, to be assessed by an independent appropriately qualified person (approved by the Coordinator-General) as having achieved suitable interim rehabilitation benchmark requirements (relating to matters such as cover density, species composition etc) before the commencement of Principal Construction Works and then continue to meet upgraded benchmarks at various points of time leading to the achievement of full maturity benchmarks for relevant riparian ecosystem types.

Offset areas required to satisfy the VMO requirements in Schedule A, Appendix 1 may be included within the protected riparian habitat in Condition 4, Schedule C, Appendix 1.

In-stream snag habitat creation must be established and maintained in 50 km of in-stream areas adjacent to the riparian areas of restored and protected vegetation (i.e. protected riparian habitat). Condition 21(j), Schedule C, Appendix 1, requires the widespread introduction of snags in waterways, adjacent to protected riparian habitat within the inundation area buffer, consistent with the standards and processes described within the *Design Guidelines for Reintroduction of Wood to Australian Stream (Brooks, 2006)*. The proponent must produce a design and associated explanatory report, prior to the commencement of the Principal Construction Works, detailing how the system of snags is to be spread throughout the waterways within the inundation area buffer and located at different levels within the Project reservoir to meet habitat needs (e.g. shelter, substratum for the growth of freshwater sponges, and above water turtle basking habitat).

Based on the assessment presented in the EIS, SREIS, the Response to Reviewer Reports and Response to Information Requests, I am satisfied that the mitigation and offset measures proposed by the Proponent together with my imposed conditions, address the identified impacts. However, in recognition of risks and uncertainties associated with the biological needs and ongoing threatening processes relating to EVR aquatic fauna, I consider that further precautionary habitat creation and other measures (e.g. research to address knowledge gaps) are required in addition to the restoration and enhancement of habitat within the Project Area.

Further, the benefit of requiring additional measures is supported by advice provided to me by Advisory Agencies that undertaking targeted research, as well as protecting and enhancing habitat elsewhere in the catchment where there are known populations of EVR species, would address not only residual risk associated with species' response to the Project, but also reduce the risks to EVR species from ongoing catchment-wide threatening processes.

I am therefore requiring, at Condition 5, Schedule C, Appendix 1 that the proponent cause the establishment, protection and maintenance of further protected riparian habitat and associated in-stream aquatic fauna refuge areas outside the Project Area throughout the catchment via a Catchment Enhancement Program involving habitat creation activities. The proponent must ensure that habitat is created by:

- providing protected riparian habitat along bank stretches individually of not less than 100 m in length to establish areas of protected riparian habitat with a minimum width of 30 m (and desirably 60 m where achievable) from the waterway edge
- protecting existing remnant native vegetation
- restoring native vegetation
- controlling and, where possible, eradicating weeds and pest animals
- where required to exclude stock, installing perimeter fauna friendly fencing
- where protected riparian habitat areas include Mary River Turtle nesting areas, the Mary River Turtle nesting areas may remain uncovered by vegetation, and must be surrounded by suitable protective measures including native vegetation and predator and stock exclusion fencing on the non-riparian boundaries
- introducing snags into in-stream locations that would benefit Mary River Turtles, Lungfish and/or Mary River Cod

I estimate that the Catchment Enhancement Program's protected riparian habitats and associated refuge areas should be targeted at achieving approximately 20 km of stream length within the Mary River catchment, based on an approximation of the stream length that is converted from a riverine to lacustrine environment by the Project. I further estimate that associated riparian habitat in the order of 250 ha would be provided based on the rehabilitation requirements for the Catchment Enhancement Program applied to a 20 km stream length.

I consider that at least $10 million in funding will be required to ensure the implementation of the Catchment Enhancement Program based on recent projects involving revegetation of riparian habitat in SEQ.

It is desirable that the proponent commences physical works associated with the Catchment Enhancement Program as soon as practicable. However, I recognise that considerable planning in conjunction with community groups, landholders and Government agencies will be required to maximise stakeholder support and hence the water quality and habitat benefits that are being targeted. As a result, I consider that it is appropriate to allow up to 10 years to achieve the establishment of the protected riparian habitat areas in the Catchment Enhancement Program. However, prior to the Completion of Construction, I am seeking detailed plans associated with identified target sites upon which the rehabilitation and maintenance work may be applied to create the protected riparian habitat outside the inundation area buffer for the benefit of Mary River Cod and Lungfish and/or Mary River Turtle and/or Giant Barred Frog. There will need to be a well-specified and comprehensive forward program of work designed to secure and develop a relevant proportion of particular targeted sites and to achieve substantial water quality and habitat benefits. The Catchment Enhancement Program must be developed in consultation with the chief executives administering the *Fisheries Act 1994*, the *Nature Conservation Act 1992* and the *Water Act 2000* and community groups with an interest in catchment rehabilitation. The Program must:

- identify all actions necessary to achieve the protected riparian habitat, including verification
- demonstrate that the actions are adequately funded to to achieve the required outcomes
- include benchmarks to be achieved
- identify who will undertake the actions (acknowledging that some actions may be undertaken by local community groups, landholders or government agencies).

Sites to be targeted by the proponent should include have regard to areas identified the *Mary River and Tributaries Rehabilitation Plan (Stockwell 2001)*, which identified good existing habitat for Mary River Cod and that rehabilitation should build upon these good habitat areas if possible. Further I note that QPIF are of the view that Mary River Cod habitat is likely to coincide with good habitat for the Lungfish, as indicated in the Response to Reviewer Reports. In addition, advice from the MRCCC indicates that the stretch of the Mary River between the vicinities of the junction with Yabba Creek and the junction of Amamoor Creek junctions should be a focus for conservation and habitat restoration efforts.

In order to achieve the maximum beneficial outcomes for threatened species through the Catchment Enhancement Program, I require that the program be directed at optimising habitat in the catchment at or adjacent to existing populations or for the purposes of increasing connectivity. I therefore require that the protected riparian habitat areas must preferably be distributed across all, but in at least 2 of the following locations:

- Mary River Turtle nesting areas on the banks of the Mary River as verified by the chief executive administering the *Nature Conservation Act 1992*
- both banks of the Mary River from one kilometre downstream of the Project dam wall to the Amamoor Creek confluence
- priority Mary River Cod recovery areas[31] (which may also be relevant to Queensland Lungfish recovery) selected from the following: Six Mile Creek from Lake McDonald to Mary River Junction, Tinana Creek from the mouth of Goomboorian Creek (Anderleigh Road) to Teddington Weir, Coondoo Creek from Windsors Road to the junction with Tinana Creek, Obi Obi Gorge from Lake Baroon to Skene's Creek (or Baxter Creek), Amamoor Creek from McGills Creek to Amamoor
- areas within the Mary River Catchment occupied by the Giant Barred Frog as verified by the chief executive administering the *Nature Conservation Act 1992*.

The requirements I have imposed for the protected riparian habitat in Conditions 4 and 5, Schedule C, Appendix 1 is consistent with key elements of habitat restoration programs being pursued in the highly degraded Murray Darling Basin. For example, the North Central Catchment Management Authority in partnership with the Department of Primary Industries and the landholders and communities along the

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[31] As set out in Table 4.5, Mary River Catchment Coordinating Committee “*Mary River and Tributaries Rehabilitation Plan Implementation Edition*” 19 July 2001

Loddon River has been implementing a large-scale riparian enhancement project since 2003 that has resulted in the installation of over 200 km of river fencing to control stock access, substantially improve the habitat provided by the vegetation along the river and improve the quality of water entering the river from adjacent paddocks.[32] Another relevant example involves a resnagging habitat-restoration trial, undertaken from 1999 to 2002 in the Murray River between Yarrawonga and Tocumwal, in which over 300 items of large woody habitat were installed at sites along approximately 30 km of river. Monitoring results from 2004–2005 indicate that resnagged logs are utilised by many species of native fish. In particular, the response to resnagging has been outstanding for the critically endangered Trout Cod, with a large increase in numbers being recorded since the start of that project.[33]

As well as large-scale revegetation of protected riparian habitat and the associated creation of new aquatic fauna and frog refuge areas, the proponent must implement and provide at least $35 million funding for the research actions imposed by Condition 11, Schedule C, Appendix 1 (as recommended by the then DPIF and the then EPA) to address knowledge gaps relating to the species. The outcomes of the research development plan are required to be applied to maximise the effectiveness of the mitigation and offset areas required by Conditions 4 and 5, as well as other Project mitigation and offset measures for the Mary River Cod, Lungfish, Mary River Turtle and Giant Barred Frog species.

The particular research outcomes being targeted include population dynamics across a range of age classes, essential habitat characteristics, recruitment and survivorship factors, water quality effects and captive husbandry measures.

Based on the information before me, I am satisfied that the measures prescribed in my imposed conditions, in particular Conditions 3, 4, 8, 9, 21, 22 and 23 appropriately respond to the predicted impacts of the Project. However, I acknowledge that there are a complex range of interactions that influence the potential impacts on aquatic species, particularly in the context of existing threatening processes. In consideration of these issues, it is prudent that additional catchment management works, as required by my Condition 5, 22(d) and 23(b), Schedule C, Appendix 1 be implemented. I further consider that given the range of mitigation and offset measures required and the complex ecosystems within which these measures are required, it is appropriate that further research into species requirements, as required by my Condition 11, be undertaken and utilised to allow adaptive management of these measures.

In consideration of the range of requirements that I have imposed, including mitigation measures and both direct and indirect offset measures, I am satisfied that the conditions imposed on the Project are appropriate for responding to potential impacts and residual risk to aquatic species, including those matters where there is a lack of full scientific certainty about the potential impacts of the Project.

Freshwater turtles

I understand that that the Mary Catchment, along with the Fitzroy Catchment, has the highest biodiversity of freshwater turtles in Australia with six species from five genera of chelid turtles (Legler and Georges, 1993; Cann, 1998). The six species and the numbers of each species identified during the EIS survey within the inundation area are listed below.

[32] See http://www.nccma.vic.gov.au

[33] See *Murray-Darling Basin Commission Native Fish Strategy 2004–2005 Annual Implementation Report*

Name		Endemicity	Status	EIS Survey inundation area
Common	Scientific		EPBC and NCWR	Numbers
Southern Snapping Turtle	Elseya albagula	Occurs only in Mary Catchment, SE Qld	Not Listed	229
Mary River Turtle	Elusor macrurus	Wide spread, Mary River to Cape York Peninsula, Qld	Endangered	179
Krefft's Turtle	Emydura macquarii kreftii	Wide spread, northern NSW, QLD & eastern NT	Not Listed	123
Saw-Shelled Turtle	Wollumbinia (formerly Elseya) latisternum	Wide spread, SA, Vic, NSW, and sth Qld	Not Listed	8
Broad-Shelled Turtle	Chelodina expansa	Wide spread, SA, Vic, NSW, and sth Qld	Not Listed	7
Eastern Snakenecked turtle	Chelodina Longicollis	Wide spread, SA, Vic, NSW, and sth Qld	Not Listed	0

The Krefft's Turtle, Saw-Shelled Turtle, Broad-Shelled Turtle, Eastern Snakenecked Turtle are widespread relatively adaptable species and are thought to have healthy populations within the catchment. I consider there can be confidence that the populations of these species would not be adversely affected, and in some instances the populations may increase (particularly Krefft's Turtle given that the impoundment will represent favourable habitat).

In contrast to the other four species, the Southern Turtle and the smaller Mary River Turtle (Elusor Macrurus) have a range that is restricted to the region. The Mary River Turtle species has been a particular focus in my evaluation of the EIS. I anticipate that many of the required mitigations in my conditions, focusing particularly on the Mary River Turtle, will also be of benefit to the Southern Snapping Turtle.

The Mary River Turtle species is restricted to the Mary River catchment and it is the largest freshwater turtle in the catchment. It is thought to occur along 200km of the Mary River from Kenilworth to the Mary River Tidal Barrage at Tiaro as well as inhabiting some of the River's larger tributaries including Yabba Creek.

The Mary River Turtle is listed as endangered under the EPBC Act. The Mary River Turtle is also listed as endangered under the *Nature Conservation (Wildlife) Regulation 2006*.

The Mary River Turtle is considered to be the rarest turtle in Queensland, although there are no soundly based estimates on total population numbers. The proponent estimates that there is a local population in and around the inundation area of between 895 and 3580.

The Mary River Turtle, with a particularly large tail and back legs, is a relatively strong swimmer and the species uses a cloacal respiration system (i.e. they have the ability to spend extended periods underwater by extracting DO through cloacal cavity). Despite these notable traits, the species wasn't described in science until 1994. It was however well known to the pet trade and sales of hatchlings were common in the 1960s and 1970s.

Information presented to me explains that since the 1960s, the Mary River Turtle population is considered to have fallen by up to 95%. During the 1960s and early 1970s, Mary River Turtles were subject to excessive egg harvesting for the pet trade. Having a long lifespan, (females do not reach breeding maturity until at least 15 years) the impact would not have been immediately evident. However, it is now clear to researchers this was a primary cause in the substantial population decline.

Evidence from collectors active in the 1960s, suggest that hundreds of females once laid around 2000 eggs a year at popular nesting bank near Tiaro. By the end of last century, egg production at the site was found to be as few as 150 eggs in only ten nests.

In 1974, harvesting and sale of eggs was prohibited. However, there is currently no evidence to support a confident view that the success of recruitment of hatchlings into the population has improved since 1974. The current population appears to continue to have an unacceptably low proportion of juveniles. Based on the advice of DERM experts, I consider this is primarily because, even though most females produce viable eggs annually, without direct human intervention very few, or possibly no, eggs are hatching. DERM experts have advised me that there is no evidence to support the conclusion that reduced sub-adult and/ adult survivorship has contributed to the population decline, as suggested by submitters including one of the Commonwealth reviewers.

I have concluded from the information provided to me that the Mary River Turtle numbers have declined due to both increased impacts within the catchment, including habitat destruction, and the extensive harvesting of eggs for commercial purposes in the 1960s and 1970s. The reduced population due to these factors appears to have been unable to extensively regenerate, due to habitat reduction, ongoing and increased predation especially from non-native species, and the disruption of nesting areas through stock access. In terms of these ongoing adverse impacts, I have imposed conditions at Conditions 4 and 5, Schedule C, Appendix 1 that will provide a strong measure of response to these existing issues within the catchment in order to promote increases in Mary River Turtle numbers as a mitigation for any residual risks that may be presented by the Project.

The EIS material indicated that there are three potential risks to the Mary River Turtles that are directly related to the Project. Without suitable mitigation, these risks include the change of habitat associated with clearing and inundation, the potential for trauma caused by contact with the dam infrastructure (such as turtles falling from the spillway or being crushed by moving parts within the dam structure) and the barrier effect created by both the dam wall and the inundation area. The mitigations required by my conditions to address these risks are:

- Change of habitat associated with clearing and inundation
  - artificially introducing snag habitat into the inundation area to create suitable turtle habitat (and for other species) and enhancement of aquatic habitat within the restoration areas
  - the protection of existing turtle nesting areas both within the Project Area and in the downstream catchment, and the relocation of impacted turtle nesting areas within the inundation area
  - riparian and aquatic habitat restoration works (both upstream and downstream) to be completed in association with the protected riparian habitat areas detailed in Condition 4, Schedule C, Appendix 1, including controlling, and where possible, eradicating weeds and pest animals
  - retention of vegetation areas within the inundation area to 1.5 m of FSL
  - a documented habitat restoration plan that sets out auditable rehabilitation benchmarks, with interim benchmarks to be achieved prior to the commencement of Principal Construction Works for both habitat restoration works within the Project Area and the greater catchment
- Potential for trauma associated with the dam infrastructure
  - a turtle bypass trial for cloacal breathing turtles
  - a turtle bypass system designed for the safe movement of turtles that is informed by the bypass trial, all available information including agency advice, be developed in consultation with the chief executives administering the *Nature Conservation Act 1992*, the *Fisheries Act 1994* and the *Water Act 2000*, and that must be approved by the Coordinator-General before the commencement of Principal Construction Works

- Project design must minimise the risk of injury of death to wildlife, particularly in regard to inlet and outlet structures, the fishway and spillway structures

- Connectivity past the dam wall and through the inundation area

  - a turtle bypass trial for cloacal breathing turtles

  - a turtle bypass system designed for the safe movement of turtles, that is informed by the bypass trial, all available information including agency advice, be developed in consultation with the chief executives administering the *Nature Conservation Act 1992*, the *Fisheries Act 1994* and the *Water Act 2000*, and that must be approved by the Coordinator-General before the commencement of Principal Construction Works

  - a monitoring program to monitor the effectiveness of the turtle bypass system, with the results of the monitoring program informing the specific research outcome targets. In addition provision must be made for continuous improvement of the turtle bypass system in response to the outcomes of research undertaken the creation of aquatic and riparian habitat within the inundation area that is supportive of turtle movement through and around the inundation area

  - the creation of aquatic and riparian habitat within the inundation area that is supportive of turtle movement through and around the inundation area

  - the protection and enhancement of aquatic and riparian habitat upstream and downstream of the Project that is supportive of turtle movement thorugh and around the inundation area, including controlling, and where possible, eradicating weeds and pest animals

  - the provision of riparian habitat around the turtle bypass system to provide refuge and protection for turtles and other native species

  - a documented habitat restoration plan that sets out auditable rehabilitation benchmarks, with interim benchmarks to be achieved prior to the commencement of Principal Construction Works for both habitat restoration works within the Project Area and the greater catchment

The protection and enhancement of aquatic habitat downstream is also dependent on the optimisation of flows to enhance important dependent aquatic ecological outcomes. These matters are discussed in section 3.2 of this report. I have set at Condition 8(b), Schedule C, Appendix 1, FPIs to be observed at Dagun Pocket based on the understanding of the species requirements, including those of the Mary River Turtle, and an analysis of the flow regimes before water resources development and under current extractions. In general, statistics closer to pre-development conditions have been set to improve the existing flow regime.

The outcomes of optimisation modelling with the FPIs implemented further support the conclusions made within the EIS and SREIS regarding the capacity of the Project to successfully manage environmental flows across all months and seasons and will improve upon conditions currently experienced within Dagun Pocket section of the Mary River with those conditions containing measures specifically targeted at the protected and enhancement of both instream and adjacent riparian habitat that supports the Mary River Turtle.

I have imposed conditions, to address these risks, including Conditions 4, 5, 8, 9, 11, 21(j), 22, 23 and 31 (d) (ii) and (iii), Schedule C, Appendix 1. In determining the suitability of these conditions, I have taken into account all advice received, especially that provided by the Department of Environment and Resource Management. That advice suggests that turtles do attempt to climb infrastructure and it appears certain that a bypass that is appropriately designed would be used by turtles. The key issue appears to be that existing fish transfer systems have not been designed to accommodate safe passage for non-fish species including turtles. The agency recommendation is that effective turtle passage ways need to be developed and implemented in new and existing impoundments to allow the safe passage of turtles in both directions past infrastructure barriers.

I have set out below the key issues that I have taken into account when setting my conditions in regards to the Mary River Turtle.

The number and content of submissions focusing on issues associated with this species suggest a high level of concern in the community about the Mary River Turtle. A primary concern in the submissions relates to a view that Mary River Turtles (particularly juveniles) prefer riffles and will not inhabit or breed in substantial numbers or at all in impoundments. Submitters therefore argue that the Project will cause a further loss of habitat, centred on the one area the Mary River Turtle appears to be doing well, and will therefore push the species closer to extinction. A common theme within submissions was the argument that the EIS assessment is unsatisfactory as there is inadequate knowledge of the Mary River Turtle's lifecycle and habitat needs (particularly relating to recruitment from birth through to adulthood) to make any predictions of impacts or statements on the effectiveness of proposed mitigations. It appears that the proponent, DERM (i.e. the agency responsible for the NC Act) and submitters all generally agree that there is relatively limited available information on this species, its lifecycle and its habitat needs.

In light of this, I have taken a precautionary approach to requiring impact mitigations. I am satisfied that this approach will ensure that the risks in this regard are suitably treated.

In particular, the potential of the proposed applied research program, required by Condition 11, Schedule C, Appendix 1, to assist in developing a better understanding of the Mary River Turtle and to refine mitigation measures over time is a particularly important element of the Project in that one of the main impediments to the effective conservation of the Mary River Turtle is the lack of understanding of the species habitat needs.

I agree with advice from experts within from DERM that the recovery of the species can be achieved with appropriate planning and application of resources to the outcomes of planning. In this regard, I consider my requirements for the research, the provision of bypass systems for turtles both across the dam wall and on one other existing barrier within the Mary River catchment, the habitat restoration and protection and the other threat reduction measures (inclusive of pest control) to be delivered in accordance with my conditions, present a unique opportunity to facilitate the recovery of this species.

In terms of habitat requirements, I note that the proponent challenges the view the species is a riffle hydraulic habitat specialist largely on the basis of inconsistency with the findings of the EIS survey and the then EPA's 2007 *"Freshwater Turtles in the Mary River"* report.

DERM advice indicates that the species utilises pool as well as riffle habitat and that Mary River Turtles "appear to be functioning well in shallow, slowly flowing impoundment habitats". Their report also indicates that cloacal breathing turtles have been recently found in impoundments that were constructed decades ago. Furthermore, after identifying over 170 Mary River Turtles in and around the Project Area, the proponent noted, Mary River Turtles have "a marked preference for deeper water localities" and were found in ponded water up to six metres deep. Another study that utilised radio tracking and was referenced in the EIS also indicated that males and females spent the majority of their time within pools.

It may be that the Mary River Turtle was originally believed to be riffle specialist because researches found the species easier to identify and catch when in the riffle zone. In the absence of further empirical evidence it appears the riffle specialist tag has become an accepted but potentially false hypothesis.

One submitter argued that Mary River Turtle prefers habitat with a mix of riffles and deep ponds, possibly because upstream ripples discharge into the ponded habitat water with high DO as well as food. Furthermore, the submission considered Mary River Turtle females choose to breed near riffles and that it is likely that hatchlings are dependent upon riffles for food.

Adult Mary River Turtles are known to feed on macrophyte vegetation and algae. The EIS indicates that ribbon weed is a preferred food source. It also appears that Mary River Turtles may also feed on riparian vegetation (particularly fruit) that falls into the waterway, i.e. fruit from various lillypilly, fig, or blackbean trees.

Younger Mary River Turtles are likely to principally feed on the macro invertebrates that live in the macrophyte beds. Information on the habits and needs of juvenile Mary River Turtles is mostly speculation based on knowledge of similar species. Mary River Turtle juveniles have been observed in very shallow water as well as deeper pools. It is assumed that, as with adults, good levels of DO and healthy macrophyte beds (that include aquatic insect larvae) are important. The proponent in the EIS indicates that it considers young Mary River Turtles could be more abundant in areas with a high proportion of riffles.

In addition, I note that the EIS and SREIS present a strong case that it is likely to be the actual physical characteristics of the impoundment, not its hydraulic habitat type, which determines the suitability for Mary River Turtles. I consider that Cloacal breathing species require good levels of DO. Water bodies with low levels of DO, will limit the foraging time of Mary River Turtles. It may also force them to the surface and expose them, particularly the young, to predation.

I note that the upper layer of water and the periphery of the impoundment are expected to be of similar water quality to the contributing river and tributaries. It is not expected that the turtle would utilise the poorer water quality in the deep water layers (Hypolmnion).

The proponent is required by Condition 7(b), Schedule C, Appendix 1 to remove most of the vegetation that would otherwise immediately break down during the initial inundation, thereby minimising the related potential for increased nutrient loads. Furthermore, the filling is expected to be relatively rapid (as indicated above) with a potentially available contingency strategy involving the release of water from Borumba Dam to dilute poor quality water within the inundation area during filling.

In addition, to help maintain the oxygen in released flows downstream, the Project's outlet release design includes a device to increase the oxygenation of the water.

Low DO levels may also eventuate if excessive levels of floating macrophytes (particularly weeds such as Eichhornia crassipes and Salvinia molesta) develop over the dam. However, the proponent has committed to, and I have imposed at Condition 21(k), Schedule C, Appendix 1, vigilant and early control of macrophyte weeds. As discussed above in the subsection entitled macrophyte responses, I consider there is a high chance of success.

Based on EPA/DERM findings and advice, I consider that it is likely that the impoundments that are not suitable for Mary River Turtles are those that substantially have low DO and limited micro habitat characteristics. I do not consider that a substantial proportion of the inundation area will be in this category. As per pages 20-64 and 20-65 of the SREIS, favourable characteristics will be present within the inundation area. For example, around 60% of the impoundment area will be within the identified optimal depth range. While inundation without suitable mitigation could potentially remove Mary River Turtle microhabitat that provides shelter, the proponent is required by Conditions 21(j) and 7 (a) and 7(b) to introducing a range of snags at different levels within the inundation area, as well as leaving the riparian vegetation at 1.5 metres from FSL will help to provide micro habitat Mary River Turtles. A variety of macrophytes, including ribbon weed, are expected to quickly recolonise. Flow conditions downstream, consistent with my requirements at Condition 8 Schedule C, Appendix 1, are also expected to enhance habitat conditions and involve more protection to any nesting areas that occur immediately downstream as well as help create healthy beds of ribbon weed (a food source for the Mary River Turtles).

Also, the proponent is required to restore and enhance riparian vegetation, including the establishment of species important for particular species (e.g. lillypilly, fig and blackbean species) around the impoundment and in new areas of protected riparian habitat.

I further consider, as discussed above in relation to Lungfish and Mary River Cod, that there are considerable opportunities to create protected riparian habitat areas and associated in-stream refuge areas with characteristics that will be favourable to Mary River Turtles (as well as Mary River Cod and Lungfish) and other turtle species in accordance with my requirements throughout Conditions 4 and 5, Schedule C, Appendix 1. The most likely essential habitat factors that will need to be included within these areas involve parallels with those relating to Lungfish and Mary River Cod and/or factors that can readily co-exist within proposed refuge areas. A key exception is the need to maintain sparsely vegetation sand banks within areas of otherwise high quality overhanging riparian vegetation adjacent to well-oxygenated pools. I consider that it will be important for the new habitat refuge sites to include complex microhabitat features such as snags and rock crevices, particularly for younger turtles and suitable sand banks to encourage nesting.

From the EIS material and submissions, I consider that the following important nesting-related factors can be assumed with some confidence:

- Female Mary River Turtles produce one clutch of eggs annually
- Eggs are laid in mid October to end of November
- The incubation period for eggs is around 50 days
- Hatchlings emerge throughout December until February.

Flooding during the incubation period is a constant threat to Mary River Turtles, with an entire breeding population able to be lost in a year with considerable flood events from October through to January/February. However current observations indicate that even without floods, the majority of eggs are being either trampled by cattle or alternatively consumed by feral dogs, foxes, pigs, goannas or water rats. It is also possible that illegal egg harvesting is continuing.

In recent years an EPA (now DERM-QPWS) supported Tiaro community nest protection project has actively intervened to save Mary River Turtle hatchlings. The Project involves erecting protective cages over nests to prevent cattle or predators destroying Mary River Turtle eggs. Eggs are also placed in incubation should there be a risk of flood. Additionally, a captive breeding program released hatchlings in 2007. The impact of the apparently successful intervention actions is not known as a scientific assessment has not been commenced.

The Project represents an opportunity to enhance the resources dedicated to protecting eggs through measures which keep water and pests away from nests in key times and that lead to the creation of new refuge areas with favourable characteristics. This will be accommodated and encouraged through the activities to be implemented to address the requirements of Conditions 5, 11 and 21, Schedule C, Appendix 1.

While it is not known with certainty what makes an attractive egg laying site, it is seemingly well established that eggs are buried in sparsely vegetated sand banks approximately between 2 to 50 metres from the water edge, and about 1 to 3.5 metres above the water level. It appears that females remain loyal to the same hatching location throughout their life. I am satisfied that the proposed large-scale riparian vegetation restoration proposed by the proponent, in consultation with the chief executive administering the *Nature Conservation Act 1992* will suitably accommodate these requirements and not result in the loss of key sparsely vegetated sand banks.

Experts from DERM have advised that it is highly likely that the majority of nesting (both historically and presently) occurs well downstream of the Project Area, particularly in the vicinity of Tiaro. Cattle trampling and predation are ongoing challenges to the hatchling success at known nesting sites.

I understand that Mary River Turtles have been considered to not be a particularly mobile species, although there is insufficient available data to confirm migration requirements at the various life stages, particularly during the pre-adulthood stages. Mary River Turtles do not appear inclined to travel overland. Adult turtles are believed to move on average less than 200 m per day. Even during the breeding season, when the females venture to their preferred hatching locations, Mary River Turtles still manage to stay within the same 2 km stretch of the River.

Survey results and analysis from the EIS and the then EPA suggests that the proportion of juveniles in the population upstream of Gympie may have increased and be increasing relative to the proportion downstream of Gympie (i.e. the area associated with the key nesting banks).

This may be due to one or more of the following factors:

- differences in sampling techniques and/or
- better recruitment success upstream due to land use related water quality variations between localities and/or
- improved predator control in upstream locations and/or
- juvenile migration from the Tiaro nesting banks

The proponent's analysis relating to juvenile turtles in section 4.3.1.3 of the Response to Reviewer Reports, and advice from DERM, emphasises the need for caution in choosing among four potential factors and explanations for the survey results indicating greater juvenile presence in the Project Area.

Given the uncertainty associated with juvenile migration and factors affecting the survival of juveniles after hatching (as per the analysis in section 4.3.1.5 of the Response to Reviewers), it is therefore prudent, in terms of conditioning, to assume:

- that immature turtles do migrate upstream from the Tiaro vicinity as far as Kenilworth
- that juvenile recruitment has improved generally in the Project Area in recent years
- that juveniles may have difficulties surviving in considerable proportions of the impoundment (particularly deeper parts) for sustained periods (noting however, as discussed above, the characteristics of the impoundment area suggesting that the key DO and water quality levels will not be permanently diminished in the shallower areas of the impoundment through which turtles are more likely to pass through and/or occupy at least temporarily).

In the absence of new information coming to light to demonstrate that one or more of the above factors or assumptions are not important or are incorrect, I must assume that all of the factors are important and the assumptions are relevant. This means I am obliged to place comprehensive requirements on the proponent to allow for all possibilities and to therefore comprehensively address risks associated with Project and ongoing threatening processes applying to the species.

I consider that a precautionary approach must be taken and therefore I must assume that all of the abovementioned factors are important. This means that I am requiring the proponent to apply considerable resources to accommodate or treat each of the factors as relevant through my relevant imposed conditions, particularly those at Conditions 5, 11, 21, 22 and 23 Schedule C, Appendix 1. These relate to, among other items, the undertaking of a trial bypass for turtles, the construction of a turtle bypass system to allow turtle movement past the dam wall informed by that trial and a second turtle bypass system on an existing barrier within the Mary River catchment, an applied research program to improve understanding of the biological requirements of the species, monitoring and data-logging procedures, monitoring-based thresholds for the triggering of further specific mitigation measures to address adverse population changes and substantial habitat restoration and protection within the inundation area buffer and elsewhere (e.g. in the vicinity of Tiaro).

The EIS identified 64 potential nesting sites (sand banks above the river) around the inundation area of which 32 would be lost to the inundation. It was not known, which or if any of the sites are being utilised for laying. The EIS indicates that nesting sites were also lost after the completion of the Mary River Barrage and that females responded to the inundation by selecting new nesting areas immediately upstream of the inundation area.

The proponent has committed to move sand banks that will be inundated to new locations. Development of these artificial sand banks will be part of the waterway restoration. In addition, the Project will create a number of islands, the proponent will develop nesting banks for breeding on these islands. The islands' separation may provide a location for egg incubation safe from predators and cattle.

Another key issue raised by submissions related to concerns about the potentially fatal injuries that spillways, release valves, and fishways may cause to turtles. There is evidence that freshwater turtles in the vicinity of dams are more likely to suffer fractures to their shells from trauma. Life threatening injuries may result from the turtles being caught in the fishway mechanism or the flows over the spillway. Protective trashracks/trash filter screens are also known to contribute to injuries.

The proponent is required, by Condition 21(j)(viii) Schedule C, Appendix 1, to complete the design of protective measures within the design of Project structures such as the spillway during the detailed design process and then construct those designed structures in a manner that will minimise harm to turtles.

Conclusion

Under the existing situation, the continued viability of Mary River Turtles is of concern and even with continued human intervention numbers may still continue to fall. The EIS process has confirmed that the areas below, within, and upstream of the proposed inundation contain Mary River Turtles. Furthermore it would appear that, while nesting may be limited, successful recruitment of juvenile turtles into adulthood could be taking place within the Project Area.

By implication the inundation area must have at least reasonable habitat values. In itself, the inundation of the Project Area would probably result in a reduction of population size. However, the Project includes specific aspects (e.g. extensive areas within the impoundment of suitable depth range, instream snag habitat creation, maintenance of sand banks and riparian revegetation) that will mitigate the impact upon Mary River Turtles. Furthermore, the Project and my conditions include large-scale threat reduction requirements (e.g. habitat restoration, applied research activities and feral predator and cattle access controls) that will directly address the major known threats to the Mary River Turtles that exist whether or not the Project proceeds.

I consider that the provision of additional and enhanced existing aquatic and riparian habitat will mitigate and offset the loss of habitat within the inundation area. However, in order to ensure that connectivity is maintained with both the aquatic habitat to be created within the inundation area and the existing (and to be enhanced) aquatic habitat that exists upstream of the Project Area, I have required that certain mitigations (that must be provided before construction is able to proceed) are provided in regard to passage across the dam wall and measures to support movement thorugh the inundation area.

I consider that the Project, without the mitigation measures proposed by the proponent and the additional measures that I have required through conditions, could have caused overall adverse impacts on Mary River Turtles. However, the proponent has proposed measures within the Project, which taken together mean that, on balance, the Project is likely to produce net benefits for the species. The current uncertainty about some aspects of the lifecycle and habitat needs of Mary River Turtles has led me to require further comprehensive and precautionary mitigations over and above those proposed by the proponent to provide certainty that the potential impacts of the Project have been managed.

3.5. Air

The EIS identifies the existing air quality in the Project Area to be predominately rural, primarily influenced by agricultural and natural sources. The key air emission sources include a combination of general rural/residential activities, trains using the Queensland Rail railway line, the use of local roads and the Bruce Highway, and emissions from a number of quarries within the general vicinity of the Project, including a small quarry operating approximately 500m north of the dam wall site.

The EIS confirms that air emissions will result from Project construction activities; particularly dust from excavation, quarrying (including Meadvale and Moy Pocket Quarries), concrete batching, material handling and storage, drilling and blasting, and from vehicles using the haul roads, the dam access road and road realignments. Small quantities of gaseous pollutants will be emitted from internal combustion engines in construction equipment and from traffic along the roads realigned as part of the Project, however, ambient concentrations of these substances are expected to be low compared to air quality objectives in relevant guidelines.

The air quality modelling associated with the dam wall construction in the EIS indicates that during spillway excavation and construction of the embankment dam section, exceedances of the now repealed *Environmental Protection (Air) Policy 1997* (EPP Air 1997) goal of 150 µg/m^3 24-hour PM_{10} can be expected at sensitive receptors within 300-500m of the works. Further, the modelling indicates that sensitive receptors within 300-1200m of significant dust generating activities within the construction area will experience exceedances of 50 µg/m^3 24-hour PM_{10} which is the air quality objective established in the National Environmental Protection Measure (NEPM) and the new *Environmental Protection (Air) Policy 2008* (EPP Air 2008).

I note that further investigation into the potential for air quality impacts for all other aspects of the Project is required to be included within the Project EMP to be prepared for the Project. The Project EMP will ensure that controls specific to sensitive receivers adjacent to the works, such as Kandanga, Carters Ridge and other rural residences, are developed and implemented.

I note the limitations of the predictive modelling outlined in the EIS relating to the availability of site specific meteorological data, the assumptions relating to location of operation of construction activities (i.e. strict dust management controls included in modelling of crushing and concrete batch plants) and the absence of specific background dust levels. I further note the statement in the EIS that the dispersion modelling outcomes should be used as a tool to assist with the identification of potential issues and areas requiring management controls or further investigation, rather than a tool for determining Project compliance with ambient air quality criteria.

In addition, I note that the proponent has developed performance criteria to reduce dust impacts and comply with DERM and NEPM standards. Outcomes in accordance with the performance criteria are to be achieved through the implementation of impact mitigation measures tied to an ongoing dust-monitoring program within the construction EMP. For example, these measures include:

- regular watering of construction sites, haul roads, and exposed areas, such as stockpiles, with consideration of chemical stabilisation should water use prove inefficient
- restriction of vehicle movements to dedicated haul roads and speed limits to minimise dust
- detailed optimising of blast design to minimise dust emissions and
- rehabilitation of cleared areas, including reseeding, as soon as practicable.

The Proponent identifies in the EIS that the potential for air quality impacts associated with all construction works associated with the Project must be considered as part of the detailed design of the construction program. For the purposes of clarity, the conditions that I have imposed at Condition 17, Schedule C, Appendix 1 include:

- an ambient particulate and meteorological monitoring station be established at a representative location within the study area at least 12 months prior to the commencement of any road relocation or upgrade works associated with the Project and the Principal Construction Works to assist with the detailed assessment of potential air quality impacts and the development of appropriate dust management measures
- identification of all areas where elevated off-site impacts may potentially occur (and the conditions under which these impacts may take place), including road works, worksite activities, vegetation disposal, movement or queuing of construction vehicles with diesel-powered motors adjacent to sensitive receptors, and long-term operation of diesel-powered plant and equipment at worksites
- an implementation plan detailing all approaches adopted and all reasonable and feasible mitigation measures to address environmental dust issues within the surrounding areas. Where specific exceedances are predicted to occur the proponent is obliged to implement specific proactive mitigation measures targeted to minimise potential impacts on the receptor. These measures may include the measures listed in table 10.12 of the EIS

- development of a strategy for communicating planned mitigation measures to potentially affected receptors

- regular monitoring of air quality for deposited dust, total suspended particulates (TSP) and particles (PM_{10}) to determine whether the construction air quality criteria are being met. The monitoring program, including the frequency of monitoring and the locations of monitoring stations, are to be established in the Project EMP and

Where all available practical mitigation measures have been employed, but monitoring demonstrates that air quality criteria are still being exceeded, a short term scaling back of operations must be undertaken to ensure that the air quality criteria are met.

Further, I note that specific activities, such as crushing, screening, concrete batching and quarrying are ERAs and to operate will require a detailed air quality assessment and management plan as part of the development application process for each ERA.

Numerous issues were raised in relation to air quality impacts. I have considered each of the submissions and how the SREIS has responded to the issues raised in submissions. Key issues that I considered warranted particular elaboration and/or explanation in my evaluation included:

- the methodologies and scope of the dust emission inventory were inappropriate, and did not consider 24 hour operation of the RCC concrete batch plant or wind blown dust

- ambient air quality needs to be considered when developing performance goals; and

- the need to detail proposed measures that will actively manage dust emissions to achieve acceptable air emission levels and minimise dust nuisance.

These matters are discussed further below in this section of this Evaluation Report.

Section 21.1 of the SREIS emphasises that the proponent has used appropriate methodologies in development of the dust emission inventory, including the National Pollutant Inventory *Emissions Estimation Techniques for Mining, version 2.3* (NPI, 2001) and the USEPA *Compilation of Air Pollutant Emission Factors.* Further I note the proponent's clarification in relation to how 24 hour operation of the RCC batch plant and wind blown dust has been included in the dust emission inventory.

The EIS and SREIS both identify that no publicly available ambient air quality data is available for the Project Area and that the closest monitoring data available is a DERM monitoring station located at Mountain Creek, approximately 50km south east of the Project Area, near Maroochydore. The proponent notes that monitoring data from this location is likely to be conservative, overestimating the ambient air quality concentrations for the Project Area, due to proximity to the Sunshine Motorway.

The modelling results presented in section 10.2.1.5 of the EIS considers the background monitoring data in the assessment of potential Project dust impacts against Project air quality goals, which demonstrates dust concentrations approaching and exceeding the project air quality goals at dust sensitive receivers closest to the Project construction works. The proponent identifies in the EIS that the potential for air quality impacts associated with all construction works associated with the Project must be considered as part of the detailed design of the construction program, including consideration of site specific ambient particulate and meteorological data to be collected by a monitoring station be established at a representative location at least 12 months prior to the commencement of any road relocation or upgrade works associated with the Project and the Principal Construction Works. I require that the monitoring station must be maintained at least until the inundation area first reaches FSL, and data should be made available to agencies on request.

Submissions raised issues relating to detailing proposed measures that will actively manage dust emissions to achieve acceptable air emission levels and minimise dust nuisance, it is noted that section 10.2.7 and table 10.12 of the EIS, and section 21.1.4 and 30.4.12 of the SREIS outline a variety of detailed mitigation measures to be considered as part of the development of a detailed air quality management plan committed to by the proponent. Further, the proponent commits to a proactive dust management strategy through notifying the community of proposed activities, and undertaking an iterative monitoring and adaptive management approach using air quality monitoring, visual inspection and community complaints as key feedback mechanisms.

With the need for specific ERAs to require a detailed air quality assessment and management plan as part of the approval process for each ERA, together with my requirements at condition 17(a)(iii), I am satisfied that the management and monitoring strategies will be sufficient to manage potential air quality impacts.

The then EPA provided me with a range of suggested conditions, relating to ERAs of relevance to the Project, which are designed to minimise the potential for unacceptable impacts. As a result, in addition to the conditions referred to above, I require that the conditions in Schedule A, Appendix 1 be attached to any development approval for a material change of use for an ERA granted for the Project to minimise environmental nuisance at any dust-sensitive place resulting from activities during the construction phase of the Project.

Greenhouse gas emissions

The EIS presents an assessment of the likely greenhouse gas emissions and their significance, reporting the result as tonnes of carbon dioxide equivalent (t $CO_{2\text{-}e}$).

The greenhouse gas calculation for the Project has been carried out in accordance with the guidelines issued by the Australian Greenhouse Office, and is based on:

- construction energy consumption
- indirect emissions and
- land use change.

The greenhouse gas emissions relating to construction energy consumption and indirect emissions applicable to construction of the Project presented in the EIS are summarised in Table 14.

- **Table 14: Estimated construction greenhouse gas emissions**

Construction Related Source	Estimated Greenhouse Gas Emissions (t $CO_{2\text{-}e}$)
Direct emissions during construction (energy consumption)	36,699
Indirect emissions during construction (energy consumption)	9,063
Vegetation clearing and land use change (forest areas)	96,545
Vegetation clearing and land use change (grazing/ pasture)	451,010

The EIS states that when compared to Queensland's annual greenhouse gas emissions of 157 Mt $CO_{2\text{-}e}$ in 2005, the Project's construction energy consumption emissions and indirect emissions represent a small fraction of these emissions (approximately 0.03%).

In relation to emissions as a result of vegetation clearing and land use change which contribute the majority of the Project's emissions, the EIS recognises that these emissions are likely to occur over tens of years following inundation, and that the factors influencing the rate of release and quantity of greenhouse gas emissions from inundation are poorly understood in Australian conditions. Using the AGO National Carbon Accounting Toolbox methodology the EIS identified greenhouse gas emissions of 96,545 tonnes $CO_{2\text{-}e}$ for carbon stored with forest areas, and 451,010 tonnes $CO_{2\text{-}e}$ for carbon stored within grazing and pasture areas. For comparison with the carbon stored within grazing and pasture areas, the EIS presents an estimate to provide a general indication of possible annual rate of emissions calculated using a methodology outlined in the *Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories: Volume 4* (IPCC, 2006). Further, the EIS notes that there is high uncertainty associated with this estimate resulting from the variability in site specific conditions, however using the IPCC default assumptions for a 3,039ha dam within a warm temperate environment annual emissions of approximately 5,770 $CO_{2\text{-}e}$ could occur.

The EIS identifies that the primary emission source of the dam during operations will be electricity use to operate pumps, the fish way, lighting and buildings services. The estimated energy consumption during operation is 1,000 MWh/a, which estimates greenhouse gas emissions of approximately 1,045 t $CO_{2\text{-}e}$, per year which represents a small fraction (approximately 0.007%) of Queensland's annual greenhouse gas emissions. I note that the operational greenhouse gas assessment did not include an assessment of the operational greenhouse gas emissions of either the water treatment plant or the pipeline linking the dam to the SEQ Water Grid's Northern Pipeline Interconnector as these do not form part of the Project and will be assessed separately.

Numerous issues were raised in submissions in relation to greenhouse gas emissions. I have considered each of the submissions and how the SREIS has responded to the issues raised in submissions. Key issues that I considered warranted particular elaboration and/or explanation in my evaluation included:

- concerns the EIS does not adequately discuss greenhouse gas issues, including the emissions resulting from cement manufacturing and aggregate required for concrete
- concerns that the greenhouse calculations do not take into account greenhouse gas emissions (CO_2 and methane) from the dam during operation and
- concerns regarding offsetting greenhouse gas emissions through timber plantations.

These matters are discussed further below in this section of this Evaluation Report.

In section 21.2.1 of the SREIS the proponent recognises that although the emissions associated with cement manufacture are considered by the Department of Climate Change to be Scope 3 emissions (i.e. indirect emissions which are the consequence of the organisations actions but are not from a source owned or controlled by that organisation), that without the Project the concrete would not be required and the greenhouse gases associated with production of the cement would not occur. The SREIS identifies that, dependent on the type of dam wall construction, there could be up to an additional 61,463 t $CO_{2\text{-}e}$ emitted as a result of the Project due to the manufacture of cement. This is additional to the amounts specified in the EIS and outlined in Table 14.

The proponent goes further, in the SREIS, to estimate a conservative scenario (100% imported to site from Meadvale and/or Moy Pocket quarries) of emissions associated with quarrying the aggregate required to mix with the cement to produce concrete, which is estimated to produce an additional 6,540 t $CO_{2\text{-}e}$.

In relation to the issue of greenhouse gas emissions from the dam itself during operations relating to land use and land use change, I note the *'Brief Literature Review on Greenhouse Gas Emissions from Reservoirs'* by Dr Tim Blumfield presented in Appendix F of the SREIS, which identifies uncertainty relating to emissions from reservoirs in sub-tropical environments, and concludes that "significantly more research needs to be undertaken on a global scale to better understand the role of such impoundments, as carbon sinks as well as emitters, in the overall carbon cycle." In response to the findings outlined by Dr Blumfield, I have included conditions at Condition 18 (c, d and e), Schedule C, Appendix 1, requiring the proponent to prepare and implement a research plan with a minimum contribution of $250,000, for my approval, to advance research into the issue of greenhouse gas emissions and carbon sink capacity and options for dams. The research plan should be targeted at further understanding the role of dams as carbon sinks as well as emitters.

Further I note that the proponent identifies that mitigation measures can be developed through adaptive management to minimise greenhouse gas generation, such as catchment management improvements to reduce the mass of organic material entering the storage.

In July 2009 the proponent provided me with a document titled '*Review of Greenhouse Gas Emissions and Proposed Offset Requirements – Traveston Crossing Dam*' (8 July 2009). The document provides a summary of the Greenhouse Gas Emissions associated with the Project and presents an alternative approach to calculation of greenhouse gas emissions associated with Land Use, Land Use Change and Forestry, due to a range of issues identified by the proponent, including:

- Carbon calculations of onsite biomass and soil carbon were based on relatively undisturbed site history. Significant previous land use practices within the Project Area will have led to serious degradation of actual carbon levels

- The controlling factors influencing the rate of release and quantity of greenhouse gas emissions from inundation are poorly understood, particularly in Australian conditions

- The post-flooding emission calculations do not take into account the background (pre-flooding) emissions which must be considered the true baseline for the Project

- All emissions reporting methodologies recognise a high degree of uncertainty associated with default emission estimates and

- The IPCC Good Practice guidance for Land Use, Land Use Change and Forestry (LULUCF) (IPCC 2006) identifies the uncertainty of emissions calculations is greater then 50% where national emissions database on dams are not available.

Given the limitations identified with the National Carbon Accounting System (NCAT) (formerly AGO National Carbon Accounting Toolbox), the proponent presents a revised greenhouse gas assessment relating to LULUCF in accordance with the accepted IPCC methodology, which has been reviewed by Professor Peter Grace, Director – Institute for Sustainable Resources, Queensland University of Technology. The revised greenhouse gas assessment relating to LULUCF is based on land use conversions related to flooding (such as dams), only addressing the carbon stock change associated with the loss of living biomass. I note that IPCC advises that there are large temporal and spatial variability relating to methane emissions for land conversions to wetlands, which has precluded development of default emission factors.

The revised greenhouse gas assessment identifies total emissions of 173,488 tonnes $CO_{2\text{-}e}$, using a Tier 1 calculation which is the fallback for all countries where specific emission data is unavailable and assumes that 50% of the native timbers cleared would be used for beneficial reuse and hence the carbon would be locked up and not contribute to greenhouse gas emissions.

Accordingly, the Project's estimated construction related greenhouse gas emissions is summarised in Table 15:

- **Table 15: Estimated Project greenhouse gas emissions**

Emission Source	Estimated Greenhouse Gas Emissions (t $CO_{2\text{-}e}$)
Direct emissions during construction (energy consumption)	36,699
Indirect emissions during construction (energy consumption)	9,063
Emissions resulting from cement manufacture	61,463
Emissions resulting from quarrying of aggregate required to produce concrete	6,540
LULUC – Forestry and Pasture	173,488
TOTAL	287,253

I note the written review provided by Professor Peter Grace, who states:

> *"In the absence of the collection of site specific data on greenhouse gas emissions, the use of a recognised framework, such as the methodology outlined for the National*

Greenhouse Inventory, or IPCC Guidelines is essential for estimating emissions for any project.
Based on my detailed examination of the review document and the QWI methodology in the absence of hard data, I support the overall conclusions that the greenhouse gas emissions attributable to the construction of the TCD project are estimated to be 287,000 tonne $CO_{2\text{-e}}$."

I have considered the information presented by the proponent, and accept the methodology outlined as providing a robust assessment of the expected greenhouse gas emissions attributable to the Project.

I note that the proponent aims to achieve greenhouse neutrality for the construction phase of the Project through environmental revegetation and commercial native hardwood plantations. For the purposes of clarity, the condition that I have imposed at Condition 18, Schedule C, Appendix 1, obliges the proponent to, at a minimum, offset 287,253 t $CO_{2\text{-e}}$ (associated with construction) as well as operational emissions over a 100 year operational life, which are to be quantified by an operation greenhouse gas assessment, based on the detailed design of the Project. The offset should be achieved within 25 years of commencement of operation of the dam, and plantings must be retained for a minimum of 100 years in line with Kyoto based accounting methods and the NSW Greenhouse Abatement Scheme. Should the proponent choose to manage carbon offset plantations for commercial purposes, then the management of the plantations should ensure that at any point in time the minimum offset of 287,253 t $CO_{2\text{-e}}$ plus the quantified operational emissions are maintained within the plantation. I note that through the application of offset harvest and replanting, and rotational harvesting principles, as outlined in the *'Traveston Crossing Dam: Proposed Forestry Development, Timber Queensland Report'* presented at Appendix C18 of the SREIS, that maintaining the offset in this fashion is achievable.

Several issues were raised in submissions on the EIS relating to carbon offsetting, principally in relation to timelessness and permanence. Timelessness relates to the issue of the greenhouse gas emissions occurring during the construction period, and the sequestration of carbon in the plantation offset occurring over many years. Permanence relates to the issue of the potential release of CO2 from the plantation offset when trees are harvested, burnt or are decomposing. The SREIS identifies that under Kyoto based accounting principles the carbon stored in a tree is considered to be released to the atmosphere when harvested. However, management practices such as staggering establishment and harvest cycles, can be implemented to ensure that a pool of carbon is maintained over time. I am satisfied that these issues have been adequately addressed by the proponent in the SREIS and the greenhouse offset proposal as clarified by a condition that I discuss below.

I further note that the proponent has recommended the following approaches which have been included in the condition I have imposed at Condition 18, Schedule C, Appendix 1:

- the required number of trees that will be planted progressively from the commencement of the Project and prior to Completion of Construction and

- the planting will be actively maintained for a period of five years to ensure their viability and with adequate viable stock to ensure the equivalent, within 12 years, of a minimum of 300 trees/ha for commercial plantations, or between 300-500 trees/ha for environmental planting purposes.

I have set further requirements within Condition 18, Schedule C, Appendix 1, as discussed in section 3.1, to provide further details of the timber plantation proposal to ensure that the proposal is adequately defined and any potential impacts have been addressed by mitigations.

I consider that the mitigation measures proposed by the proponent in section 10.2.7 of the EIS, the SREIS and Project EMP, combined with the condition I have imposed at Condition 18, Schedule C, Appendix 1, will ensure a suitable reduction in the potential generation of greenhouse gases as a result of the Project.

3.6. Noise and vibration

Numerous issues were raised in relation to noise and vibration impacts. I have considered each of the submissions and how the SREIS has responded to the issues raised in submissions. Key issues that I considered warranted particular elaboration and/or explanation in my evaluation included:

- appropriateness of noise goals identified in the EIS
- potential impacts of blasting at potential quarry sites associated with the Project and
- noise emissions exceeding the Project noise goals at properties within close proximity to the dam wall construction site.

These matters are discussed further below in this section of this Evaluation Report.

In Chapter 11 of the EIS, the proponent indicates that the existing noise amenity, as outlined by background monitoring, in the Project Area is representative of a typical rural and rural residential environment. Noise sources are from the predominately agricultural land uses, as well Moy Pocket Quarry, a small quarry operating in the vicinity of the dam wall site and a number of commercial concerns in the Mary Valley region, including a number of sawmills, an abattoir , food factories and a lime works. Use of local and State controlled roads throughout the Mary Valley also contributes to the existing noise environment, and includes noise from heavy vehicles transporting quarry and rural products throughout the region.

The EIS confirms that the main potential for impact on noise amenity will result from Project construction activities, particularly dam and road construction works, blasting, quarrying, vegetation removal within the inundation area, haulage of construction material, and traffic on realigned roads.

The key noise sensitive places identified by the proponent in Chapter 11 and Appendix F-7 of the EIS, included:

- rural residential dwellings and work places near the dam wall site, inundation area (vegetation clearing) and local haul routes between Meadvale Quarry or Moy Pocket Quarry and the dam wall site, along Gympie-Brooloo Road (Mary Valley Road) and Traveston Crossing Road
- rural dwellings and work places adjacent to the realignment of sections of local roads, telecommunications and electricity distribution infrastructure and
- Federal State School.

The proponent has established target goals for noise, vibration and blasting levels to guide construction and operational planning and management for the Project. I note the concerns raised in submissions on the EIS relating to the appropriateness of the construction noise goals for the Project. I note that following consultation between the proponent, the then EPA and DIP, and the proponent's consideration of the *New South Wales Department of Environment and Climate Change (DECC) Noise Control Guideline – Construction Site Noise*, that the proponent has set revised construction noise goals for the Project in section 22.1.1 of the SREIS.

While the proponent has established target goals for noise and vibration levels to guide construction planning and management, I have adopted and, in some cases, enhanced in accordance with advisory agency advice construction noise criteria for the Project, as per the conditions set down in Condition 19, Schedule C, Appendix 1,.

Dam construction activities

The noise modelling in the EIS and SREIS indicates that, during a range of scenario's modelled for construction activities at the dam wall site for the proposed RCC construction option that the Project noise goals are exceeded at a number of potentially noise sensitive receivers. The proponent notes that many of the potentially noise sensitive receivers located near the dam wall site have been purchased by the proponent and the proponent commits to ensuring there will be no tenants or lessees residing in these properties during construction.

It is noted however, that modelling indicates that the noise sensitive receiver located at Lot 2 on Registered Plan 172026 to the north west of the site, which is outside the Project's land purchase boundary, will experience elevated noise levels for all scenarios modelled in the EIS and SREIS.

I note the concerns raised in submissions on the EIS relating to noise emissions exceeding the Project criteria at properties within close proximity to the dam wall construction site, however I further note Figure 22-1 in the SREIS which highlights the land purchase status of properties in this area, and QWI's commitment to ensuring there will be no tenants or lessees residing in these properties during construction. However, I am concerned that the occupants of the premises at Lot 2 on Registered Plan 172026 may be subject of unacceptable noise impacts, which may result in a significant reduction in quality of life for periods during the construction phase.

I have imposed requirements in Condition 13(e), Schedule C, Appendix 1, for the proponent to consult with the occupants of premises at this receptor to develop sufficient mitigation measures to allow the occupants to maintain an acceptable quality of life. I require the proponent to report to me the outcomes of this consultation including details of discussion about mitigation measures targeted at this receptor prior to commencement of Principal Construction Works. Proposed mitigation measures include unattended ongoing environmental noise monitoring to be maintained at the receptor throughout construction, should physical mitigation measures be used, and a specific corrective action program.

I recognise that the proponent may achieve an acceptable environmental outcome, via a range of mitigation measures, including managerial methods (e.g. purchase of property or relocation of occupants) and physical methods (e.g. noise barriers or architectural acoustic treatments to the premises). I am satisfied that through the implementation of mitigation measures outlined in the EIS SREIS (particularly section 30.4.13) that potential impacts can be managed to achieve an acceptable environmental outcome.

Further, it is recognised that given the rural nature (with relatively low existing background levels) and the subjective nature of noise nuisance, that some receivers may experience impacts even if compliance with the Project criteria are achieved, therefore it is important to implement noise management measures as presented in the EIS and the SREIS (particularly section 30.4.13).

I further note that the proponent has committed to further investigation into the potential impacts and effective management controls would be undertaken prior to the commencement of construction and a detailed construction noise management plan being prepared. The construction noise management plan, would include a range of noise management controls, such as those outlined in section 11.2.10.1 of the EIS and Chapter 30 of the SREIS, to reduce the noise levels to minimise noise impacts from the Project.

New local road construction noise impact

The EIS presents a conceptual description of likely construction activities, as detailed construction information is not yet available, as the basis for a simplified qualitative assessment of potential impacts on nearby receivers. The key activities identified with the potential to generate significant noise impact are vibratory and hammer pile driving, rock breaking, and other construction equipment, such as graders, compactors and rollers.

Based on sound power level data, the EIS identifies the approximate sound pressure levels at a range of distances from construction noise source in Table 11.20 of the EIS. The locations of sensitive receivers adjacent the proposed road realignment and upgrading works identified in Figure 11.1 and Appendix F-7 of the EIS demonstrate that without appropriate mitigation measures, noise impacts can be expected at a range of sensitive receivers.

I note that the proponent has committed to further investigation into the potential impacts and effective management controls to be undertaken prior to the commencement of construction and a detailed construction noise management plan being prepared. The construction noise management plan must include noise management controls, such as those outlined in section 11.2.10.1 of the EIS and Chapter 30 of the SREIS, to reduce the noise levels and minimise noise impacts from the Project.

Vegetation clearing

The EIS identifies that in excess of 480 hectares of vegetation will be cleared within the water storage area for the Project, over a period of approximately 18 months. Noise sources during these activities are expected to include the use of saws, mulchers, excavators and trucks. However, impacts on sensitive receivers are expected to be temporary as the activities move around the proposed inundation area.

I note that the proponent has committed to further investigation into the potential impacts and effective management controls prior to the commencement of construction and a detailed construction noise management plan must be prepared. The construction noise management plan must include noise management controls, such as those outlined in section 11.2.10.1 of the EIS and Chapter 30 of the SREIS, to reduce the noise levels to minimise noise impacts from the Project.

Vibration

The EIS identifies the importance of buffer distances of between 20 m and 60 m, depending on specific construction activities involved, between the location of all sensitive receptors and the dam and road construction activities. Provided the buffer distances are maintained, there are not expected to be any human comfort impacts or potential damage to buildings or structures from vibration caused by construction equipment at the dam construction site, haul roads and the dam access road. I have set requirements to address potential vibration impacts at Condition 19, Schedule C, Appendix 1.

Blasting

The EIS finds that during blasting the air blast overpressure will be the determining factor in achieving the Project's air blast overpressure and vibration criteria outlined in the *EPA Guideline Noise and Vibration from Blasting (EPA 2006)*. Further the EIS finds that providing blast sizes are carefully controlled, the potential impact of blasting at the excavation site near the dam wall, will be minimal. For a charge mass per delay of 5 kg or less, criteria are expected to be met within 410 m of the blast site, based on a conservative assessment not including topographical shielding or meteorological conditions.

I note issues raised in submissions regarding the potential impacts of blasting at potential quarry sites associated with the Project.

Initial modelling in the SREIS shows that the air blast overpressure criteria can be met at sensitive receivers, resulting from blasting associated with the proposed quarrying on the eastern side of the dam wall construction site.

I further note that the EIS and section 30.4.13 identify that a detailed blasting management plan will need to be developed by the blasting contractor to ensure compliance with the Project's criteria. If compliance with the Project's criteria cannot be achieved or is marginal, I recommend that the proponent liaise with affected sensitive receptors to determine if a short-term exceedance from blast is preferable to continuous noise over an extended period from mechanical excavation options. I have imposed construction blasting criteria in Condition 19, Schedule C, Appendix 1.

Dam operational activities

The operational noise sources associated with the Project include the dam gates, fishway, spillway, dispersion valves, generators and pumps. While the EIS does not assess the noise impacts in detail, due to the limited design information available, the noise associated with these sources is expected to be at moderately low levels, and it is not expected to have impacts on sensitive receptors. The EIS notes that noise from generators associated with the operation of dam administration buildings, gates and the fishway can be controlled using acoustically designed plant rooms and strategically placing barriers to ensure operational noise level goals are met (EPP Noise).

The EIS further notes that a water treatment plant and pump station are likely to be required to treat and transport the water, and identifies that the current ambient noise environment at each of the likely sites is influenced by road traffic noise from the Bruce Highway. It is recognised that the operation of pump stations and water treatment plants with rural areas has the potential to result in noise impacts at nearby sensitive receivers, if adequate acoustic controls are not incorporated into the design of the plant. I note that approval for the water treatment plant and pump station are not being sought as part of this EIS, and that the noise issues associated with the water treatment plant and pump station must be adequately assessed and managed through the approval and design processes for this infrastructure.

In relation to recreational activities, the EIS notes that activities such as vehicular access, motorised boats, motorbike riding areas, mountain biking, horse riding and commercial activities (such as cafes) have the potential to generate noise impacts. The EIS notes that the types of recreational uses are yet to be determined and that these will be considered by QWI, GRC and the relevant State government departments if the project is approved. The recreational uses would be selected subject to acceptable environmental and social outcomes, and management procedures controlling their use would be included as part of the operation EMP to mitigate potential noise impacts.

I note that Condition 17, Schedule C, Appendix 1 requires the proponent to adhere performance criteria, mitigation commitments and other items within section 30.5 of the SREIS. This includes requirements for the development of operational EMP sub-plans relating to potential noise impacts during the operational phase.

New local road operational noise impact

The EIS undertook noise modelling for the relocated roads, including the relocated Bruce Highway. The Bruce Highway is being realigned as a separate project by the Queensland Department of Transport and Main Roads.

The EIS presents an assessment of the operational noise impacts associated with the Kenilworth-Skyring Road and the Gympie-Brooloo Road (Mary Valley Road), as other road upgrades within the study area are expected to have road traffic flows much less than these roads.

The noise assessment based on traffic flow estimates for 2021 demonstrate that compliance with operational road noise criteria of LA10(1 hour) 63 dB(A) will be achieved at noise sensitive receivers located more than 10 m from Kenilworth-Skyring Road and more than 25 m from the Gympie-Brooloo Road. The EIS further notes that current spatial data indicates several dwellings along Gympie-Brooloo Road and Kenilworth-Skyring Road are situated within these setbacks, however, the EIS notes that further assessment will be required during detailed design.

I further note that the proponent has committed to further investigation during detailed design into the potential impacts and effective management controls associated with operational impacts of the new and upgraded local roads for inclusion in a detailed construction noise management plan. The construction noise management plan, would include a range of noise management controls, such as those outlined in section 11.2.10.1 of the EIS and Chapter 30 of the SREIS, to reduce the noise levels to minimise noise impacts from the Project.

Dam access road

The key potential noise impact identified in the SREIS relating to the realigned dam access road is the noise associated with the construction of the road and operation of the road during dam construction works. The construction noise modelling completed in the SREIS demonstrates compliance with construction noise criteria at all noise sensitive locations

Traffic noise levels assessed for the operational phase of the road, during dam construction, are anticipated to increase as a result of the dam access road, however it is expected that noise levels will remain within the *Main Road's Code of Practice* of LA10(18hr) 63 dB(A) at all noise sensitive locations. The SREIS recommends that operational noise monitoring is carried out at Locations 1, 2 and 3 (as identified in Figure 31-14 of the SREIS), to confirm the extent of predicted impacts, and should the results of monitoring indicate exceedance of the Project noise criteria, then additional mitigation measures must be implemented.

At Condition 19 Schedule C, Appendix 1, I have required the proponent to develop specific measures for mitigation of predicted impacts on sensitive receptors where predictive modelling indicates exceedance of the Project noise and vibration criteria. To further ensure clarity, I have included a further condition at Condition 19, Schedule C, Appendix 1, requiring the proponent to conduct monitoring at Locations 1, 2 and 3 (as identified in Figure 31-14 of the SREIS), to confirm the extent of predicted impacts, and should the results of monitoring indicate exceedance of the project noise goals, then additional mitigation measures must be implemented.

I am satisfied that noise mitigation measures outlined in section 31.15 and section 30.4.6 of the SREIS, combined with the conditions I have imposed at Condition 19, Schedule C, Appendix 1, will satisfactorily minimise the potential noise impacts associated with the construction and operation of the dam access road.

Conclusion

I have considered each of the submissions and how the SREIS has responded to the noise and vibration issues raised in submissions. Three key issues warranted particular elaboration and/or explanation in my evaluation.

I also note the proponent's commitment to develop a robust noise management strategy to ensure that the affected community is adequately consulted regarding developments within the project and to gauge and address concerns and feedback associated with all aspects of construction activity. Minimum requirements regarding consultation relating to noise, vibration and blasting impacts are included with the condition at Condition 19, Schedule C, Appendix 1, however, it is my recommendation that the proponent develop a strategy to engage more broadly with the community relating to noise, vibration and blasting issues.

I have imposed a condition at Condition 19, Appendix 1, Schedule C requiring the proponent to implement measures that will avoid, or mitigate and manage the potential adverse environmental impacts of noise and vibration arising from construction activities, including:

- construction activities associated with the dam wall construction site
- construction noise impacts of the dam access road; and of the realigned and upgraded local roads
- vegetation clearing activities.

While noise and vibration will not be able to be eliminated, given the strategies provided in the EIS, SREIS and processes within the EMP regarding noise and vibration mitigation, together with appropriate conditioning described within this report, I am confident that predicted effects can be suitably mitigated.

3.7. Waste management

Several issues were raised in relation to waste impacts. I have considered each of the submissions and how the SREIS has responded to the issues raised in submissions. Key issues that I considered warranted particular elaboration and/or explanation in my evaluation included:

- availability of land fill

- recycling of millable timber
- burning of vegetative waste

These matters are discussed further below in this section of this Coordinator-General's Report.

Spoil volumes will vary depending on the chosen design, however under all design options the spoil can be reused within the Project area.

The decommissioning of existing buildings and structures will generate waste within the inundation area. Some of these buildings and structures may be able to be removed intact and relocated to other areas for re-use. If this is not feasible, buildings and structures are to be dismantled, removed from site and recycled where possible.

A summary of the major waste stream generators during the mobilisation and road construction phase includes:

- construction material wastes (timber framing, concrete and its components, rock, gravel, scrap metals, cable, wire, insulation, plastics and packaging and bitumen)
- vegetation and soils as a result of clearing and excavation (spoil)
- regulated waste (hydrocarbon waste, detergents, solvents, batteries and tyres)
- domestic and other general waste (food scraps, paper, rags, cans and glass)
- drums and containers from the supply of chemicals and oils
- recyclable waste (aluminium cans, glass, cardboard, plastics and paper); and
- sewage effluent and sludge.

During construction, the development of a construction camp, a concrete batching plant and associated vehicle wash-down activity will contribute additional wastewater to the Project.

The operational phase of the dam will create only minor waste streams such as wastewater at on-site offices and accommodation, general office waste and woody debris within the impoundment itself.

Submissions in relation to waste generation and management included concern as to:

- the capacity of available landfill in proximity to the project
- the applicability of burning of cleared vegetation under Cooloola Shire Council development applications
- the need to clear vegetation from the inundation area if the area is to be safely used for future recreational use (e.g. boating, water sports etc).

Due to concerns that there is limited landfill space available proximate to the project area, I have conditioned at Condition 27, Schedule C, Appendix 1 that all inert soil, rock and concrete material from excavation and demolition is to be reused:

- in the dam embankments; or
- in areas between islands that are planned to be joined through infilling; or
- as fill in the former river channel below and downstream of the dam wall; or

- in recreation areas where fill is required or where mounding will add to visual appeal.

For all other waste, off-site disposal to landfill is to remain a last resort only, as per the waste hierarchy.

The proponent has committed, and I have conditioned at Schedule A, Appendix 1 that all commercially 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. The remaining suitable material will be mulched for use in rehabilitation and landscaping.

Prior to vegetation clearing, a weed assessment must be undertaken. The outcome of the weed assessment is to ensure waste disposal actions do not contribute to the further spread of declared weeds' genetic material.

I have conditioned, in Condition 27, Schedule C, Appendix 1, the requirement to conduct weed assessment prior to vegetation clearing and the implementation of practices to ensure weed material does not contaminate areas via the disposal process.

The proponent may maintain burning of cleared vegetative waste as a disposal option (as per other infrastructure projects) only where non-burning options are cost prohibitive or otherwise impracticable (e.g. disposing of contaminated weed material) and where this is consistent with statutory approvals.

I have conditioned, in Condition 27, Schedule C, Appendix 1, the adherence to guidelines for burning consistent with best practice. Further, I consider that the making of a transparent decision making process in accordance with the waste management hierarchy will ensure optimised beneficial reuse of vegetative waste. noting that condition 27, (d) requires the proponent may burn vegetative waste only as a last resort having regard to factors such as cost, potential beneficial reuses and vegetation types. Burning of vegetative waste may only occur in favourable weather conditions. Vegetative Waste Instructions must be issued to construction contractors and workers undertaking activities relating to vegetation within the Project Area to ensure that construction method documentation (e.g. EMP) includes transparent, auditable and enforceable decision making procedures for disposal of vegetative waste. These Vegetative Waste Instructions must:

- be developed in consultation with the DERM, GRC and SCRC
- address specific types and/or locations of vegetative waste
- be consistent with the Waste Management Hierarchy (see 27(a)). In this regard, offsite burning may only occur for purposes of energy recovery and where energy recovered is greater than energy expended in transporting the waste.

Vegetation clearing within the impoundment area is to be consistent with the proposed recreational use of the dam and be consistent with surrounding land use and habitat protection requirements, as will be shown on the Land Use Master Plan on Condition 2, Schedule C, Appendix 1.

During the dam construction phase wastewater from the vehicle wash-down activity is to be treated and reused on site as per Condition 27, Schedule C, Appendix 1. The concrete batching plant is an ERA and effluent release will be subject to development approval requirements.

The construction camp will contain a sewage treatment plant designed and operated to treat sewage effluent to Class A+ quality specifications. Treated sewage effluent from the sewage treatment plant may be discharged to land provided that it complies with the criteria specified in Schedule A, E2, Table 3 and the conditions of the development approval or alternatively wastewater from the construction camp facilities is to be collected in holding tanks and transported to a local government wastewater treatment plant by a licensed carrier as per Schedule A, Appendix 1 conditions.

The proponent has committed in the EIS and the Waste Management EMP of the SREIS to implementing waste management practices for the Project consistent with the waste management hierarchy outlined in the EPP Waste.

The operational phase of the dam will create only minor waste streams which can be readily managed by the proponent's proposed management and mitigation measures.

Subject to the conditions above, I consider that the proponent has demonstrated suitable and workable strategies within the EIS, SREIS and associated draft EMP to effectively control waste management matters.

3.8. Transport and access arrangements

Numerous issues were raised in relation to traffic and road network impacts. I have considered each of the submissions and how the SREIS has responded to the issues raised in submissions. Key issues that I considered warranted particular elaboration and/or explanation in my evaluation included:

- opportunity for stakeholder participation in the development of the redesigned road network, traffic management and emergency response plans
- lack of geotechnical investigations for road and bridge construction
- road safety for non project related traffic and school buses caused by increased construction traffic and oversized or higher mass transport on local roads
- satisfactory temporary and permanent property access due to road realignments and closures
- impact of road closures on travel time and connectivity of the road network
- identification of road infrastructure proposed for decommissioning
- design and maintenance responsibility of the eastern dam access road.

These matters are discussed further below in this section of this Coordinator-General's Report.

Existing road network

The road network in the Project Area includes roads controlled by QTMR (State controlled roads) and local roads controlled by the GRC and the SCRC. Regional and district roads connecting the various townships with each other and the Bruce Highway are described in Table 13.1 of the EIS. There are also many local roads which provide access to local properties as shown in Figure 13-1 of the EIS.

The Bruce Highway is a road of national significance running north-south to the east of the dam wall site. In the vicinity of the Project area, it is a two lane 100 km/h road which carried about 14 000 vehicles per day (vpd) in 2004 with 16% of these being heavy commercial vehicles.

The Gympie – Brooloo Road (also known as the Mary Valley Highway) is a regionally significant road which runs north- south to the west of the dam wall site and reservoir. It is a two lane road with varying speed limits up to 100km/h. In 2004 it carried about 1500 vpd with 15% heavy commercial vehicles.

These two roads are connected by the two-lane, State-controlled Tuchekoi Road which runs east-west through rolling terrain to the south of the inundation area. It carried some 960 vpd in 2004 with 10% heavy vehicles. To the north of the dam wall, the GRC controlled Traveston Crossing/Meddleton Road provides a second east-west linkage between the Highway and the Gympie – Brooloo Road carrying 570 vpd in 2004.

Other local government controlled roads in the vicinity of the Project include Meddleton Road, Dobson Road, Mountain View Road, Kandanga Connection Road, Ironstone Creek Road, Chinamans Creek Road, Walker Road, Whittle Road, Peacons Pocket Road, Bergins Pocket Road, Chippindale Roar, Kress Road, Weber Road, Carlson Road, Juster Road, Hasthorpe Road, Knobby Glen Road, Riverdale Road and Goomong Road.

Local roads which may be used as haulage routes for Project traffic include Moy Pocket Road south of the Project Area and Woondum Road and Traveston Road to the north. I consider that the current condition of the sections of Woondum Road and Traveston Road near the Bruce Highway, and the section of Moy Pocket Road from the Moy Pocket Road Quarry to the Kenilworth – Brooloo Road are not sufficient to accommodate substantive increases in heavy vehicle numbers.

There is currently no public road access to the proposed dam wall site and a dam access road will be constructed as part of the Project. The site is close to Gympie – Brooloo Road and current access is via a four wheel drive standard unformed track through property owned by the proponent.

Proposed changes to road network

Sections of 16 roads and 15 intersections will be inundated by the Project. The location, length, speed and ownership of these roads and the location and impact on the intersections are detailed in Figure 13.2, Table 13.2 and 13.3 of the EIS and Table 24-1 and Figure 24-1 of the SREIS. Inundated or closed road sections and bridges are to be decommissioned, removed and rehabilitated as detailed in Table 24-2 of the SREIS. I require, at Condition 20(c), Schedule C, Appendix 1, that all redundant pavement material is to be removed (i.e. dug up) and disposed of in an acceptable manner. Redundant road alignments are to be rehabilitated to remnant vegetation or recreational area access tracks or productive agricultural land.

The proponent has committed to, and must, provide suitable alternate routes or modification to roads, bridges and intersections to maintain a functional road network. New roads, road upgrades and relocations (approximately 35 km), nine new bridges (seven replacing existing bridges or culverts) and individual property access are to be constructed by the proponent to ensure local and regional accessibility, links to schools, towns and neighbourhoods. Section 4.8.1 and Table 13.2 of the EIS describes the extent of works to be implemented by the proponent for each road segment. I also require, at Condition 20(e)(vii), Schedule C, Appendix 1, sufficient modifications to roads servicing the Kandanga Cemetery to maintain or enhance existing access standards, particularly from a flood immunity perspective.

The Project roadworks are planned to be constructed over a 15 month period. State controlled roads with proposed changes include the Gympie-Brooloo Road, Kenilworth –Skyring Creek Road and Tuchekoi Road. I note that the proponent and DTMR are developing a formal agreement over land tenure arrangements for state controlled roads. Road works are proposed on many council roads including Meddleton Road, Knobby Glen Road, Kandanga Connection Road, Ironstone Creek Road, Chinamans Creek Road, Walker Road, Whittle Road connection, Peacon Pocket Road, Weber Road, Carlson Road and Juster Road. A new local-controlled road is to be built to replace the inundated and closed Hasthorpe Road and Goomong Road. New local roads will also be built to maintain access to properties along the sections of the Kenilworth Skyring Creek Road that will not be inundated.

Eastern Dam Access Road

The dam access road will involve the construction of approximately 3km of new two lane, two way bitumen road that will intersect with the Traveston Road approximately 400 m east of the Bruce Highway, a six span overpass 150 m in length, over the existing Bruce Highway, and 1km of road from the overpass to the proposed dam wall. Other elements to be installed include street lighting, line marking, signage, roadside furniture, drainage and landscaping.

At the time of the EIS, the proponent was only proposing to build 1km of road from the Bruce Highway to the proposed dam wall. Submissions on the EIS raised issues of the safety of the eastern access road and the maintenance of the road following construction. I note that functional and safety issues of the dam access road are addressed by the proponent in traffic investigations undertaken for the EIS and SREIS, especially with regard to vehicles and haulage trucks crossing the Bruce Highway to enter the dam site. The proponent presented a re-configured dam access road and a related assessment in section 31 of the SREIS. The majority of the footprint of the alternate route is within the Project Area as shown in Figure 31-1 of the SREIS.

The reconfigured access road presented in the SREIS removes all right hand turns in and out of the access road directly onto the Bruce Highway. I consider that the reconfigured access road presented in section 31 of the SREIS suitably addresses issues that were raised in submissions about road safety and functionality of proposed road works, including the dam access. In this regard, I note that DTMR has advised that the proponent has demonstrated that impacts on the state-controlled-road network have been sufficiently mitigated.

In regard to maintenance issues, the SREIS advises that the access road is primarily to be used as a temporary road to enable Project construction traffic accessing the eastern side of the construction site. The proponent has indicated that the road may continue to provide access to the dam during operational phase for maintenance vehicles and possibly recreational access depending on the location of recreational areas. I note there is also proposed road access from the west of the main dam off the Brooloo-Gympie Road. The final operational phase access arrangements, particularly off the realigned Bruce Highway, are dependent on DTMR's ongoing design requirements.

The proponent indicates that, after the completion of construction of the Project, the ownership of one or both of these access roads may be transferred to either DTMR or the GRC. DTMR has confirmed that the access roads will not serve a strategic link function and therefore the roads will not be declared as a state-controlled roads. Similarly, if the GRC sees no value in taking control of the road, the proponent will be obliged to own and maintain the roads indefinitely. As part of its obligations, the proponent must design and construct site access roads to a standard commensurate with their intended uses, being construction access, operational access and potentially public recreational access. These matters are addressed by Condition 20(e), Schedule C, Appendix 1.

Impacts of road closures and construction traffic

Road construction and closure impacts

The road closure impacts of the Project include altered traffic patterns and or travel delays during both the construction of the Project and the operation phase due to road closure or road redundancy caused by isolation after inundation. State controlled roads directly affected by the Project due to inundation by the reservoir include the Bruce Highway (although under a separate project this road is to be realigned), Tuckekoi Road, Gympie - Brooloo Road (also known as the Mary Valley Road) and Kenilworth – Skyring Creek Road. Twelve local roads are impacted by inundation.

In Table 30-5 of the SREIS, the proponent has committed to constructing road, access and intersection realignments and/or relocations and upgrades as per those described in the EIS. The roads will have at least the same, if not improved, flood immunity as presently provided. The proponent has also committed to liaising with the relevant local councils or State government agency prior to the design and construction of the transport infrastructure. I have also conditioned, at Condition 20(i), Schedule C, Appendix 1, mandatory consultation with local businesses, industry groups, community groups and primary producers to specifically address road network design, connectivity and traffic issues for consideration during design of the future road network.

Five school bus routes will be redundant or deviated due to closure/decommissioning of parts of the Bruce Highway (Route P1531), Carlson Road (Bus Route S314), Gympie - Brooloo Road (Route S66 and P290), Goomong Road (Route 290) and Kenilworth – Skyring Creek Road (Route S489) as detailed in section 13.2.2.5 of the EIS and Figure 24-2 of the SREIS. I note that the proponent has suggested route deviations using new or existing road segments to access properties which are not inundated and may require bus services post inundation. The route deviations may result in increased travel time. As per my Condition 20(h), Schedule C, Appendix 1, the proponent is to continue to liaise with DTMR and DETA regarding issues for their school bus routes in the Mary Valley area during the construction period.

The revised road network post inundation will have the marginal impact of an additional two minutes on travel times between some centres in the Mary Valley. Changes to the Kenilworth – Skyring Road will result in increased travel times and community dislocation for residents of the Carters Ridge area who travel north to Gympie. The response times of police, emergency and fire brigade services to some centres will be increase by up to an additional two minutes. However, reduced travel times will occur between the townships on the western side of the reservoir as a result of the upgraded and relocated Gympie – Brooloo Road.

The reconfigured road network is being designed to provide safe access to all properties affected by the Project. There will be significant improvements with road upgrades, pedestrian and cycle improvements and bus stop enhancements. In particular, the proponent has committed to funding $46 000 towards bus pull in bays with the DTMR and local community groups to enhance safety of school children and motorists on the Gympie – Brooloo Road.

Construction traffic impacts (materials haulage and workforce)

State controlled roads impacted by increased construction traffic are the Bruce Highway, Kenilworth – Skyring Road, Tuchekoi Road, Gympie – Brooloo Road, Kenilworth - Brooloo Road and Yabba Creek Road. Local council roads impacted by increase in construction traffic include Woondum Road, Traveston Road, Traveston Crossing Road, Kandanga- Amamoor Road, Kandanga – Imbil Road and Moy Pocket Road.

The construction traffic impacts of the Project include increased light and heavy vehicle movements to the dam construction sites due to materials haulage, oversized loads delivering indivisible construction equipment, workforce traffic to and from site and the removal of waste and excavated material. This could result in conflicts between construction traffic and existing road users, pedestrians and cyclists, altered traffic patterns and or travel delays and safety issues for the current road users during the construction phase. Noise, dust and vibration caused by construction traffic may also impact on the community, especially those residences within 20 m of the realigned or new roads. These issues are discussed in sections 3.5 and 3.6 of this report while visual amenity is discussed in section 3.1. At Condition 20(ij), Schedule C, Appendix 1, I have conditioned landholder consultation during the design phase of the new road routes.

The major impact of traffic generation will be the additional heavy vehicle movements associated with transport of construction materials and the increase in light vehicle movements of the workforce over the 36 month period of construction of the Project.

I note that the proponent will consider specific safety and amenity issues on particular roads in the Project area during the detailed design stage of the Project as discussed in section 13 of the EIS and Table 30.4.16 of the SREIS. The construction traffic will use sealed roads, therefore wet weather conditions will have minimal impact on road safety, except where pavement condition starts to deteriorate. If unsealed roads are used, measures must be implemented to ensure safety of road users in wet weather and minimise environmental impacts. I have conditioned at Condition 20(f), Schedule C, Appendix 1, that the proponent is to monitor pavement condition in consultation with the DTMR and the relevant local councils.

The proponent's preferred location for obtaining quarry materials for construction of the dam wall is from the Project Area, however, if geotechnical testing shows it to be insufficient, the materials will be sourced elsewhere. Of the three material supply scenarios presented in the EIS, I have assessed the high end scenario involving the construction of the RCC dam with 50% of aggregate sourced from the nearby Queensland Rail quarry at Meadvale (12km by road north east of site along the Bruce Highway) and 50% from the Sunshine Coast Quarries P/L Moy Pocket quarry (20km by road south of the site), 100% of cement and fly-ash from Gladstone and Brisbane and sand from borrow areas adjacent to the Mary River within the inundation area. I note that the exact haulage routes will not be known until the supply options for these materials are decided, and I have accounted for this in my conditions, at Condition 20 Schedule C, Appendix 1 relating to the Construction Traffic EMP Sub-Plan.

Figure 13-14 of the EIS identifies the Project's proposed haulage routes and associated traffic volumes from Meadvale Quarry and Moy Pocket Road Quarry are shown in table 13-6 of EIS. Sand will be transported to the RCC plant on site along purpose built haulage roads within the inundation area where possible. Alternatively, sand will be trucked along the Gympie – Brooloo (Mary Valley Road) to the western site access and along the Kenilworth – Skyring Creek Road onto the Bruce Highway/eastern access road.

The peak truck movement volume increase on local roads will occur over a one year period while construction of the dam wall, and the other local and district roads are occurring simultaneously. Details of the vehicle numbers involved in dam and road construction material delivery are shown in Table 13.15 of the EIS. During this period there will be up to 346 trucks movements per day on numerous roads in the Project area to transport materials (cement, flyash, aggregate, sand, rock and road base) to construction sites. Removal of the redundant road pavement material will also result in on-road haulage and additional truck movements

In the high end case scenario, up to 1200 extra light vehicle trips per day will occur in the peak construction period distributed throughout the road network, assuming a construction camp is not established in the vicinity of the dam. The proponent should consider provision a bus service for the workforce from the construction camp and encourage car pooling to reduce vehicle flow as part of the Workforce Management Plan. Excluding haulage routes, the proponent considers that the local roads in the Project area have spare capacity to safely accommodate the additional light vehicle traffic movements.

Table 13-16 of the EIS shows the breakdown of existing (2004 figures) and additional light and heavy vehicle traffic movements on roads in the Project area. Additional heavy vehicle movements range from 0 to 211 trips per day on individual road segments. There will be a 100% increase in heavy vehicles using some roads with Woondum Road increasing from nil to 193 trucks per day and Moy Pocket Road from nil to 111 trucks per day due to materials cartage if the proposed off site quarries are used. The section of the Gympie-Brooloo Road between Dobson Road and Brooloo will be particularly impacted with over 100 more trucks and 300 more light vehicle trips per day. This significant increase in truck movements was raised by submissions and I have conditioned road improvements, safety measures and truck movement limits in Condition 20, Schedule C, Appendix 1, to minimise inconvenience to existing road users and maximise safety.

During the construction period school bus trips will encounter longer than usual travel times due to lane closure and travel diversions caused by associated Project roadwork, as discussed above, on the bus route. Delays for bus routes S314, P1531, S489, S680, S66 and P290 may also be caused by following slow moving heavy vehicles on materials haulage routes along the Bruce Highway, the Gympie – Brooloo Road and the Kenilworth – Skyring Road.

The proponent has committed to and I have required at Condition 20(h), Schedule C, Appendix 1 maintaining acceptable traffic flows past worksites on all bus routes, with heavy vehicle movements to be minimised during student pick up and drop of times between 8.00am and 9.00am and 2.30pm and 3.30pm.

The Bruce Highway traffic flow will also be impacted by the construction of the overpass for the dam access road south of Traveston Road and the flyover on the Bruce Highway at Woodum Road intersection if the Meadvale Quarry is used as a source of material. The proponent indicated in the draft EMP in Table 30.4.16 of the SREIS that one lane would remain open on all roads during the three year construction period. However, I consider that the Project should not impede on the current two-way traffic flow of the Bruce Highway with the overpass/flyover constructed in consultation with the DMR using existing DMR traffic management strategies.

I have conditioned, at Condition 20(e), Schedule C, Appendix 1, that the Project EMP address relevant components of DTMR's *Environmental Management Policy and Strategy 2002-2007.*

I note that the traffic analysis post construction shows that increased traffic caused by the maintenance workforce and recreational/tourist trips will be minimal and not have a significant impact on safety or traffic flow in the region.

Pavement

The proponent has assessed the road haulage network as in good condition and has committed to upgrading pavement if required to allow movement of heavy and oversized haulage vehicles.

A pavement assessment of the proposed haulage routes was conducted by the proponent to determine reduced road lifespan due to additional construction traffic. Table 13-20 of the EIS contains the results showing the predicted reduction in life span ranges from 1 month to 3 years. The road segments that will have the largest reduction in life span are the Moy Pocket Road (3 years reduced lifespan) Kenilworth – Brooloo Road (19 months), the Gympie – Brooloo Road between Kandanga and Tuchekoi Road (17 months).

The proponent must undertake dilapidation surveys in consultation with the relevant agency prior to haulage operations commencing to identify pre-start improvements. The proponent is also to maintain and manage any restorative road works that are required during construction and post construction as per the draft EMP in Table 30.4.16 of the SREIS.

The road segments that will be impacted most in terms of damage/wear are Woondum Road from the Meadvale Quarry to the Bruce Highway, a 7.5km section of the Bruce Highway to Traveston Road and 400 m along Traveston Road to the new dam access road. The proponent has committed to upgrading the existing intersection on Woondum Road and committed to a flyover on the Bruce Highway if the Meadvale Quarry is used as a source of quarry material. If neither of the proposed quarry sources are used, the proponent is to undertake a road safety study on the road route of whichever quarry is used, liaising with the relevant State agency or local government to determine if the route is suitable, safe and if upgrades are required to pavements, intersections and signage before haulage can commence.

The reduced lifespan of the 400 m section of Traveston Road from the Bruce Highway to the dam access road was calculated to be 8 to 12 months. The proponent has proposed an upgrade to this section and construction of a new intersection to the dam access road with a designated right turn bay into the access road, signage, line markings and lighting. The works will be designed in accordance with DTMR and Australian standards. I have required this upgrade in Conditions 20(e), and 20(f), Schedule C, Appendix 1.

Intersections

I note that traffic capacity analysis of the road intersections has not been conducted by the proponent, however the draft EMP in Table 30.4.16 includes a commitment to confirm intersection configurations in the preliminary design phase of the Project to ensure new and existing intersections are adequate to safely cater for the construction traffic volumes.(p 13-28 EIS) I have conditioned this in Condition 20, Schedule C, Appendix 1.

Property access

Disruption to traffic flow and accessibility to individual properties in the Project area during the three year construction period must be avoided or minimised. I have required at Condition 20(e)(iii), Schedule C, Appendix 1 that the proponent resolve land tenure arrangements, including reestablishment of appropriate access arrangements for private properties.

Key impacts and conclusions

The proponent has committed to develop traffic management plans for all elements of the works to ensure the continued use of the road and minimise disruption to motorists at road work sites where the new road construction follows an existing road alignment. The proponent is required to implement measures to minimise potential adverse effects on the road network from the construction of the Project, including safety and convenience for all road users.

I am satisfied that there will not be any significant impacts on the regional and local road network in terms of traffic capacity, road safety or pavement deterioration with the exception of the local roads used for haulage routes. I am satisfied that these impacts are manageable by implementing the required mitigation measures recommended by the proponent and conditioned at Appendix 1.

3.9. Cultural heritage

Indigenous cultural heritage

Section 14 of the EIS indicates there are no registered native title claims covering the Project area. A previously registered claim (Gubbi Gubbi People #2, QC99/35; QUD 6034/99) existed, however this claim was voluntarily withdrawn by the applicant in February 2005. Two other claims were lodged, however these claims were never registered and have been discontinued, including the Kabi Kabi People #2 (QC06/06; QUD 65/06) and Kabi Kabi People #3 (QC06/07; QUD 136/06).

The EIS indicates that the proponent advertised their intent to negotiate an ILUA with those persons who asserted a native title interest in the area to be affected by the Project in January 2007, and a public meeting was held in February 2007, where the three claim groups mentioned above were represented. Following meetings in accordance with each group's internal decision making processes, all three native title groups decided to participate in the development of an ILUA with the clear intention of including cultural heritage as a component, and nominated representatives to a working group.

The EIS confirmed that it was the proponent's preferred strategy to develop a Cultural Heritage Investigation and Management Strategy (CHIMS) to meet the duty of care requirements under the *Aboriginal Cultural Heritage Act 2003* (ACHA) that would take the form of a cultural heritage agreement forming part of an ILUA for the Project. Further, the EIS outlined that this preferred strategy was based on:

- the proponent's prerogative to engage with the broadest possible range of Indigenous interests throughout the Project. I note that this is particularly relevant given that the development of an approved CHMP under the ACHA would have resulted in a single individual, being the applicant of the discontinued Gubbi Gubbi #2 application, exclusively assuming procedural rights in the management of cultural heritage for the Project. This would have resulted in the other native title parties being excluded from the cultural heritage management process

- concerns that two separate processes for cultural heritage and native title would have been difficult to manage, with potential for confusion and consultation fatigue with the indigenous community and

- all three native title groups for the Project area asserting that their rights included the management of cultural heritage.

The EIS notes that in June 2007, representatives of the Gubbi Gubbi People #2 informed the proponent that they would not consent to the construction and operation of the dam, due to environmental impact concerns, and would not be signing the ILUA. Further, the EIS confirms that the remaining native title parties advised they wished to continue the ILUA negotiations. The Gubbi Gubbi People #2 advised they wished to participate in the management of cultural heritage, and were given the opportunity to continue to participate in the negotiations relating to management of cultural heritage. Despite the Gubbi Gubbi People #2 not consenting to the Project, the native title parties agreed to a process whereby the Gubbi Gubbi People #2 will be included in any cultural heritage management processes that ensure following the registration of the ILUA.

The EIS notes that on the 11 August 2007, the native title parties for the Project Area authorised the ILUA and on 12 September 2007 the ILUA was lodged with the National Native Title Tribunal (NNTT). I note that the ILUA has been registered by the NNTT on 14 April 2008 (Ref: QI2007/003).

I am satisfied that in acting under a cultural heritage agreement forming part of the ILUA the duty of care requirements under the ACHA are satisfied, and commend the proponent in developing a strategy designed to engage the broadest possible indigenous interests in the management of cultural heritage for the Project.

I note that initial investigations into Indigenous Cultural Heritage in the EIS included constraint statements prepared by Native Title parties, which identify a range of cultural heritage values within the Project Area, including:

- the significance of the incidence of the Bunya Pine in the Project Area
- potential destruction of durn (ceremonial) and other sites, including Bora rings, burials, resource areas, a fighting ground, a massacre site, artefacts and a women's place
- the cultural significance of the Project Area to the Gubbi Gubbi and Kabi Kabi people as a result of traditional connection and historical association
- the significance of the dala (Lungfish) and the potential destruction of its habitat and
- contemporary uses of the Project Area by Aboriginal people

Further, I note that initial investigations into cultural heritage in the EIS includes database and register searches, as well as review of historical literature and identifies a range of cultural heritage values within or adjacent to the Project Area, including:

- stone artefacts either as scatters or isolated stone artefact/s
- bora rings
- burial sites
- a scarred tree
- a historic campsite and landscape features
- Aboriginal Cemeteries
- a range of general areas of significance
- a massacre site and
- traditional hunting places.

The EIS further notes that many of the places identified lie outside of the direct area of impact of the Project, however some sites are located with the area of direct impact.

In the EIS, the proponent recognises that to damage or destroy cultural heritage places without direct and on-going Aboriginal involvement in all stages of decision-making and implementation would seriously diminish the opportunity for Aboriginal people to exercise their rights and responsibility to manage these places in accordance with their tradition. Accordingly, the proponent has 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. Finally the EIS notes that any management and mitigation processes that may apply for Indigenous cultural heritage values within the Project Area will be agreed between the parties as provided in the ILUA.

Numerous issues were raised in relation to indigenous cultural heritage impacts. I have considered each of the submissions and how the SREIS has responded to the issues raised in submissions. Key issues that I considered warranted particular elaboration and/or explanation in my evaluation included:

- concerns into the nature of agreement making in negotiation of the ILUA, including the involuntary nature of agreement due to negotiation timeframes, exclusion of some indigenous interests and conduct of negotiations

- the Butchulla People were not involved in the ILUA (even though the submission advised that the group has previously had a native title claim over the Project Area) or cultural heritage management negotiations, as potential downstream impacts may affect their interests

- concerns that addressing cultural heritage as part of the ILUA process does not negate the need to address cultural heritage interests of people outside this process and

- concerns that no formal cultural heritage surveys have been completed, and that significant cultural heritage sites had not been identified in the EIS.

These matters are discussed further below in this section of this Evaluation Report.

In relation to the concerns raised in submissions relating to the nature of agreement making in negotiation of the ILUA, including the involuntary nature of agreement due to negotiation timeframes, exclusion of some indigenous interests and the conduct of negotiations, the SREIS in section 25.1 reinforces the notification and consultation process undertaken in both identifying those indigenous interests who assert a native title interest in the Project Area, and the negotiation process undertaken in development of the ILUA for the Project, which were both discussed in detail in section 14.2.2 of the EIS. The inclusive nature of the process undertaken by the proponent in development of the ILUA is demonstrated by the Gubbi Gubbi People #2 being included in negotiations relating to the cultural heritage agreement under the ILUA, following them advising the proponent that they would not be signing the ILUA, owing to concerns about the environmental impact.

The SREIS also outlines that the proponent advised native title parties at the commencement of negotiations that the timeframes for the Project to ensure completion of the Project by 31 December 2011, as required under the *Water Regulation 2002*, allowed for a six month negotiation period, from February to August 2007. Further the SREIS confirms that the native title parties indicated their willingness to proceed with negotiations in full knowledge of the Project timeframes. I note that a timeframe of six months for the negotiation of an ILUA is consistent with standard timeframes for commercial projects.

In section 25.1 of the SREIS the proponent outlines the notification and consultation process undertaken in relation to identifying those indigenous persons who assert a native title interest in the Project Area, including consultation with the relevant native title representative body. The SREIS further notes that the Butchulla People did not advise the proponent of their interest in the Project Area during this consultation process relating to preparation of the ILUA, and that searches of the National Native Title Tribunal (NNTT) registers indicate that there has not previously been a native title claim by the Butchulla People including the Project Area. Searches of the NNTT registers conducted by the proponent indicate that native title claims by the Butchulla People, both previous and current, focus on areas downstream of the Project area.

In response to concerns raised by the Butchulla People that they were not included in the cultural heritage management negotiations, as potential downstream impacts may affect their cultural heritage interests, the SREIS clarifies the proponent's obligations under the ACHA in relation to prioritisation of native title parties and other Aboriginal persons who may claim an association with the area, under section 32 of the ACHA. Further, in relation to the potential for downstream impacts on cultural heritage the SREIS references the work completed in the SREIS and EIS on potential downstream impacts of the dam, including hydrology and the aquatic environment inclusive of impacts on downstream fish populations. Based on this information, the SREIS concludes that there will not be an increase in intensity or geographical severity of flood events downstream, or any impacts on fauna or flora of cultural significance, nor on any culturally significant places or practices located downstream. The submission made by the Butchulla People does not contain any evidence that there will be any direct impacts on any particular Butchulla cultural heritage. I am satisfied that the legislative requirements of the ACHA are sufficient to ensure potential impacts on Aboriginal cultural heritage are appropriately identified, managed and protected.

In response to the issues raised relating to addressing cultural heritage as part of the ILUA process not negating the Proponent's need to address cultural heritage interests of people outside this process, the EIS and SREIS clearly describe how the cultural heritage agreement forming part of the ILUA satisfies the duty of care requirements under the ACHA, and is designed to ensure engagement with the broadest possible indigenous interests in the management of cultural heritage for the Project.

The SREIS acknowledges that no comprehensive cultural heritage surveys were completed as part of the EIS, however identifies that the EIS was informed by searches of relevant Commonwealth and State databases, a review of historical and other literature, and direct input from relevant indigenous groups via the provision of constraint statements. Further, the EIS outlines 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.

Mitigation measures to address indigenous cultural heritage issues are proposed to be confirmed through the ongoing development and implementation of the CHIMS for the Project's construction phase, providing for the initial cultural heritage assessment, management of cultural heritage values during construction and post-construction heritage management measures.

I acknowledge the overview of the CHIMS presented in the EIS, and note the wide range of principles with respect to cultural heritage management that the proponent has committed to. It is noted that these principles will be refined in the further development of the CHIMS with the relevant Aboriginal People.

On the basis of the proponent's responses to these issues, provided in the section 25.1 of the SREIS, I am satisfied that the proponent has suitably engaged with the broader indigenous community in relation to the ILUA and cultural heritage agreement for the Project area. I also recognise the role of the National Native Title Tribunal (NNTT) in relation to the formal registration of the ILUA under relevant State and Commonwealth legislation and that the NNTT has registered the ILUA for the Project.

The dam access road arrangements as detailed in Figure 31-15 of Section 31 of the SREIS demonstrates that a small area of the dam access road falls outside the area covered by the registered ILUA and associated CHIMS.

The SREIS confirms that the proponent will develop an approved CHMP with the relevant Aboriginal party, and develop a specific CHMP to ensure compliance with the ACHA.

In summary, I conclude that the proponent has made, and I have conditioned at Condition 25, Schedule C, Appendix 1, satisfactory commitments relating to Indigenous Cultural Heritage. The proponent is obliged to meet the requirements of the ACHA.

Non- Indigenous cultural heritage

The proponent found, as per section 14.7 of the EIS, that there are no sites of non-indigenous cultural heritage within the Project Area listed on statutory registers maintained by State and Commonwealth agencies.

A range of other features that may hold general historic significance or links to the past were identified adjacent to or within the Project Area in the EIS, through a historical review, including of published and unpublished cultural heritage studies, the then EPA's Cultural Heritage Information Management System, relevant local government area studies (Maroochy, Cooloola and Noosa) and consultation with a range of organisations who hold an interest in cultural heritage. The features that were identified through this process included:

Items within the Project Area:

- Mary Valley Heritage Railway and Kandanga Rail Bridge
- Traveston & Belwood homesteads

- Federal Memorial Hall
- Federal Character Area and Upper Mary Valley (aesthetic precinct)
- Green Ridge State School (Church)
- Bunya Creek Township Site and
- Ernst's Barn.

Items lying within 100m of the Project Area:

- Kandanga State School, War Memorial, Memorial Hall and Cottage
- Kandanga Cemetery
- Residences and shops within Kandanga
- Kandanga Uniting Church and
- Federal State School.

Based on a review of detailed studies on inundation levels for the dam, plans for the realignment of roads, and modelling of inundation for a 1 in 100 year flood event following construction of the dam, the EIS presents an assessment of the potential impact the Project will have on each these items, and presents recommendations relating to management measures for each item, including:

- realignment of road corridors to avoid potential impact
- construction of a low verge to prevent the 1 in 100 year flood event entering the cemetery and
- instances where no management measures required due to minimal or no predicted impact.

The EIS also identifies features within 100-500m of the Project Area that hold general historic significance or links to the past, however it is confirmed by the EIS that these sites are not impacted by the 1:100 year flood event with the dam in place, or the flood level is consistent with current 1:100 year flood event.

Further, the EIS identifies three features that may hold general historic significance or links to the past that are potentially proximate to the Project Area, however their exact location is currently unknown. These include:

- Yabba Station Tractor Engine
- Doyle Sawmill; and
- Rodwell Sawmill.

The EIS recommends that the proponent locates these features, and should they be impacted by the Project, conducts an assessment of the historical values and develop appropriate management measures. I consider that requirements imposed at Condition 26, Appendix 1, Schedule C, requiring additional field assessment and further consideration of management strategies as necessary is sufficient to manage potential unforeseen impacts on these potentially impacted non-indigenous cultural heritage features.

Numerous issues were raised in relation to non-indigenous cultural heritage impacts. I have considered each of the submissions and how the SREIS has responded to the issues raised in submissions. Key issues that I considered warranted particular elaboration and/or explanation in my evaluation included:

- concerns regarding lack of consultation with local historical organisations
- concerns that the EIS did not present a constraints analysis as required by ToR
- concerns regarding flooding impacts on places of non-indigenous cultural heritage value; and
- concerns regarding impact on Kandanga Cemetery.

These matters are discussed further below in this section of this Evaluation Report.

In the response to these matters, within section 25.2 of the SREIS, the proponent emphasises that section 14.7.4.2 of the EIS identifies the local historical societies that were contacted by the proponent in preparation of the EIS, and identifies the data provided by these organisations in response. Further, in the SREIS the proponent observes that unless specific organisations or information relating to specific non-indigenous cultural heritage sites are identified in public submissions then, no further analysis can be undertaken.

In relation to issues raised in submissions that the EIS did not present a constraints analysis as required by the ToR for the Project, I am satisfied that the information provided in sections 14.5 to 14.8, and Appendix F-10 of the EIS addresses the ToR.

In response to concerns relating to flooding impacts on places of non-indigenous cultural heritage, the SREIS outlines the process whereby the location of places of non-indigenous cultural heritage and flood modelling data were overlaid within a Geographic Information System (GIS) to identify potential flooding impacts and the results of this analysis is presented in tables 14.8 to 14.10 of the EIS.

In response to the concerns raised regarding the Project's impact on Kandanga Cemetery, the SREIS identifies that Kandanga Cemetery will not be impacted by the Project at FSL, however the Cemetery and road access to the Cemetery will be impacted by increased flooding. The SREIS and EIS both propose the construction of a verge or earthen bund wall on the western side of the Cemetery to ensure the Cemetery will remain unaffected by the 1 in 100 year flood. I note that the earthen bund wall is an appropriate engineering solution to protect the Cemetery from flooding impacts. However, I further note that cemeteries attract a special interest from the local communities due to a direct linkage between family and loved ones being buried there. Therefore, I have imposed a condition at Condition 32 Schedule C, Appendix 1, requiring the proponent to consult with the local community and interested individuals who have relatives or loved ones buried in the Cemetery, regarding the preferred mitigation measures associated with the potential flooding impact on the Cemetery facilitated by an independent facilitator.

In the absence of a consensus decision, as determined by the Coordinator General based on the advice of the independent facilitator, the grass verge option as described in the EIS is to be implemented as the default option prior to the completion of construction. These requirements are specified in Condition 32, Schedule C, Appendix 1.

I have also required at Condition 20(e)(vii) that roads servicing Kandanga Cemetery be modified where required to at least maintain existing access standards.

On the basis of the investigations conducted to date, I concur with the proponent's view that the possibility that impacts on items of non-indigenous cultural heritage within the locality are such that substantive constraints and/or required design modification to the Project are unlikely to be warranted. Further, I consider that requirements imposed at Condition 26, Appendix 1, Schedule C, requiring additional field assessment and further consideration of management strategies as necessary is sufficient to manage potential unforeseen impacts on non-indigenous cultural heritage. The abovementioned condition requires suitable ongoing consultation with local heritage societies, the National Trust, DERM and Queensland Heritage Council.

The SREIS confirms that there are no non-indigenous cultural heritage issues associated with the dam access road corridor.

For the purposes of clarity, the areas traversed by the dam access road must be included into the additional field assessments to be conducted by the proponent. Similarly, the general Project related consultation requirements mentioned above, involving entities such as DERM and the Queensland Heritage Council, also apply to the dam access road corridor.

3.10. Social

Summary of social issues

Numerous issues were raised in submissions in relation to social impacts. I have considered each of the submissions and how the SREIS has responded to the issues raised in submissions. Key issues that I considered warranted particular elaboration and/or explanation in my evaluation included:

- The methodology followed by the proponent
- Community health and well being (pre-construction) – including the government services provided in response to the announcement of the Project
- Property impacts (property purchase/lease back/flooding)
- Workforce impacts (housing and population)
- Community infrastructure and services
- Future Land Use Planning (OUM study)
- Construction Impacts – localised disturbance

These matters are discussed further below in this section of this Evaluation Report.

Methodology

The Social Impact Assessment (SIA) conducted by the proponent was based on an assessment of both quantitative and qualitative data related to demographic factors, community capacity, community values, social capital and access to social infrastructure.

The SIA described characteristics at three levels: the primary study area, adjacent communities and the Regional Local Government Areas.

Although based on the 2001 Census data that was available at that time, the SIA included:

- A summary of the existing socio-economic conditions in the surrounding LGAs
- An assessment of the social impact of the proposed Project on affected communities
- Commentary on the significance of social impacts
- A description of measures to mitigate adverse impacts and enhance benefits.

As discussed in section 3.1, Council amalgamations have subsequently changed the boundaries for Local Governments affected by the Project. Approximately 95% of the Project is now located within the jurisdiction of the GRC area with the remaining 5% within the Sunshine Coast Regional Council.

The 2006 census data was not available at the time of the EIS investigation to assist in developing the community profile. The SREIS indicates that 2006 data was used to update the demographic profile and that it was consistent with the 2001 data.

I agree with the proponent's conclusion within the SREIS that the Project announcement would generally not have had a significant impact on the changes in the region's population and demographic profile since 2001. Changes in the region's population and demographic profile between 2001 and 2006 more likely reflect the trends identified in the EIS such as the influx of tree-changers into the area, ageing of the population and movement away from farming due to dairy deregulation and drought.

Government services in response to the announcement of the Project

I note the following Queensland Government initiatives were implemented in response to the announcement of the Project in April 2006.

Community Futures Taskforce

The Community Futures Taskforce (CFT) was formed following the announcement of the Project. The Taskforce, when originally assembled included an independent Chairperson, community members, the Mayors of Cooloola, Noosa, and Maroochy LGAs, the Director-Generals of key Queensland government departments, and the Chief Executive Officer of QWI.

The CFT was charged with addressing the immediate impacts of the Project and identification of capacity building initiatives to position communities for the future. One of the CFT's key strategies has been the provision of a One-Stop-Shop, at Kandanga, providing assistance to community members regarding individual, community and economic well being. The results of the CFT's consultation and interaction with community members have informed the social impact assessment. The CFT and the One-Stop-Shop provided an extensive service for the community until July 2009 and continues to operate in a reduced capacity until December 2009 at which point the services will be integrated as part of existing government service provision.

Regional Services Forum

The Regional Services Forum was formed to ensure a local whole-of-government response to community needs arising from announcement of the Project and to implement recommendations of the CFT over the medium to longer term.

The role of the Regional Services Forum is to facilitate government responses and support community development activities, which has included: rural and business adjustment schemes; computer training; farm financial counselling; studies in future investment opportunities in the food and fibre industries; school residential recreational camps; Kandanga public toilet facilities; school bus lay-bys, worker assistance and the Mary Valley Tourism Project.

Office of Urban Management (OUM) planning studies

At the request of the CFT, the OUM and the former Department of Local Government and Planning, Sport and Recreation (the planning function has now transferred to the Department of Infrastructure & Planning) are undertaking a planning study into the effects of the Project on land use and infrastructure. The study is also to identify and address opportunities for future development that could be incorporated into a long-term land use plan for the Mary Valley. The draft planning study will be revised on the finalisation of this Evaluation Report.

Traveston Crossing Dam Business Adjustment Scheme

The Traveston Crossing Dam Business Adjustment Scheme (BAS) is a government-sponsored scheme, administered by Queensland Rural Adjustment Authority (QRAA) on behalf of the former Departments of Tourism Regional Development and Industry (TRD&I) and DPI&F (both now part of DEEDI). The BAS was been developed to assist eligible businesses to develop and implement strategies to improve their on-going viability and to restructure in preparation for the economic changes arising from construction of the Project. The program includes exit assistance for those businesses in circumstances where this is the only realistic option.

Community health and well being (pre-construction)

The announcement of the Project has had a significant impact on the wider Mary Valley community. I acknowledge that there is significant community opposition to the Project reflected in the SIA survey responses, the organised opposition to the dam, petitions and the large number of submissions received in response to the EIS.

Notwithstanding a lack of empirical data to support a detailed assessment of mental health issues, the SIA found clear anecdotal evidence that psychological distress and the incidence of mental illness increased in the Mary Valley in the twelve months post the dam announcement.

As a result of the reported increase in demand for support services by community organisations and service providers, additional services have been introduced by key agencies and community service groups to the primary study area to assist individuals, households and communities to cope with the proposal and to plan for the future.

These additional services have been co-ordinated primarily through the Community Futures Taskforce, with its brokerage of other agencies' services to meet identified needs, including:

- establishment and operation of the Kandanga One-Stop-Shop to provide a central source of information about the Project and referral to government services
- funding to Lifeline to provide personal and financial counselling, and emergency relief payments; and
- appointment of a Community Development and Engagement Officer based at Kandanga to assist community organisations.

Table 16 below, taken from the EIS, shows the number of community contacts at the Kandanga One-Stop-Shop for the twelve months from 1 July 2006.

- **Table 16 One Stop Shop Contacts - July 2006 to June 2007**

Contact Type	Number
General enquiries	384
Referrals to Queensland Government agencies	1,174
Counselling (including outreach)	634
Community development	187
Total	2,379

Many submissions on the EIS detailed impacts on community health resulting from the announcement of the Project, including stress, anxiety, mental anguish, depression and insomnia. The impacts raised in submissions are consistent with the EIS findings in section 15.1.3.5.

The EIS acknowledges the impact to community health the announcement of the Project has caused. The EIS also found that for some people opposed to the Project, information provided by the Queensland Government and the proponent has not, and may never satisfy all their concerns and questions.

Substantial mitigation measures have been implemented since the announcement of the Project including additional community services, programs and facilities to provide access to information and support services for residents and businesses.

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

Having regard to numerous submissions received and the findings of the EIS, I concur with the proponent's assessment in the SREIS that the only way to resolve uncertainty and perceived threats to security and local values, for some residents, would be to rescind the Project.

I have weighed the benefits of secure water supplies to the wider community of SEQ, including substantial localised benefits resulting from the Project construction, against the negative impacts the Project will have for some people.

Community services

Consultation undertaken during the EIS advised there has been increased demand for community services in the pre-construction period including:

- increased demand for health care services, such as general practitioners, support and counselling services to cope with stress impacts
- increased need for information about and access to government services available to assist people experiencing or fearing hardship

The Project would likely have positive benefits for sport and recreation clubs in the Mary Valley through an increased participation and membership base drawn from Project workers and their families.

It is anticipated the presence of construction families would lead to an increase in school enrolments, assisting with the viability of some schools.

Some submissions raised concern that an influx of workers during construction may result in increased demands on community services particularly local health and education services.

The EIS advised the construction workforce will likely increase demands on local health and ambulance services, with demand likely to be expressed in Gympie rather than the Mary Valley. This demand would need to be monitored, and provision of on-site or local medical services considered if there is a risk of reducing service levels to the wider community.

The construction population could potentially lead to additional demands on health and family support services. As per the proponent's EIS, such services would again need to be monitored and supplemented if demand exceeded supply.

The proponent has committed to liaise with the health care and education providers as part of a cross-agency working group representing several government departments. The cross-agency working group will be operational prior to construction. The proponent has committed to advise of increases in workforce composition (e.g. to identify peaks) to ensure there are adequate services to respond to any increased demand as a result of the Project.

I consider the impacts of an increase in demand on community health and education services due to an increased workforce population can be readily managed on the basis of the following:

- Department of Education advice that additional enrolments would further sustain school viability
- The proponent's commitment to ongoing consultation as part of the Regional Services Forum and the establishment of a cross-agency working group

- Community Health Services are widely available in Gympie, Noosa and Nambour. Collectively they provide a range of services to the Gympie and Sunshine Coast Health Districts

I require that the proponent submit to me for approval, in accordance with Condition 30, Schedule C, Appendix 1, a Work Force Management Plan, including arrangements to advise key agencies and service providers of increases in workforce numbers.

Recognising the requirement for ongoing provision of additional services for the Mary Valley Region as a result of the Project and the anticipated ongoing role of particular organisations as part of a regional cross- agency working group, I recommend that the proponent work with the cross-agency working group to ensure the local community health services (within GRC LGA) are maintained as necessary and secure additional funding if required. I note the valuable work undertaken by Lifeline.

Property impacts

The Project will directly impact 334 properties (including 76 dwellings) either wholly or in part.

The EIS identified that people affected by property impacts were at risk of suffering emotional impacts due to changes to and uncertainty about future plans, severance of family history and ties, and disruption to lifestyle.

In recognition of these impacts, the proponent'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.

Properties affected by the Project are currently being purchased under voluntary agreements, to provide certainty for property owners. The voluntary purchasing approach was adopted after feedback from the community and is outlined in the QWI Land Purchasing Policy.

Under the Land Purchasing policy, if they choose to, owners of Stage 1 properties are able to remain on their property until 2011 under a "discounted lease back" scheme with the proponent.

Some properties that would be affected for Stage 2, should it proceed, are currently being purchased at the request of the property owners to provide certainty and flexibility to them.

In recognition of the uncertainty as to whether Stage 2 would proceed, owners of properties affected by a possible Stage 2 are able to remain on their property under the discounted lease back scheme until 2035.

Further details on the property purchase arrangements and impacts are in section 3.1 Land of this report.

I am aware from submissions received, that the inclusion of Stage 2 purchases in the voluntary purchase arrangements has caused a level of angst and or confusion in the wider community. However, I support the proponent's initiative to provide the opportunity for landholders to enter into voluntary agreements in regards to possible Stage 2 impacts. However, my comments in relation to Stage 2 in Section 4.3 should be noted.

Kandanga Township

The township of Kandanga will be affected by the Project inundation area and increased potential for flooding. 16 houses within Kandanga are fully or partially below the Q100 with dam flood line. Of these 16 houses 14 are currently owned by QWI. The 2 remaining houses are proposed to be purchased, preferably by voluntary process or, if not, by compulsory processes.

Community facilities below the 1 in 100 AEP flood line, with the Project, are proposed to be replaced with upgraded facilities on higher ground at Kandanga. These facilities are already subject to intermittent flooding impacts without the Project.

The proposed relocation of these community facilities (including the bowls club, swimming club and community hall) responds to this risk of flooding but the resulting upgrade of the facilities would also provide a substantial benefit to the community and I am satisfied that the proposed upgrade offsets the community infrastructure impacts relating to the Project.

As discussed in Section 3.1 Land of this Evaluation Report and conditioned at Condition 32, Schedule C, Appendix 1, within 12 months of this Evaluation Report the proponent must arrange for an independently facilitated consultation process with the people of the Kandanga community and the GRC to establish a masterplan for delivery of Project mitigation measures relevant to Kandanga and other measures in an integrated way. The proponent must facilitate and fund the development of an Urban Development Masterplan for Kandanga and provide at least $3.5 million towards implementation of the Masterplan.

The consultation process must consider the following measures for inclusion in the Masterplan:

- provision of a replacement swimming pool
- development of sports fields
- public hall facilities
- relocation and/or upgrade of the Kandanga rural fire brigade headquarters and training facilities
- other measures selected from options identified through the abovementioned independently facilitated consultation process.

I note that if agreed through the consultation process, some measures may be delivered prior to finalisation of the Masterplan document.

I have also required the proponent to contribute at least $2.5 million towards the relocation of the Kandanga Bowls Club.

I note, in addition to the above requirements, the proponent has committed funds of $4 million to ensure the upgrade of sewage and water supply for Kandanga. I have required at Condition 32, Schedule C, Appendix 1 that the proponent contribute at least $4 million for the upgrade of sewerage and water supply for Kandanga and ensure the upgrade of those facilities prior to the completion of construction.

Kandanga Cemetery

The proximity of Kandanga Cemetery to the inundation area and the associated flooding risk is a significant concern for the community. While there is no impact on the cemetery by the Project at its full supply level, the proponent has investigated methods to protect burials from risk of inundation during major flood events.

The establishment of a grassy verge is an option to reduce flood risk to the cemetery. This would enable the cemetery to operate in exactly the same way and all used and unused plots to be preserved.

The CFT engaged with the community regarding options for the cemetery for inclusion in the planning for the measures to be provided at the cemetery.

At July 2007, community members involved in the consultation process chose not to nominate a preferred option for the cemetery, and requested that this matter be revisited if the Project proceeds.

I require the proponent to continue to work with the community to decide on the most appropriate action from the options currently on the table, noting the proponent’s commitment to ensuring the ongoing access to and use of the Kandanga Cemetery.

As discussed in section 3.2 of this report, the lower areas of the Kandanga cemetery already flood in major events but would be subjected to increased and longer floods with the dam present. The proponent has suggested a grass verge be placed to provide flood protection up to the 1 in 100 AEP event, and undertaken consultation with the community on this issue. This issue is clearly of considerable concern to the Kandanga community and I require the proponent to continue to consult with the community to identify and implement the preferred approaches to dealing with cemetery flood impacts prior to construction. The proponent must identify and fund the involvement of an appropriately qualified independent facilitator approved by me. The terms of reference for the independent facilitator must include the identification of members of the Kandanga community and those with a direct connection to the cemetery who wish to be involved in a process to determine by consensus the preferred approaches to dealing with cemetery flood impacts.

In the absence of a consensus decision, the grass verge option as described in the EIS is to be implemented as the default option prior to the completion of construction. These requirements are specified in Condition 32, Schedule C, Appendix 1.

Roads and connectivity

Upon completion of the Project there will be both positive and negative impacts to local access and connectivity in the Mary Valley resulting from changed local and regional road networks. Changes will include the closure of roads within the impoundment, relocation of roads outside of the impoundment, and changes to property access.

Road planning has been undertaken to ensure access is maintained to all properties and to achieve appropriate safety standards in design and construction.

All changes in relation to road alignments, upgrades and access and connectivity are discussed in section 3.8 transport and traffic of this report.

Downstream Flood Protection

The dam design includes flood control gates on the dam spillway to provide a level of flood mitigation to Gympie and areas downstream by limiting flood discharges from the dam.

Major flooding occurred in Gympie in 1999 and affected around 60 residences and 130 businesses. Hydraulic modelling indicates that the Project could achieve flood attenuation of 3.5 – 4.0 metres in Gympie, by the controlled release of flood waters from the reservoir. This action would avoid flooding for all residences, and reduce the number of businesses affected to around 34. The flood attenuation effect in Maryborough would be in the order of 1-2 metres in this scenario.

Flood mitigation for these downstream areas is a significant beneficial impact of the Project.

Upstream Inundation

Submissions raised concern regarding the potential for increased duration of flooding upstream of the Project including inundation of pasture as a result of the Project and in particular the use of the flood control gates for downstream flood protection.

Modelling undertaken for the EIS indicates that the duration of upstream flooding may be increased by up to 24 hours in some locations outside the Land Purchase Boundary.

Proposed changes will not result in inundation exceeding three days for the 1 in 100 AEP regional design flood event. Therefore it is unlikely there will be any adverse impacts to these areas which are primarily covered by pasture and in any event no sensitive infrastructure would be impacted in this area.

In the case of road upgrades and relocations, all roads will be designed to provide equivalent or better flood immunity than the existing roads with no significant impact to outage times as depicted in Table 6.28 of the EIS.

Population and workforce impacts

Impacts on Population

It should be noted that demographic, economic and land use changes were occurring before the Project announcement, including changes relating to dairy industry rationalisation and increasing demand for rural residential living. However, the rate of population change was clearly accelerated by the initiation and implementation of Project-related property purchases in accordance with the proponent's land purchasing policy.

The EIS found that changes from farming to residential land uses are likely to occur at a faster rate during the next five years, as some people depart from and others move to the Mary Valley. Those moving to the Mary Valley are expected to do so for lifestyle and business opportunities related to the Project or land use change brought about by the Project.

It is estimated in the EIS that approximately 100 households living in the Mary Valley before the Project announcement would have left the area due to property purchases, with a similar but slightly fewer number arriving to occupy rented dwellings.

The EIS found that population with the dam in place is expected to exceed the no-dam scenario at some stage between 2014 and 2018.

Impacts on Housing and Accommodation

Housing and accommodation availability may be impacted due to increased demand during the construction phase from construction workers and the unavailability of some of the existing housing stock located within the inundation zone.

Construction related impacts on housing and accommodation are more likely to be experienced in those towns close to the Project (including Gympie), and particularly in those areas that provide good access to the worksites.

The proponent estimates that based on the Paradise Dam experience:

- approximately 30-40% of workers (i.e. about 200) will be sourced from the local area and adjacent communities
- approximately 200 workers will be accommodated in a workforce construction camp; and

- remaining workers will utilise other housing options including shared rental accommodation, commercial accommodation and temporary accommodation (e.g. caravan parks).

The establishment of a construction camp will help to reduce the affects of increased demand for accommodation and housing in the Mary Valley and adjacent communities. The proponent advised that without a construction camp, it is unlikely that there would be sufficient housing or accommodation in the Mary Valley or surrounding localities to accommodate the construction workforce.

Timely establishment of the construction workforce accommodation would alleviate the potential for short term stress on the local housing supply. As such, I have conditioned at Condition 30, Schedule C, Appendix 1, that the proponent must develop a Workforce Management Proposal for the approval of the Coordinator-General prior to the commencement of Principal Construction Works. This Proposal must:

- be developed in consultation with GRC and SCRC
- include analysis and related measures designed to deliver suitable worker and community safety and amenity outcomes
- provide for a construction camp able to accommodate at least 200 workers, including optimisation of potential future use for the local community, for example for affordance housing, recreational and tourism use
- demonstrate that the proposed measures are unlikely to cause significant adverse housing availability or affordability outcomes in the GRC or SCRC local government areas and where necessary the development of any temporary or permanent residences to house Project workers and provide for the establishment of infrastructure to support workforce facilities
- include documented workforce commuting arrangements (possibly involving buses), including consistency with the Transport and Traffic requirements in Condition 20 of this Schedule C
- include arrangements to advise health care and education providers of increases in workforce numbers that may result in any increased demand for their services

Many submissions made mention that the workforce accommodation camp presents an opportunity to develop infrastructure to benefit the region beyond the construction period. As per the condition described above, the Workforce Management Plan will ensure that planning for the placement and design of the construction camp is to be done in conjunction with the GRC with the purpose of maximising future use opportunities.

I note the advice of the then Department of Housing that the required inclusion of a construction camp has satisfied their concerns regarding the negative impacts of additional workers on rents or home ownership in the region.

Construction impacts

Construction impacts related to noise, air, transport and traffic are to be expected in the delivery of large infrastructure projects such as for a dam.

The Construction EMP process will ensure these issues are appropriately managed. Construction impacts and the associated mitigations are addressed in detail in sections 3.5, 3.6 and 3.8 of this report and in the Construction EMP.

Conclusion

The proponent has provided sufficient information for the assessment of the social impacts of the Project. The SREIS has adequately captured and responded to the issues raised via the EIS submission process.

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

The Project will require the purchase of significant numbers of properties in addition to those already owned by the proponent.

The loss of property will result in changes to property use and management. Further, the acquisition of property for the Project has and will lead to uncertainty and concern to affected property owners. Impacts on these property owners in-particular include the emotional impacts to property owners, including changes to and uncertainty about future plans, severance of family history and ties, and disruption to lifestyle.

During construction of the Project there will be localised negative impacts, particularly for the directly impacted property owners or due to road diversions or changes stemming from construction activities, however, with proactive management and conditioning these impacts can be minimised.

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 including schools and sporting clubs.

The requirement to house a proportion of the workforce in a construction camp will help to mitigate the impact of an influx of people into the local housing market in the short run.

At the regional level, the impacts of the Project will be largely positive, with the completed dam expected to improve the supply and reliability of water. The dam operation is likely to provide positive benefits for the community as a tourism or recreation attraction.

Negative impacts during operation of the Project will be mainly associated with the ongoing impacts of changed farm management practices for property owners directly affected by the Project.

I have imposed a series of conditions within Condition 30, Schedule C, Appendix 1 of this Evaluation Report, that will suitably mitigate the social impacts as a result of the Project.

3.11. Economic

Numerous submissions raised issues in relation to economic impacts. I have considered each of the submissions and how the SREIS has responded to the issues raised in submissions. Key issues that I considered warranted particular elaboration and/or explanation in my evaluation included:

- methodology followed
- agricultural impacts, loss of productive land
- economic effects of property changes including the lease back arrangements
- extractive industries, maximising resources
- downstream impacts on industries – commercial fishing, recreation etc
- economic effects of construction activity
- loss of local government revenues via rates; and
- tourism development potential as a mitigation.

These matters are discussed further below in this section of this Evaluation Report.

Methodology

The economic assessment within the EIS identified and assessed the economic impacts associated with the construction and operation of the Project.

The Mary Valley is largely composed of rural industries with forestry, dairy, beef and horticulture as the predominant land uses. Other land use activities include a small tourism industry that draws on the rural lifestyle and natural assets of the area, a number of agribusinesses that support the timber and agricultural industries, and some small home based and service based businesses.

Despite the existence of some industry and small business in the Mary Valley, the local economy relies heavily on its linkages with Gympie, which is the economic and administrative centre of GRC.

The economic assessment comprised three main methodologies:

- Economic Profiling of the former Cooloola (containing approximately 95% of the Project area), Maroochy, and Noosa LGAs and their relativity within the greater Queensland economy
- Computable General Equilibrium (CGE) Modelling to assess the direct and indirect economic impacts of the Project at the regional, State and national level and
- Cost Benefit Analysis (CBA) to assess the benefits and costs of the Project under the “with” and “without” Project scenarios.

The results of the CBA for the Project, including in relation to assessment of alternatives, considered are summarised in section 1.4 of this Evaluation Report.

Numerous submissions questioned the appropriateness of the CBA undertaken for the Project, specifically, that the use of least cost comparisons was inappropriate and did not constitute a full cost benefit analysis.

It is evident that, if regional water demand is to be met under all supply options, the only material differences between options arise from differences in the cost of supply.

I consider that the methodology was appropriate in allowing appropriate economic comparison between different supply options and note that the methodology has been:

- reviewed by Queensland Treasury at both the inception stage of the Project and again after model results had been presented
- adopted by QWC in the Strategy and
- reviewed by Professor Harry Campbell (Professor of Applied Economics at the University of Queensland) where he has noted that the benefits from water use to the consumer are not relevant in this economic cost benefits analysis, and confirmed that the approach was appropriate.

Agricultural impacts

A high proportion of the Mary Valley workforce is employed in the primary industries sector, including agriculture, forestry and fishing. The EIS found approximately one quarter of people in the Mary Valley are employed in primary industries, compared with 5% for Queensland as a whole. However, this proportion is trending downwards.

Loss of Rural Land and Output

The Project will result in the loss of rural land and therefore impact on agricultural industries, including dairy, grazing and crop production.

The loss of GQAL was addressed in section 9.1.1 of the EIS and concludes that the overall loss of agricultural land uses in the Mary River Catchment is minimal and unlikely to result in the closure of local produce markets in the Mary Valley.

The proponent indicated in the EIS that the value of production within the Project Area, as a percentage of Queensland output, represents 4.05% of dairy production, 0.04% of beef, 0.15% of horticulture and 0.03% of other industries. The production areas lost to inundation associated with the Project are estimated to result in lost annual production of approximately $15.7 million and gross direct and indirect impacts of approximately $29 million.

Some flow on impacts to dairy processors that are reliant on suppliers located in the Mary Valley will also occur. I understand that the relevant dairy processors that source milk from the Mary Valley region consider that the further potential reduction in supply base is concerning, particularly given that the supply base was already reducing as a result of drought and deregulation of the market. I understand that they also consider that maintaining road access to dairy farms so that milk can be transported to the processor needs to be a priority.

In relation to road access, I concur with the proponent that the proposed road infrastructure developments associated with the Project will ensure access is maintained to all operating properties. Modelling suggests there should not be any significant increase in travel times due to realigned roads, particularly along major heavy vehicle transport routes and many road surfaces and intersections will be improved (refer to section 3.8 of this report for further discussion).

In relation to the declining production base, DEEDI initiated the development of a Food & Fibre strategy to inform the EIS and to identify strategies to mitigate agricultural impacts from the Project and maintain the current level of agricultural production.

Despite the strategy efforts, I am advised by DEEDI that it is not considered that the current level of dairy production can be maintained into the future due to the current farm exit rates in the dairy industry relating to overall market circumstances.

DEEDI advises the Food & Fibre Futures project, which aims to increase agricultural production across the whole of the Greater Mary catchment, requires new sources of funding to continue its work and recommends the proponent commit to ongoing funding to support the continuation of the project and implementation of key strategies. The proponent has committed to, and I have imposed through conditions, the provision of (at least) $2.75 million in funding to keep the Food and Fibre Future Project in place for a period of four years.

The loss of the annual gross output for all agricultural industries, while not substantial in the context of the SEQ economy, represents an impact on the local economy that I consider should be mitigated as far as practicable. The local impacts are arguably amplified by the fact that the additional water supplies are being secured for the wider SEQ region and may not be available to directly support potential new uses in the local area.

The proponent has provided a range of commitments in chapter 30 of the SREIS to offset local economic impacts and encourage new sustainable enterprises and communities. In addition, submitters have recommended a number of mitigation initiatives and programs.

As a result, I require at Condition 31, Schedule C, Appendix 1 that a Community and Economic Development Program (CEDP) to be developed in consultation with GRC, SCRC, the Chief Executive of DEEDI, Gympie Chamber of Commerce (subject to its willingness to be involved), Sport and Recreation and Tourism Queensland for my approval prior to construction.

As well as targeting sustainable farm production, the CEDP will incorporate measures to facilitate development of an appropriate Recreation and Tourism Program, that will specify the activities and infrastructure suitable to be implemented in the Project Area and surrounds. This is further explained in the Tourism Potential sub-section of this Coordinator-General's Report.

The elements of the CEDP relating to agriculture industries must include descriptions and design specifications, timing details, cost estimates and implementation plans for:

- the extension of DEEDI's existing Food & Fibre Strategy (targeted at the Mary Valley as a whole) for an additional 4 years commencing 2009/10 at a cost of $2.75 million

- the development of individual Property Management Systems (targeting up to 200 properties) in the Mary River Valley as a whole for a four year period at a cost of at least $2 million

- funding of at least $4 million for beneficial capital investments (e.g. fencing, off-stream watering points, planting etc) identified as part of the development of Property Management Systems in (ii) to optimise catchment water quality and riparian vegetation outcomes

- funding of $3.45 million for the provision of an Innovation and Incentive fund to accelerate the establishment of new agribusinesses in the Mary Valley

Given the importance placed on programs to mitigate the loss of agricultural output within the area, I consider that the above required funding, totalling at least $12.2 million, represents a reasonable level of investment to offset lost agricultural output and underpin sustainable farm management practices. I am advised that, based on experience with a similar program managed by DEEDI, the level of support proposed is likely to lead to an increase in the value of agricultural output that exceeds the expected loss in agricultural output associated with the Project. DEEDI have advised that there is an anticipated cost benefit ratio in the region of 1:6 for Gross Farm Output as a result of the proposed Innovation & Incentive program.

As part of an appropriate precautionary approach to the losses in local farming income, I am requiring additional support for tourism, recreational and other initiatives within the CEDP. As a result, I have conditioned in Condition 31, Schedule C, Appendix 1, for the provision of at least $20 million (inclusive of agricultural, recreational, tourism and other measures) in funding to support a selection of the economic development measures consistent with the intent outlined in the Project Commitments of Chapter 30 of the SREIS pages 30-123 to 124.

I note that the Catchment Management Program (discussed at Section 3.4 of this report) could also provide benefits to agricultural landholders, including those within the dairy industry, in the vicinity of the Project and those adjacent to waterways throughout the Mary Valley.

The continuation of the Business Adjustment Scheme would appear to be beneficial in assisting those businesses not directly affected by the property purchases but experiencing losses in revenue relating to the economic changes associated with the Project and therefore, I recommend that the Government extend this initiative for an additional four years.

Forestry and Timber Processing

Forestry and timber processing are historically significant activities within the Mary Valley.

However, the industry is declining in size with limited opportunities for growth, as the availability of hardwood resources is gradually being reduced under the South East Queensland Forests Agreement (SEQFA).

Under the SEQFA certain mills have been granted 25 year sale permits which will expire in 2024. While sale permits are tradable, no new permits will be granted. After 2024 logging of non-plantation hardwood timber in native forests on State land will cease.

The proponent has released an Expression of interest (EOI) for forestry plantation operators to partner with Queensland Water Infrastructure in establishing up to 2,000 hectares of hardwood timber plantations.

The proponent has developed a trial plantation in conjunction with CSIRO, DEEDI, Timber Queensland and Ecotek. In addition to providing hardwood resources, it is anticipated the plantations will provide carbon offsets as well as opportunities for other industries, including apiculture (bee keeping), medical honey, power poles, and alternative fuel sources.

There are no direct adverse project impacts on timber plantations in the region. However, the proposed establishment of sustainable hardwood timber plantation stocks (as discussed in section 3.5 of this report) as part of the Project represents a likely positive development for the industry within the region.

Property impacts (economic)

The Project has identified a total of 334 properties likely to be directly impacted, either wholly or in part. If Stage 2 (which is not considered as part of this report) were to proceed in the future (under separate approval) an additional 265 holdings would be affected.

Approximately 80% of required properties have now been purchased and approximately 75% of these are currently being leased back to the original owner. In the majority of cases, the properties are continuing to be used for the same purpose as prior to sale to the proponent.

Land purchase and lease back arrangements

As discussed in detail in section 3.1 and 3.10 of this report, QWI is currently offering to purchase the land, including that which may be affected if Stage 2 proceeds in 2035, on a voluntary basis.

Land that is purchased now can be leased back until it is required for the Project. The EIS estimate the savings in 2007 dollars of the favourable leaseback arrangements at approximately $24 million below the market rate. This represents a significant economic benefit to affected property owners.

Extractive Industries

Submissions raised concern that the EIS was unclear about the scope of sand and other resources to be made available for commercial industry. Section 4.5.1.2 of the EIS states that soil, sand and gravel resources which will not be used in construction, site rehabilitation, landscaping or other identified needs and opportunities associated with the Project, will be made available to the commercial market for extraction. It is important to note that such activities could not be allowed if they were found to be inconsistent with the conditions for the project, including in particular the habitat restoration requirements. This issue is addressed in detail at section 3.1 of this Evaluation Report.

Downstream industry impacts

Submissions raised concerns regarding impacts on downstream industries such as commercial and recreational fishing.

The proponent will be required to operate the Project in accordance with the existing WRP. The operational rules will require the operator to maintain environmental flows downstream.

The maintenance of environmental flows will limit potential impacts on recreational and commercial fishing. The hydrology section of the SREIS further explains the changes and impacts to the flow regime with the Project. I have found at section 3.2 that the downstream impacts to industries such as fisheries, tourism, and agriculture are considered negligible. As such, costs associated with downstream impacts on industry have not been included for the Project.

Water Allocations

In response to concerns that the Project will not provide additional water allocations for irrigation or even potentially reduce existing water entitlements, I need to emphasise that the Project will not affect irrigators' water entitlements. The *Water Act 2000* and the *Water Resource (Mary Basin) Plan 2006* (WRP) legally require the proponent to ensure irrigators' water entitlements are maintained when the Project is in place.

The rationale for the Project is essentially to contribute to a reliable water supply in SEQ including contributing to the sustainability of enterprises in the local area and beyond. The Project is not intended to supply additional water allocations for irrigation locally or throughout the wider region.

For industries downstream, as discussed in section 3.1 of this Evaluation Report, the Project will not adversely affect environmental flows or water allocations. As such, adjacent communities are not expected to experience significant negative economic impacts due to the Project.

Flood Mitigation Benefits

As mentioned in section 3.10 of this Evaluation Report the inclusion of flood control gates will provide considerable flood mitigation benefits downstream of the dam, particularly to the town of Gympie, and to a lesser extent to the city of Maryborough.

The proponent estimated the economic value of the anticipated flood mitigation benefits at $70 million.

Construction economic impacts

Local Demand Stimulus

The Project will provide increased demand via the construction workforce for local goods and services within the Mary Valley and surrounding regions of Wide Bay and the Sunshine Coast.

The additional workforce, in part accommodated in a construction camp, is expected to generate an increased demand for goods and services to local businesses such as local shopping, personal and related services, and entertainment and leisure facilities.

Employment & Training

The proponent has committed to ensuring maximum potential for local participation in the delivery of the Project. The region has one of Queensland's highest unemployment rates and the Project provides a significant opportunity for initiatives that will provide a long term benefit to the people of the region.

The Project will directly employ a workforce during construction of some 500-600 people. Based on the Paradise Dam experience, approximately 30% to 40% of these jobs will be filled from the surrounding regions. A further 600 businesses will provide services to the Project leading to further indirect employment.

The proponent has identified a number of training and employment initiatives to secure local participation and the commitments made under these initiatives are conditioned as part of the approval of this project.

As per the discussion in the EIS, the proponent is required at Condition 31(i), Schedule C, Appendix 1 to ensure compliance with the *State Government's Building and Construction Contracts -Structured Training Policy*.

I note the advice of the then DTRDI on the EIS that the training and up-skilling of the existing workforce within the Mary Valley and the surrounding regions will act as a catalyst for other business opportunities to emerge.

Materials & Services

Under the Queensland Government's Local Industry Policy, *A Fair Go for Industry*, the Project must provide full, fair and reasonable opportunity for Queensland and Australian industry to participate in the provision of goods, equipment, services and technology. I have required that the proponent ensure compliance with this policy at Condition 31(i), Schedule C, Appendix 1.

The proponent will be required to package and present work so as to offer opportunities for capable and competitive local level suppliers. The proponent will be required to provide information on business opportunities in the local area and surrounding regions prior to the release of these packages, and tenders will be advertised locally.

The proponent has established a local business opportunities register to which more than 720 businesses have already registered for the Project.

Negative Construction Impacts

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

- approximately 100 businesses (60 agricultural and 40 other) within the Project inundation area that are required to relocate, a proportion of which will close; and
- indirect impacts to businesses that are reliant upon directly impacted businesses.

Business disturbance payments are paid to directly affected businesses, as part of the Land Purchase Process administered by QWI and these payments commenced from 2006. Payment includes the future relocation costs of the business to a suitable new site, a personal disturbance payment to cover legal costs and minimal personal removal costs, and the stamp duty on the new property.

The Business Adjustment Scheme (BAS) is a government-sponsored scheme, administered by Queensland Rural Adjustment Authority (QRAA) on behalf of the then DTRDI and DPIF, which has been developed to assist eligible businesses to develop and implement strategies to improve their on-going viability and to restructure in preparation for the economic changes arising from construction of the Project.

The program includes exit assistance for those businesses in circumstances where this is the only realistic option. As discussed in the section on agricultural impacts, I recommend the Queensland Government extend the former DTRDI's (now the responsibility of DEEDI) Traveston Crossing Dam Business Adjustment Scheme (delivered by QRAA) for an additional 4 years.

A Worker Assistance Program (WAP), also administered by the then DTRDI, is available to provide access to training, job preparation, and relocation and wage subsidy assistance for eligible workers who have lost their job as a result of the Project.

Conclusion

Some submitters expressed the view that the local area would suffer from a post construction downturn and would require further mitigation.

The delivery of the Project will contribute to the up-skilling of the local workforce as well as the increased capability and capacity of local businesses that increase in scale via the winning of supply contracts for the Project.

I consider the additional skilling of workers and the increased capability and capacity of local businesses to represent significant and enduring benefits to the local region that outweigh any potential post construction downturn.

Tourism potential

Numerous submissions raised the potential for the Project to increase tourism within the region.

Matters contained within submissions included requests that the proponent:

- develop appropriate infrastructure (BBQs, trails, boat ramps etc) at the dam site
- contribute to and integrate with existing bodies' development plans for tourism
- financially contribute toward specific "catalyst" events or infrastructure in the local region and
- promote the region to tourists.

The EIS and SREIS indicate that the Project Area is expected to become a significant drawcard for the local community, residents of SEQ, and tourists from interstate and overseas.

The proponent has committed to the development of an Outdoor Recreation Strategy, inclusive of:

- trails for walking, horse riding, cycling and canoeing
- cycle based tourism; and
- recreational fishing.

Long term economic and social benefits are expected in the Mary Valley as a result of increased tourism and recreational opportunities associated with the Project's recreational uses. The proponent has highlighted the potential for the Project and the associated infrastructure to provide the opportunity to create one of SEQ's premier outdoor recreational areas as well as contributing to the growth and diversification of the local economy.

As discussed in the Agricultural Impacts section of this chapter, <u>I require</u> the development of a Community and Economic Development Program (CEDP) with measures relating to agricultural, tourism and other industries.

The priority of recreational and tourism initiatives is to be developed in consultation with SCRC, GRC, Sport & Recreation Queensland and Tourism Queensland (TQ).

Initiatives targeting local sustainable enterprises, including further tourism development, may offset adverse project impacts on agricultural output and underpin a sustainable local economy that provides opportunities for local community aspirations. In light of the advice received in submissions and noting the details contained in the *State Planning Policy 1/92 (development and conservation of agricultural land)*, particularly the mention of tourism within paragraph 3.3 of the SPP, <u>I have</u> required at Condition 31 of Schedule C, Appendix 1, that the proponent allocate a sum of at least $20 million for the development and implementation of a Community and Economic Development Program (CEDP), which includes $7.8 million for the development and implementation of a Recreation and Tourism Program.

As discussed in the section on Agricultural Impacts (Economic) within this report, this funding is to be allocated to a prioritised list of initiatives within the CEDP (including tourism initiatives) to offset local impacts such as the identified loss of local farm output on the agricultural land inundated as a result of the Project.

<u>I require</u> the Recreation and Tourism Program to include descriptions of design specifications, timing details, cost estimates and implementation plans for:

- the provision and promotion of Project recreational facilities, for example multi-use trails, picnic areas

- the promotion of visitor attraction events
- the provision of infrastructure to support tourism or visitor attraction
- support for tourist attraction activities by local operators
- information interpretative centre relating to local, environmental, cultural heritage, historical or other features
- other recreational and tourism promotion initiatives designed to stimulate the local economy and developed during consultation.

I am confident that, properly implemented, the minimum amount of $20 million for the CEDP (including the amount of $12.2 million for initiatives identified above) will offset any possible reductions in farm income anticipated as a result of the Project and support further tourism development. In this regard, analysis associated with the Queensland Tourism strategy suggests that the multiplier effects of expenditure on tourism development will generate substantial economic activity and employment opportunities for the region.

Combined with mitigations for lost farm output (see Agricultural Impacts section of this report) this required investment provides confidence that economic gains can be generated in excess of the level of income lost due to reduced farm output in existing industries.

Rates - impacts to local government

The change in land use brought about by the inundation of properties is expected to reduce the rate income of the impacted LGAs. A submission was received that suggested loss of general rates income would result in rate rises above inflation for the balance of ratepayers.

The EIS included an estimate, based on existing rateable values, that the project would reduce the rates revenue of the former Cooloola Shire Council by about $298,000 ($2007) or less than 1% of rates revenue; and for the former Noosa and Maroochy shires by less than $20,000 each.

Since the EIS was published the Cooloola Shire Council has amalgamated with the former Kilkivan Shire and Tiaro Shire Councils to form the new Gympie Regional Council. The Noosa and Maroochy Shire Council are now part of the Sunshine Coast Regional Council.

At this time, the proponent continues to pay general rates on the property it owns, at the specified rate for the relevant area and land use.

It would be expected that a change in land use associated with inundation of these properties would reduce the extent of rates to be charged resulting, resulting in a reduced rate base for the affected local government areas.

Over the medium to longer term (10-15 years) the population in the Mary Valley is expected to grow at a rate at least equal to that estimated if the Project did not go ahead.

This stronger population growth in the medium to longer term will support higher land values and therefore rates revenue for the local governments.

In addition, the Council and local community will benefit from upgrades and additions to local infrastructure associated with the Project that would otherwise have been provided by Council overtime, including for example:

- Upgrades of the Kandanga sewage treatment plant
- Local replacement roads in new condition as opposed to aged condition

- Provision of new recreational facilities and opportunities

- Rehabilitation of riparian vegetation in accordance with the aspirations of the relevant planning scheme.

As a result, I consider that the potential short term decrease in general rates revenue for the Local Governments will be suitably offset over time by decreased demand for service provision to the affected properties and other factors associated with the Project as outlined above.

Operational impacts

The operation phase of the Project is not expected to have ongoing negative economic impacts beyond those of its construction.

Conclusion

The proponent and advisory agencies have provided sufficient information for the assessment of the economic impacts of the Project.

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. At the State level, the provision of an additional 70,000 ML per year of water into the SEQ water supply network will be pivotal in underpinning and supporting continued population and economic growth in Queensland.

The Project is expected to deliver enduring regional economic benefits including:

- a discounted national welfare benefit of around $3.44 billion raising national employment and income

- increased real Gross Regional Product and Gross State Product to SEQ and Queensland respectively and

- increased aggregate employment in SEQ (includes approximately 1745 jobs at peak construction in 2009).

The construction of the Project will result primarily in positive economic impacts to the local area as a large workforce will be required and this will provide a range of benefits to the local community through an increased in business activity through use of local services and facilities as well as additional employment and training opportunities.

Economic impacts during the operational stage of the Project will be largely positive, with the completed dam expected to provide increased tourism opportunities to the local area.

The negative impacts during operation of the Project will be mainly associated with the displacement of existing agricultural land use of the directly affected properties and to those subsequent businesses who currently service them.

I have imposed a series of conditions within of Conditions 30, 31 and 32 of, Schedule C, Appendix 1, of this report that will suitably minimise the localised economic impacts.

The injection of capital from land acquisition, replanting of timber on purchased land, up-skilling of labour, and increased capacity and capability of local businesses that provided goods and services for the construction of the Project will ensure longer lasting benefits to the local community into the future.

Compliance with the WRP (i.e. maintaining environmental flows and water entitlements) will avoid impacts to downstream water dependant businesses.

The people of the Mary Valley, particularly those subject to direct property impacts, are being asked to cope with substantial disruption to deliver water security for the SEQ region.

The extensive economic commitments that I have conditioned will ensure that the local economy shall reap the economic benefits of construction, the recreational benefits of the Project, and the stimulation of tourism-related activities that will develop in relation to the Project.

3.12. Hazard and risk

Numerous issues were raised in relation to hazards involved with the Project and risk of undertaking the construction and operation of the Project. I have considered each of the submissions and how the SREIS has responded to the issues raised in submissions. Key issues that I considered warranted particular elaboration and/or explanation in my evaluation included:

- hazard events involving public and Project workforce safety and the implementation of appropriate emergency action plans and
- risks including floods during construction and a sudden dam failure during operation.

These matters are discussed further below in this section of this Coordinator-General's Report.

The EIS and SREIS identify the issues in relation to hazards and risks associated with construction activities of building the dam and its ongoing operation. Chapter 16 of the EIS provides the results of the preliminary hazard identification and a preliminary risk assessment and analysis undertaken by the proponent in accordance with *Australian Standard AS/NZS 430:2004 Risk Management and ANCOLD guidelines*. This assessment addressed the risks which may affect the environment and the health and safety of the community, including the Project workforce.

The main hazard events identified are sudden dam failure and public safety. All other off-site hazards identified due to dam construction are either of low or medium residual risk. The on-site risks to workers during construction are generally low to moderate with the exception of safety risks from blasting and contact with electricity while relocating high voltage power lines. The proponent recommends the development of safety management systems, emergency plans and mitigation measures to be implemented during the design, construction and operation of the dam to manage the residual risk, particularly in relation to sudden and catastrophic failure of the dam.

Climate, climate change, natural hazards and extreme weather conditions have been examined and considered in the design, construction and operation of the Project. Dam safety emergency plans and contingency plans will be developed for the construction, operation and maintenance phases of the Project to account for natural disasters such as storms, floods and fires. I note that while earthquakes have been recorded in the region, the Project is located in an area of low earthquake risk. As the dam will be constructed in accordance with ANCOLD, I am informed that any earthquake risk can be accommodated within the design. As a precautionary measure however to prompt inspection once the dam is constructed, and to add to the broader knowledge of seismic events in Queensland, I have required at Condition 29(i), Schedule C, Appendix 1 that the proponent contribute towards a seismic monitoring station to be integrated as part of the State seismic detection network.

I note that the proponent formed a technical review panel of recognised Australian dam design experts to review the development of the preliminary design and meet regularly with the design team and the Director of Dam Safety from DERM. The proponent indicates that the detailed dam design process will occur over a six month period, prior to construction of the dam, during which time the dam design will be refined by the proponent as further geotechnical information is provided.

It is acknowledged that that the dam design is only preliminary, based on work prepared by SunWater in June 2007 for the proponent, only an initial assessment of the consequences of dam failure has been completed by the proponent. As a result, the required dam break study is yet to be completed. Similarly, the legislatively required failure impact assessment (which must be independently certified) and quantitative level of risk assessment and associated risk contouring will need to be completed to the satisfaction of the dam safety regulator prior to the commencement of construction of the dam wall. It is common practice that these investigations be conducted by the proponent as part of the detailed design of the structure. The investigations produce the information that the dam safety regulator requires in accordance with the detailed requirements set out in Schedule A, Appendix 1.

From preliminary investigations, the proponent considers it likely that the dam will be classified as having an "Extreme" Hazard Category for a Sunny Day Hazard, the Failure Impact Assessment (FIA) will be Category 2 (as defined under the *Water Supply (Safety and Reliability) Act*) and the Incremental Flood Hazard Category will be "High A". Accordingly, the proponent has developed the preliminary design on the basis that sufficient flood discharge is provided to safely pass the PMF, the highest possible category of flood. Modelling indicates that the PMF event would result in a water level of EL 88 m AHD in the storage. The proponent has advised that the preliminary design is such that the downstream community will not be subject to additional risk due to the dam being in place.

A key issue raised in submissions on the EIS was in relation to a flood during construction. I am satisfied that the proponent, in sections 4.5.2 of the EIS and 8.4.2.3 of the SREIS, has suitably responded to this issue by outlining standard dam engineering practices to mitigate construction flood risk. During the three year construction program the critical periods when dam construction is at risk from wet weather conditions are:

- when the foundations are exposed
- the final stage (phase 3) of the RCC when the spillway is acting as the flood flow channel and the RCC is behind the coffer dams
- while the crest monoliths 1 and 2 are under construction with the river closed off allowing the impoundment to start filling

As part of the conditions mentioned below, the proponent is obliged to mitigate the dam construction risk and flood event impact through the use of suitable river diversions, coffer dams, staging of activities and appropriate timetabling of the critical construction activities to coincide with the driest periods of the year.

Another key issue raised in submissions on the EIS was in relation to the possibility of dam failure after construction. I am satisfied that the proponent, in sections 8.3.1, 8.7.3 and 28.2 of the SREIS, has suitably responded to this issue by explaining the independent dam design review process to date and advising why certain analysis of dam failure has not yet been conducted because all relevant parameters needed for such an assessment are not available until detailed design is underway following approval of the Project and prior to commencement of construction.

Additional design work is required and detailed plans and specifications are to be submitted to the Chief Executive, DERM, for assessment of dam safety before the development approval for Operational Works - Referable Dam can be issued. The development approval for operational works for construction of a referable dam issued by DERM will include conditions to ensure the continued safety and structural integrity of the dam.

I have conditioned, at Schedule A, Appendix 1, that the dam will be designed, constructed and operated in accordance with the *ANCOLD Guidelines and the Queensland Dam Safety Management Guidelines, February 2002*, which represent current best practice in dam safety, to ensure that the risk of dam failure is reduced. The final design must include a quantitative risk assessment consistent with the requirements of the *2003 ANCOLD Guidelines on Risk Assessment*.

Given that the Project will almost certainly be within the Extreme Hazard category for dams, an operations dam safety program will be required to address the abovementioned condition.

This will involve:

- at least two emergency trained duty dam operators available at any one time, with one residing at the dam to allow daily visual inspection and monitoring of the physical condition and operation of the dam and instrumentation
- standby operators on call

- dam operating procedures to require a duty flood manager to be able to mobilize for flood operations within a two hour period

- a contingency plan for duty manager operating procedures in the event of loss of communications during a flood event

- major gate operating systems, other than the mains electricity supply, to be duplicated, including the switchboard, electrical motors and winches with a backup diesel generator and fuel available at the dam

- a maintenance program for all operational parts

The *Water Supply (Safety and Reliability) Act 2008* also requires that the owners of referable dams must operate and maintain dams in accordance with the Guidelines on Acceptable Flood Capacity for Dams.

The proponent has committed to the implementation of the necessary emergency/medical/site safety plans and actions must be in accordance with Workplace Health and Safety Guidelines and in cooperation with the Department of Community Safety. The then DES provided recommendations to apply to preparation of suitable emergency action plans and emergency response procedures. I require that the proponent and the dam operator must liaise with DES contacts, provided to the proponent, on an ongoing basis, especially in regard to emergency vehicle access during the changes to the local road networks. The proponent is also obliged to consult with the QFRS regarding the relocation and replacement of the Kandanga Rural Fire Brigade facilities.

I have conditioned at Condition 29, Schedule C, Appendix 1, that the proponent must construct the Project in accordance with the objectives, performance criteria, mitigation measures and other matters contained within Table 30.4.15 of the SREIS. Areas used for recreation will be monitored by the dam operator to maintain public safety. The key hazards during operation are associated with the diesel fuel oil and lubrication oils used for maintenance activities. The preliminary risk assessment shows there will be negligible risk to employees, adjacent land users, general public and the environment from these materials with the implementation of proposed controls for fuel storage and transportation. DERM has assessed the EIS and SREIS and has identified the ERAs to be triggered for works which are hazardous to on-site workers and the surrounding community during the construction phase of this Project. The ERAs are detailed in section 2.8 of this report and conditions for these ERAs, including the storage and use of chemicals and fuels, are contained in Appendix 1, Schedule A to minimise the risk of an incident.

I have conditioned at Condition 29, Schedule C, Appendix 1 that the proponent must undertake all hazard and risk proponent commitments made in Table 30-5 of the SREIS. The proponent must also adhere to the hazard and risk components of Table 30.4.15 (Draft Construction EMP) and Table 30.5.9 and 30.5.10 (Draft Operational Management Plans) of the SREIS.

3.13. Cumulative impacts

The Cumulative Impact Assessment (CIA) undertaken by the Proponent in the EIS assessed the cumulative impact of the Project on valued environmental attributes in consideration of potential cumulative impact pathways and potential risks and opportunities. This involved consideration of the cause and effect relationships between an activity and its potential to impact on the environment, and a review of potential future projects. The EIS identified “valued environmental attributes” that should be protected, maintained or enhanced based on current local and regional strategic planning instruments.

The assessment of risks and opportunities was undertaken for four major Project spatial areas being the dam construction footprint, the inundation area, across associated linear infrastructure (including roads, power telecommunications etc), and downstream of the proposed dam wall.

All potential impacts classified as having a low risk across both geographic and temporal scales were excluded by the proponent from the assessment. The remaining impacts, both adverse and beneficial, were then consolidated to allow comparison against both existing and future activities within the catchment and the Project Area.

Issues were raised in submissions in relation to cumulative impacts. I have considered each of the submissions and how the SREIS has responded to the issues raised in submissions. Key issues that I considered warranted particular elaboration and/or explanation in my evaluation included:

- suitability of methodology
- appropriateness of risk rankings
- impact on downstream habitats, including the Great Sandy Strait
- impact of other projects, including water projects as part of the SEQ Water Grid
- impact on species of national environmental significance, including Queensland Lungfish, Mary River Cod and
- mitigation measures

I am satisfied that the cumulative impact assessment in the EIS addresses the requirements of the Terms of Reference.

The methodology for the cumulative impact assessment in the EIS considered first cumulative impacts associated with the Project during construction, and then the potential for cumulative impacts during Project operation in relation to both existing and future activities. Impacts during the initial filling period were considered in the operational assessment. The risks and opportunities associated with potential impacts were assessed to quantify direct and indirect impacts associated with the Project at a local and regional scale, and potential effects over the immediate, short and long-term time frames. The EIS presents both the initial risks without mitigation measures being implemented, and the risks with mitigation measures implemented in the EIS at tables 17-7 and 17-8. I am satisfied that this is appropriate.

A range of cumulative impacts during construction were identified, including:

- altered hydraulic habitat, including pool infilling, change to riffle substrate and increased sand bar build up causing inundation and loss of riffle habitat and loss of potential habitat for species of MNES
- changes to the flow regime, resulting in both negative and positive impacts, including:
    - clear water scour
    - the opportunity to provide lower but more stable base flows within the Mary River which will support habitat suited to aquatic fauna
    - reduced intermediate flows downstream and associated effects on habitat availability, quality and water quality;
    - reduced sediment supply to the estuary (assessed as likely have a neutral impact)
- loss of good quality agricultural land
- vegetation clearing, mulching and stockpiling, with impacts including:
    - erosion and sediment transport associated with surface runoff over exposed soils
    - potential degradation and loss of remnant vegetation

- clearing of remnant riparian vegetation and habitat.

For the most part, the proponent concluded in the EIS cumulative impact assessment that the mitigation measures proposed are adequate, although there are some cumulative impacts, such as the loss of good quality agricultural land, for which the proponent considers that mitigation measures cannot be provided. I have however imposed conditions requiring the development of a Community and Economic Development Program, in order to address this impact (see Condition 31, Schedule C, Appendix 1).

The operation cumulative impact assessment in the EIS also considered adjacent anticipated future major infrastructure projects including the Bruce Highway upgrade and realignment works, the Northern Pipeline InterConnector, and the water treatment plant. In addition, a range of local development approvals and the proponent's "future sustainability projects" such as the Freshwater Species Conservation Centre, native timber plantations and recreation and tourism planning were considered.

The cumulative impacts identified during operation included:

- MNES species:
    - Mary River Cod, Lungfish and turtle – key research to improve the status of species and possibly develop mitigations for to existing infrastructure
    - Mary River Turtle – management approaches to enhance recruitment and survivorship of adults
    - Giant Barred Frog – the provision of long term habitat to replace that lost through the project implementation
    - Habitat management – MNES related management measures for riparian zones and dam management approaches in regards to aquatic weeds and water quality
- Employment benefits, both direct and indirect and economic benefits to local and regional businesses
- Vegetation clearing, mulching and stockpiling, and excavation including localised bed degradation and bank erosion from in-stream aggregate excavation and erosion and sediment transport associated with surface runoff over exposed soils.
- Greenhouse – offset for carbon emissions, loss of stores during construction and operation, however the proponent calculates this as a positive impact due to plantation offsets.

The cumulative impact assessment in the EIS, SREIS and the relevant submissions assisted me in my further consideration of potential cumulative impacts and the management of such potential impacts.

While the cumulative impact assessment in the EIS addresses the Terms of Reference, the cumulative impact assessment in the EIS and SREIS clearly could not take into account the responses from the proponent to my Information Requests, the issues raised in the Reviewer Reports, the proponent's Response to Reviewer Reports, and temporal changes since the EIS and SREIS (for example the changed relative delivery timeframe of the adjacent Bruce Highway upgrade). Most importantly, the cumulative impact assessment prepared by the proponent could not consider the conditions that I have imposed, having considered all material supplied to me by the proponent, the submissions, advice from agencies and the Commonwealth Reviewer Reports.

I have evaluated the cumulative impacts of the Project having regard to the potential risks and benefits that the Project will create, the mitigations and commitments proposed by the proponent, and the conditions I have imposed for the Project.

In the Habitat Restoration Plan, the proponent at Section 7 notes that the general trend of catchment condition has been that of ongoing degradation, commencing with the clearing of productive floodplain in the 1880s, followed by the introduction of pest animals, weeds, grazing pressure, declining water quality and chemistry, continued suppression of natural regeneration, significant erosion and sedimentation (resulting in the loss of pool habitat), de-snagging of in-stream habitat and construction of impoundments without adequate consideration of fauna passage. It is further suggested that degradation will continue without targeted mitigation measures at a suitable scale including improved flow connectivity.

The Reviewer Reports are consistent with this view, in that the MNES species have suffered a decline within the Project Area and the Mary River catchment as a result of catchment degradation accompanied by the effects of predation.

I therefore accept that the mitigations to be provided as part of the Project provide an opportunity to reduce, stabilise and reverse the degradation processes in those parts of the catchment that will be directly affected by the Project, and in other parts through additional mitigation measures. I concur with the proposition in the Habitat Restoration Plan within the Response to Reviewer Reports that the Project presents a unique opportunity to enhance the long term survival of the EVR species, particularly the Mary River Cod, Queensland Lungfish, Mary River Turtle and Giant Barred Frog.

While my evaluation of specific key attributes is explained above in the relevant report sections, I make the following broad observations in regards to important aspects of the cumulative effect of my required mitigations and offsets in respect to those key attributes:

- The proponent has predicted impacts on downstream flows and the portion of the Mary River to be occupied by the inundation area, and outlined mitigations in response to these predicted impacts. I have conditioned downstream flow performance indicators to protect identified ecological requirements for key aquatic species that provide a significantly higher level of mitigation in regards to aquatic habitat and species protection compared to those presented in the EIS and SREIS.

- The loss of riverine habitat within the inundation area requires downstream flow management measures to be optimised for the preservation of a range of species. In my view, implementation of the Flow Performance Indicators at Dagun Pocket, will mean that flows during July, August, September, and October will improve from the current situation and enable a return towards the larger winter and spring flow patterns experienced prior to agricultural development in the Mary River catchment. I consider that there will be an enhanced ability to manage releases to produce greater water level stability in the critical stretch of the Mary River from Dagun Pocket to Fisherman's Pocket during the key lower flow months of July through to January. This part of the Mary River contains breeding habitat for species such as Lungfish and nesting sites for the Mary River Turtle. Sustained lower and more stable flows during winter and spring, along with ongoing periodic large flows in summer/autumn, are particularly important for sustaining and generating macrophyte coverage and hence general aquatic life. Stable base flows and minimal extraordinary large flows during winter and spring are desirable factors in relation to Lungfish, Mary River Cod and the broader fish community. In addition the reduced overall flows (i.e. on a whole of year basis) in the most impacted section of the river downstream of the Project will also result in an increased percentage of combined riffle and pool habitat, at the expense of some run habitat.

- In the inundation area the proponent has committed to aquatic habitat establishment measures and some fringing riparian vegetation to improve the aquatic ecological values in the inundation area and towards offsetting the loss of the riverine environment to be inundated. Additionally, the fringing riparian vegetation is anticipated to have inundation area water quality benefits. I have required through conditions protected riparian habitat areas that are considerably more extensive than those considered in the EIS and SREIS. These will have greater benefits for terrestrial species in terms of both habitat and connectivity and provide even greater levels of aquatic impact mitigation as terrestrial riparian vegetation is directly related to aquatic ecological benefits providing for example the starting point of food chains, water quality filtering, overhanging shading vegetation, bank stability, protection against edge effects and predation.

- I consider that provision for the protection and re-establishment of native vegetation set out above is essential to provide mitigations in direct response to predicted Project impacts. My conditions in regards to buffer requirements, riparian habitat and wildlife corridors will enhance habitat values around and within the inundation area. This will provide significant mitigation for the conversion of degraded riverine habitat to lacustrine aquatic habitat with substantial and enduring fringing riparian habitat, with resulting advantages for native species increasing over time. The provision of extensive riparian buffers and related in-stream restoration within the Project Area, both upstream and downstream of the inundation area, will provide bank stability and water quality improvements but most importantly will provide enhanced habitat compared to the current situation for a range of important and vulnerable species including the Giant Barred Frog.

- As discussed above I am satisfied that the Project in itself and cumulatively will have no discernible impact on the estuary, including the Great Sandy Strait Ramsar Wetland. As a precautionary measures however, I have required an estuarine monitoring program to be implemented.

- The flow performance indicators together with the requirements for protected riparian habitat both around the immediate inundation area and within the broader catchment are likely to lead to an overall improvement in existing water quality within the catchment. Through mitigation of direct and indirect potential Project impacts, I am satisfied that generally water quality within the catchment can be improved, to the benefit not only of water users, but also species reliant on water quality.

- The Project will provide a mix of localised negative social and economic impacts as well as a range of social and economic benefits to both the local project area and the surrounding region. The Project will require the purchase of significant numbers of properties in addition to those already purchased by the Queensland Government. During construction of the Project there will be localised negative impacts, particularly for the directly impacted property owners or due to road diversions or changes stemming from construction activities, however, with proactive management and conditioning these impacts can be minimised. At the regional level, the social and economic impacts of the Project will be largely positive, with the completed dam expected to improve the supply and reliability of water.

- In addition to the mitigation measures outlined above to respond to Project impacts, and to provide greater certainty regarding the predicted impacts and mitigation measures, I have required that the proponent carry out additional research to better inform an understanding of species requirements and to inform continuous improvement of mitigation measures, monitoring, environmental management framework and broader catchment conditions targeted at priority areas outside the Project Area

I consider that on balance the potential cumulative impacts of the Project will be positive, particularly in consideration of the improved environmental and habitat outcomes that will be created. The social and economic impacts of the Project in regards to SEQ are strongly beneficial, but I recognise that while there are many positive local economic and social benefits that will result from the Project, the process of change and the resulting uncertainty has caused anxiety and distress to many local residents. However in view of the need for the Project and the mitigation and offset measures that have been imposed, I consider that overall, the cumulative impacts of the Project are positive and the adverse impacts are acceptable.

4. Assessment of the relevant impacts of the Project on matters of national environmental significance

4.1. Introduction

This section addresses the requirements of part 5 of the *State Development and Public Works Organisation Regulation 1999* (SDPWO Regulation). In part, the SDPWO Regulation determines the requirements for the Coordinator-General's Report for project proposals:

- that are declared as a significant project for which an EIS is required; and
- for which the relevant impacts of the project are to be assessed under a bilateral agreement.

The SDPWO Regulation and the Bilateral Agreement requires the Coordinator-General's Report for the Project to contain:

- a description of the Project, the places affected by the Project and the controlling provisions for the Project
- a summary of the Project's relevant impacts
- a description of feasible mitigation measures, changes to the Project or procedures, to prevent or minimise the Project's relevant impacts, proposed by the proponent or suggested in relevant submissions
- to the extent practicable, a description of feasible alternatives to the Project identified in the EIS process, and the likely impact of the alternatives on matters of national environmental significance
- a statement of conditions of approval for the Project that may be imposed to address impacts, identified in the EIS process, on matters of national environmental significance
- a statement of requirements for, and conditions of approval applying, or proposed to apply, to the Project when the report is prepared, including a description of the monitoring, enforcement and review procedures applying, or proposed to apply, to the Project.

4.2. The Project

The Project is the construction and operation of the Traveston Crossing Dam Stage 1. The Project is described at section 1.2 of this report. The proponent of the Project is Queensland Water Infrastructure Pty Ltd (QWI).

4.3. Stage 2

The referral for the Project under the EPBC Act was for Stage 1 only, noting that a separate referral would be required for Stage 2 should it proceed. Whether or not Stage 2 proceeds is subject to a range of considerations, including changes in technology, population projections, climate change and assessment requirements. There is no present intention or decision by the Government to proceed with Stage 2. There is no legislative authority or funding to proceed with construction of Stage 2. It may be that at the time demand exists for additional water supplies, a different course of action to Stage 2 may be considered more appropriate. Furthermore, I have not been asked and nor have I considered any approval for Stage 2 as part of my deliberations.

By letter dated 10 May 2007, the then Minister for the Environment and Water Resources asked both QWI and the State of Queensland to clarify why Stages 1 and 2 of the proposed Traveston Crossing Dam were not referred simultaneously and sought further information as to which elements of Stage 1 will be built to Stage 2 planning levels and which elements will form part of the Stage 2 proposal. Following the response from the State of Queensland and QWI, the then Commonwealth Minister for the Environment and Water Resources responded by letter dated 3 August 2007 that he was satisfied that Stage 2 of Traveston Crossing Dam does not require a separate referral and assessment under the EPBC Act, noting the commitment of the Queensland Government that if a decision is made to progress Stage 2 at some time in the future, that proposed action will be referred for consideration in accordance with the provisions of the EPBC Act. That correspondence is contained at Appendix G of the EIS.

I am of the view that Stage 2 is not a direct consequence of Stage 1, as Stage 1 does not cause Stage 2 to occur and Stage 2 is not an impact of the Project. For Stage 2 to occur, other steps must be taken, including a policy decision by the Queensland Government as to whether or not to proceed with Stage 2. Further, I am of the view that Stage 2 is not an indirect consequence of Stage 1, and that Stage 1 is not a substantial cause of Stage 2.

However at the request of the Commonwealth Environment Minister, to inform his understanding of the consequences of Stage 2 proceeding, the Coordinator-General requested the Proponent to include in the EIS a description of Stage 2 and the relevant impacts of Stage 2 where practicable.

In response, section 4.13 of the EIS includes an assessment of the relevant impacts of the Stage 2 components of the Project, as well as an assessment to the extent practicable of the likely impacts on MNES if Stage 2 were to proceed.

The assessment of relevant impacts of the Stage 2 components of the Project are included within the MNES assessment (as evaluated below), and the assessment of the components concludes that potential impacts on World Heritage, Ramsar Wetlands and Migratory Species are no greater than if the Stage 2 components of the Project were not included. Impacts on Listed Threatened Species and Communities are the same as for the Stage 1 project without Stage 2 components, except for a small area of regional ecosystems that are affected by some of the road realignments to Stage 2 levels, in particular the Knobby Glen Road realignment.

The assessment found that if Stage 2 were to proceed, the controlling provisions that would be likely to apply are:

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

An assessment of the possible impacts of Stage 2 on these controlling provisions found that impacts on World Heritage and National Heritage are unlikely assuming the existing targets in the WRP could be met.

The predicted impact on the downstream Great Sandy Strait Ramsar wetland was found to relate primarily to reduced flows. It was found that high flows, sediment regime and water quality changes associated with Stage 2 would be unlikely to cause a discernible impact in the wetland, but that reduced low flows in winter and spring and potentially more frequent and extended periods of no flow could lead to changes in the upper estuary related to increased salinity, with consequential changes in plant life and fauna. The ability of the operational rules of the dam to achieve the desired outcomes would need to be tested at the time through iterative hydrological analysis.

For listed threatened species and communities, the EIS found that a possible Stage 2 would further inundate the habitat for the Giant Barred Frog, Lungfish, Mary River Cod and Mary River Turtle. The downstream flow regime would be further modified, with low to moderate flows the most impacted. The degree of change would be greatest from the dam wall to about Fisherman's Pocket, with low to moderate flows the most impacted and the flow regime more strongly regulated. The environmental flow regime would need to be reviewed and developed at that time through iterative hydrological modelling and compliance requirements of the water resource plan in effect at that time.

The proponent concludes in the EIS that there are no significant impacts on listed migratory species if the possible Stage 2 proceeds based on the assessment for the Project that:

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

- the area does not support habitat known to be of critical importance to any such species at particular lifecycle stages

- none of the species recorded is considered to be at the limits of its range in the area and

- none of the migratory species recorded is known to be declining in the area.

Should a policy decision be made to pursue Stage 2 at some future point in time, then separate environmental assessment will be required in accordance with the Queensland State and Commonwealth requirements that apply at that time. Such environmental assessment would need to consider the potential impact of a proposed Stage 2 on the environment. The assessment would need to take account of the potential impact on outcomes of the mitigation measures that I have imposed through conditions, including flow performance indicators, water quality outcomes, protected riparian habitat within the Project Area and the broader catchment enhancement program, as well as the requirements of water resource planning that apply at that time.

Given the potential impacts of a possible Stage 2, including on the species enhancement outcomes achieved through Stage 1, I recommend that the Government should reflect on the suitability of the potential Stage 2 project, that the strategy for long term water supply for SEQ should not rely upon Stage 2, and Government should consider alternative water supply measures to address identified long term water supply requirements.

4.4. Controlling provisions for the Project

On 29 November 2006, the then Commonwealth Minister for the Environment and Heritage determined that the Traveston Crossing Dam Stage 1 Project (EPBC reference 2006/3150) was a 'controlled action' under section 75 of the EPBC Act.

The controlling provisions of part 3 division 1 of the EPBC Act that apply to the Project are:

- Sections 12 and 15A (World heritage)

- Sections 16 and 17B (Ramsar wetlands)

- Sections 18 and 18A (Listed threatened species and ecological communities)

- Sections 20 and 20A (Listed migratory species).

4.5. Commonwealth reviewer reports

In preparing this evaluation report, I have considered the findings of the Commonwealth Reviewer Reports and the proponent's response to those Commonwealth Reviewer Reports (see also the discussion at section 2.8). I have also received ongoing input from State agencies on the issues raised in the Commonwealth Reviewer Reports to assist in my evaluation of the EIS.

The Commonwealth Reviewer Reports have provided a valuable input to my evaluation of the EIS for the Project, and I have considered the issues raised in the Commonwealth Reviewer Reports in my evaluation of relevant impacts of the Project and in setting conditions for the Project to respond to potential impacts.

The Commonwealth Reviewer Reports raised a number of criticisms regarding the assessment of impacts within the EIS and SREIS and the certainty and implementation of mitigation measures to respond to those impacts.

In considering the issues raised in the Commonwealth Reviewer Reports, I make the following observations:

- the proponent provided a response to the Commonwealth Reviewer Reports to me on 28 August 2009, which needs to be considered in conjunction with the Commonwealth Reviewer Reports
- at the time the Commonwealth Reviewer Reports were released, the issues raised in those reports largely aligned with the issues I had identified and was considering in my evaluation, including issues that were the subject of further information requests to the proponent (see section 2.7) and input from my advisory agencies
- the Commonwealth Reviewers delivered their reports before the proponent had completed responding to my information requests. The Commonwealth Reviewer Reports need to be considered in the context of the response to my information requests provided by the proponent
- issues regarding uncertainty of species requirements raised by the Commonwealth Reviewers have been addressed through the precautionary approach to my evaluation and my imposed conditions, and the application of existing legislative requirements and enforcement measures. In particular, it should be recognised that my imposed conditions are statutorily enforceable conditions, and have been designed to provide a robust, comprehensive and conservative response to the potential impacts and residual risks identified through this evaluation process. In particular, my imposed conditions provide for:
    - large scale habitat restoration
    - restrictions on principal construction until performance outcomes are incorporated into detailed design and acceptable habitat restoration benchmarks are achieved
    - detailed mitigation measures supported by pre-construction trials and targeted species data collection and research
    - monitoring of the success of mitigation measures and additional mitigation requirements informed through monitoring results and
    - regular and stringent compliance reporting
- following the delivery of the Commonwealth Reviewer Reports, officers from my Department were provided with an opportunity to attend the oral briefing provided by Professor Bunn, Professor Walker and Doctor Kuchling. At those oral briefings, qualifications pertaining to the methodology and scope of analysis, additional to those identified in the Commonwealth Reviewer Reports were identified.

In relation to the scope and methodology adopted by the reviewers, I understand that the reviewers were provided with the EIS and SREIS as the primary basis for their review. Based on Mr Bewsher's report, Mr Bewsher's methodology included interviews with technical consultants to the EIS and State advisory agency experts, and he also examined the hydrological data that underpinned the analysis in the EIS. The methodology of the remaining reviewers did not include similar interviews, however Dr Kuchling was provided with access to raw data collected by the then EPA in relation to freshwater turtle species.

Given the fundamental interrelationship between the hydrological analysis and the potential impacts on matters of national environmental significance, Mr Bewsher's review provided me with a high degree of confidence in relation to my evaluation of those aspects of the EIS.

The detail as to how the matters raised in the Commonwealth Reviewer Reports have been addressed where relevant in the following sections of this evaluation report:

- water resources and water quality (section 3.2)
- terrestrial environment (section 3.3)
- aquatic environment (section 3.4) and
- summary of relevant impacts and proposed mitigation measures (section 4.6)

4.6. Consideration of the precautionary principle

A number of submissions to the EIS raised the issue of the precautionary principle, and urged me to recommend that the Project not proceed on the basis of this principle.

Precaution, and the associated prudent implementation of risk management measures, is a response to the inherent difficulties faced by decision makers confronted with uncertainty about potential risks and outcomes. The formulation of risk management strategies are problematic in the presence of uncertainty because much of the information required for such analyses is not available or is inconclusive. However, generally speaking it is not a viable option for decision-makers to do nothing in the face of uncertainty and risk.

It is clear from the information provided to me (via the EIS, SREIS, public submissions, Government Agencies and the Commonwealth Reviewer Reports) that the Project Area specifically, and the Mary River generally, represents heavily modified habitat conditions for aquatic and frog species.

Four of the NES-listed species (i.e. Mary River Cod, Lungfish, Mary River Turtle and Giant Barred Frog) have generated particular discussion and comment in the submissions.

The existing situation for these four NES species (Mary River Cod. Lungfish, Mary River Turtle and Giant Barred Frog) on a catchment wide basis is typified by high degradation of the terrestrial and riverine habitats they utilise as well as ongoing threatening processes affecting their long term viability. The examples of intact habitat or strongholds for the NES species are limited and increasingly isolated from each other.

The information before me indicates the four NES species have all experienced long-term declines as a result of lost habitat and reduced water quality and, particularly in the case of the Mary River Turtle, by predation.

I consider that, unless there is a step-change to the environmental quality of the catchment's terrestrial and riparian habitat and river system's water quality and in-stream habitat, the threatening processes that have affected the four NES species to-date are likely to continue to place the viability of the species at risk. The reliance of the four NES species on limited remaining strongholds highlights both the importance of intact habitat to these species as well as the increasing risk to the species from external factors as they form sub-populations in these isolated pockets which allow little genetic transfer between sub-populations.

Despite active efforts by the community to secure the future of these species over many years (including recovery plans/efforts for the Mary River Cod, Mary River Turtle and Lungfish) they remain in decline and at risk.

The approach of the proponent, which is supported by its panel of scientific advisers, has been to commit to a package of measures designed to offset adverse impacts and produce an overall net benefit outcome for the species. This approach is commendable and provides confidence that the mitigations as proposed will adequately ensure the survival of the NES species.

The Proponent has provided further detail on the implementation of mitigation measures via the "implementation framework" focused on these vulnerable or endangered species under the EPBC Act.

Taking into account the potential impacts identified through the EIS and SREIS, the submissions to the EIS and the Commonwealth Reviewer Reports, the proponent's response to the Commonwealth Reviewer Reports and the response to information requests provided by the proponent, I have taken a conservative, cautious approach in the evaluation of impacts and the imposition of conditions on the Project.

I have imposed conditions on the Project directed at ensuring the following outcomes are achieved:

- large scale habitat restoration
- restrictions on principal construction until performance outcomes are incorporated into detailed design and acceptable habitat restoration benchmarks are achieved
- detailed mitigation measures supported by pre-construction trials and targeted species data collection and research
- monitoring of the success of mitigation measures and additional mitigation requirements informed through monitoring results and
- regular and stringent compliance reporting

I consider that the conditions imposed on the Project are appropriate for responding to potential impacts and residual risk to matters of national environmental significance, including those matters where there is a lack of full scientific certainty about the effects of the Project.

4.7. Summary of relevant impacts and proposed mitigation measures

World Heritage Areas and Ramsar wetlands

Project impacts on World Heritage and Ramsar wetlands are discussed in detail at section 3.1, 3.2 and 3.4 of this report.

Downstream from the proposed Project, the Mary River flows into the Great Sandy Strait Ramsar Wetland. A further 10km from the coastline is the Fraser Island World Heritage Area. Both these protected areas feature outstanding biodiversity values providing critical habitat for migratory and EVR species. They also have significant economic, recreation and aesthetic values for the local community, and the State of Queensland.

The Great Sandy Strait Ramsar Wetland is particularly important for its shallow seagrass beds, mangrove forests, salt marshes and saltpans. The Wetland is fully contained within the Great Sandy

Marine Park. The majority of the wetland receives additional protection under *Queensland Fisheries Act 1994* as a Fish Habitat Area and a Dugong Protection Area.

Fraser Island is the largest sand island in the world. It is known for its diverse vegetation communities including swamps, heaths, woodlands, and rainforest, as well as pristine freshwater lakes. Its World Heritage listing recognises its diversity in species and its unusual and dynamic geological processes. Almost all of Fraser Island is protected through the Great Sandy National Park.

The submissions demonstrated the public is highly protective of the environmental values of the Mary River Estuary, Great Sandy Strait and Fraser Island.

In all cases, the core issue is a concern that the Project would change hydrologic flows and water quality impacts at the Estuary, Bay or Island. Another major issue related to turbidity and sediment loads. Concerns were expressed about increased sediment loads causing sand and mud bars at the river mouth or destroying the sea grass beds. Alternatively concerns were raised over reduced, or changed particle size sediment loads having an effect on Fraser Island. A number of submissions highlighted potential bank erosion impacts due to the Project.

Other water quality issues included changes to nutrients or increasing salinity.

The mandated sediment and erosion controls will suitably mitigate impacts upon water quality during construction thereby ensuring that the construction of the Project will not impact on the Estuary, Bay or Fraser Island.

Any impact on the Estuary during Project operations, relating to changes in water quality or flow, is unlikely to be of sufficient magnitude to be detectable due the comprehensive conditions relating to these matters within Conditions 8 and 9, Schedule C, Appendix 1.

Analysis of the EIS flow models demonstrate that the Project's proposed release regime will have only a minimal impact on the flows to the Mary River Estuary when compared to the existing situation. Mean total flow volumes to the Estuary will reduce by 4%. According to the EIS, the peak daily flows during floods at the Estuary will reduce between 4-17%, however, this represent only 1% of the volume of flood water. The impacts of additional zero flows to the Estuary are also negligible with only 7 extra days identified during the 109 years of the data modelling. Furthermore, the required flow regime that <u>I have mandated</u> will also result in slightly enhanced flows during the typical low flow months.

Concerns that the Mary River sediment and nutrients loads are necessary for Fraser Island are disputed by the proponent. The proponent indicates that the Island's sediment is sourced from longshore drift up the east coast not the Mary River. Sediment plumes from the river move towards Hervey Bay and eventually flow over the continental shelf.

The minimal reductions in sediment and nutrients are not expected to have any perceptible impact on seagrass, mangroves, and saltmarsh communities. Similarly, macro invertebrate communities are unlikely to be impacted. Nor is it likely that the Project would have any impacts on Bay coral.

There may be some salinity increase in the upper estuary due to the reductions in flow mentioned above. However, the impacts will be negligible since the Mary River Barrage and the natural tidal influences are the dominant factors in determining Estuary salinity.

The Project will result in improved water quality, through reduced sediment loads and subsequent nutrient levels. However, 208km downstream at the Estuary this impact will be very minor. Even the expected reduction in fine sediments of 20% will be difficult to detect as tide, wind and wave action causes re-suspension. Additionally, the Mary River sediment loads will still be well above its natural state.

Summer and autumn flows can also be important as a cue for the migration or reproduction of fisheries species. Even with the current development and the Project, Summer and Autumn mean daily flows will only reduce to 92% and 93% respectively to the predevelopment flows, this will not cause an additional impact.

In light of many concerns raised by submitters in relation to Hydrological matters, the analysis within the Bewsher review was particularly useful in terms of confirming the robustness of the proponent's hydrological modelling and thereby provided me with an extra degree of confidence in relation to this complex technical field.

In addition, I have found Professor Bunn's advice regarding downstream flow requirements (e.g. the benefits in maintaining sound base flows) and the likelihood of there being limited or no impacts on the estuary helpful in reinforcing views that I was forming in relation to these matters.

Professor Bunn stated that:

> *"I concur with the proponent that species associated with the inter-tidal areas and the large seagrass beds within the Great Sandy Strait Ramsar Wetland, downstream of the proposed dam are unlikely to be greatly affected, given the upper catchment location of the proposed dam (~208km AMTD) and relatively minor flow alteration at the mouth of the river (at least as proposed in Stage 1). Similarly, the proposed dam in unlikely to result in the loss, damage or degradation of any of the World Heritage values of either the Great Barrier Reef WHA or Fraser Island World Heritage Area."*

Professor Walker seems to agree with Professor Bunn in stating that:

> *"…it is difficult to identify likely changes (to the estuary) that could confidently be ascribed to dam operations, and none is likely to be on a scale to match the specifications in the (EPBC Act) guidelines."*

As a result, the Project is not predicted to have any discernible impact upon Fraser Island or the Great Sandy Strait. The impact on the Estuary will be negligible. As the Project will not have any significant impact on the marine vegetation, macro invertebrates, coral, of fish communities, it is not expected to have any impact upon the EVR or migratory bird, mammals, reptiles and sharks that depend upon the estuary and the Great Sandy Strait.

Consistent with the precautionary approach that I believe is warranted, as discussed in section 4 of this report, I have required at Condition 24 that the Proponent develop an estuarine monitoring program for my approval prior to the extraction of Project Yield. My specifications for this program require monitoring to be implemented to confirm the expectation of minimal impacts on the estuary.

Listed threatened species and communities

Table 17 presents the EVR species and communities present or considered likely to be present in the study area.

- **Table 17: EVR species and communities present or likely to be present in the study area**

Common Name	Species Name	NC Reg	EPBC	Presence in Study Area
		Status		
EVR Plants				
Slender Milkvine	Marsdenia coronata	Vulnerable	Vulnerable	Confirmed. Adjacent to Yabba Creek & Skyring Creek
Ball Nut	*Floydia praealta*	Vulnerable	Vulnerable	Highly Likely
Hairy-joint grass	*Arthraxon hispidus*	Not listed	Vulnerable	Likely (low)
Three-leaved bosistoa	*Bosistoa transversa*	Not listed	Vulnerable	Likely (low)
Minature moss-orchid	*Bulbophyllum globuliforme*	Not listed	Vulnerable	Likely (low)

		NC Reg	EPBC	
-	*Cossinia Australiana*	Endangered	Endangered	Likely (low)
A fontainea	*Fontainea rostrate*	Vulnerable	Vulnerable	Likely (low)
Macadamia nut	*Macadamia integrifolia*	Vulnerable	Vulnerable	Likely (low)
Small-fruited Queensland nut	*Macadamia Ternifolia*	Vulnerable	Vulnerable	Likely (low)
A plectranthus	*Plectranthus omissus*	Endangered	Endangered	Likely (low)
A plectranthus	*Plectranthus torrenticola*	Endangered	Endangered	Likely (low)
Shiny-leaved coondoo	*Pouteria eerwah*	Endangered	Endangered	Likely (low)
-	*Romnalda strobilacea*	Vulnerable	Vulnerable	Likely (low)
Brush sophora	*Sophora fraseri*	Vulnerable	Vulnerable	Likely (low)
Austral toadflax	*Thesium australe*	Vulnerable	Endangered	Likely (low)
Southern penda	*Xanthostemon oppositifolius*	Vulnerable	Vulnerable	Likely (low)
EVR Reptiles and Amphibians				
Three-toed snake tooth skink	*Coeranoscincus reticulates*	Rare	Vulnerable	Likely (Low)
EVR Frogs				
Giant Barred Frog (Southern barred frog)	*Mixophyes iterates*	Endangered	Endangered	Present
EVR Mammals				
Grey-headed flying fox	*Pteropus poliocephalus*	Not listed	Vulnerable	Present
Large-eared pied bat	*Chalinolobus dwyeri*	Not Listed	Vulnerable	Likely (low)
Spotted-tailed quoll	*Dasyurus maculates maculates (SE mainland)*	Vulnerable	Endangered	Likely (low)
EVR Birds				
Coxen's fig-parrot	*Cyclopsitta diophthalma coxeni*	Endangered	Endangered	Likely (low)
Regent honeyeater	*Xanthomyza Phrygia*	Endangered	Endangered, (migratory)	Likely (low)

		NC Reg	EPBC	
Swift Parrot	*Lathamus discolour*	Endangered	Endangered	Likely (low)
Red goshawk	*Erythrotriorchus radiates*	Endangered	Vulnerable	Likely (moderate)
Painted Snipe	*Rostratula benghalensis s. lat.*	Vulnerable	Vulnerable	Likely (moderate)
EVR Fish Species				
Mary River Cod	*macculochella peeli mariensis*	*Protected under Fish and Oyster Act 1914*	Endangered	Present
Lungfish	*Neoceratodus forsteri*	*Protected under Fish and Oyster Act 1914*	Vulnerable	Present
EVR Freshwater turtles				
Mary River Turtle	*Elusor macrurus*	Endangered	Endangered	Present

EVR plants

For over 150 years, the Mary River catchment has been modified through the timber, horticulture, grazing, and river mining (originally gold but in recent years sand and gravel) industries. Additionally, an ever growing portion of its catchment has now been covered in rural-residential development. These intensive industries and housing development have all had a significant impact on the Mary River and its catchment, principally through vegetation clearing. The terrestrial environment in and around the Project Area has similarly been subject to significant development. At the time of European settlement the area boasted dense subtropical rainforest and eucalypt woodlands. The high rainfall, deep soils and habitat complexity would have contributed to a significant abundance and diversity in terrestrial life. However, the impact of timber gathering, agriculture development and other activities has significantly altered the landscape and diminished the area's biodiversity values.

A *1997 Land Use, Vegetation Cover and Land Disturbance Survey of the Mary River Catchment (Pointon 1998)* was conducted for the then Department of Natural Resources. The study concluded that, in terms of vegetation coverage, only 1% of the Mary River Catchment was still in its natural state whilst a further 5% was largely intact (some impacts from seasonal gazing). A further 10-15% had vegetation of a quality that would meet the requirements of remnant vegetation. Non remnant vegetation equated to a further 24-29% of the catchment. Therefore, the 50-60% of the catchment had been extensively to completely cleared by that time.

Within the Project Area, the extent of clearing is reported in the EIS to be approximately 85%.

Despite this level of disturbance, two EPBC Act listed plant species have been identified or are considered likely to be present, being the vulnerable slender milkvine (*marsdenia coronate*) and ball nut (*floydia praealta*).

Slender milkvine can be found in various locations in South East Queensland and Northern NSW. A few individuals were found at two sites: one site would be inundated, whilst a second site is just outside of the inundation area. Despite targeted searches, very little slender milkvine was found in the broader study area as described in the EIS. However, the Project does result in the loss of approximately 7.5ha of potential habitat (stands of 12.11.3 or 12.11.11 on hill-slopes and foot-slopes). Some habitat will not be affected including, for example, areas near Gibber Creek and Yabba Creek. The proponent is committed to develop an active Translocation Plan and I have conditioned at Condition 21(f), Schedule

C, Appendix 1, that suitable translocation and/or propagation plans must be documented and implemented to ensure no net loss of the species.

Despite targeted searches, no individuals of ball nut were found within the broader study area containing the Project Area. However, the Project would result in the inundation of 7.36ha of potential habitat (RE 12.11.10 and 12.11.11) for this species. Ball nut is a tall tree growing to 30m with rough, brown bark. Following the release of the EIS several individuals of ball nut were found close to the periphery of the Project Area within a remnant vine forest - RE 12.11.10. These individuals will not be impacted by inundation, the Dam wall or road infrastructure. There are 26 historic records of ball nut being identified in the Mary Valley (in the vicinities of Kenilworth, Amamoor and Imbil).

Further, as with up to 14 other EVR plant species assessed in the EIS as being of low likelihood to be present within the Project Area, Condition 21(f), Schedule C, Appendix 1 requires the proponent to offset any loss of the plant if it is identified as being present in the future.

Despite the possible loss of habitat for particular individuals, it is expected that all the present EVR flora species will remain within the Project Area since viable habitat will remain and I have mandated appropriate offset and mitigation activities in Condition 21, Schedule C, Appendix 1 and Schedule A.

I have imposed conditions that require that these EVR plants are successfully integrated into the extensive VMO and riparian habitat restoration works that are mandated, particularly through Condition 4, Schedule C. Appendix 1. If additional EVR plants are found during the works, the priority is to protect the plants, and if that is not possible, to undertake propagation and/or translocation activities on land to be restored to vegetation to ensure no net loss of individuals from the Mary Valley.

EVR reptiles and amphibians

The Three-toed Snake-tooth Skink (Coeranoscincus reticulates) is listed in both the Commonwealth EPBC Act (vulnerable) and the Queensland NC Reg (rare). This species is better known in mountainous rainforest habitat within southern Queensland, including the Conondale Ranges. However, it has also been found in forest on sand dunes at Cooloola.

The Three-toed Snake-tooth Skink is a cryptic species and may be found in well-mulched, loose, rainforest soil in leaf litter, often immediately adjacent to fallen tree trunks.

The EIS survey included targeted but unsuccessful searches for the Three-toed Snake-tooth Skink. However, after the release of the EIS documents, the remains of a Three-toed Snake-tooth Skink were found in a property just outside of the Project Area.

Threats to this species include loss of leaf litter and soil compaction through overgrazing by stock, clearance of habitat for agriculture and grazing, removal of fallen logs and leaf litter through frequent fire and fragmentation of habitat. Most of these processes have already occurred within the study area. The EIS indicates that, if this species is present at the Project Area, it will probably be on the hill-slope vine forest. As there is less than 7.5ha of this habitat is in the inundation area and considerably more outside of the inundation area it is unlikely to have a significantly impact should the species be present.

The Three-toed Snake-tooth Skink is likely to benefit from my conditions (at Condition 4(f), Schedule C, Appendix 1) for the proponent to create a wildlife corridor linking the vegetation to be restored within the inundation area buffer to its preferred eucalypt forests outside of the Project Area.

Giant Barred Frog

Since the 1970s there has been a significant decline in Queensland stream dwelling frogs. Giant Barred Frogs (and Cascade Tree Frogs) have been part of this overall decline. While the cause of the decline is not certain; it is thought to be associated with infection from the Chytrid fungus. However, it may also be related to a combination of changes to habitat associated with water quality changes, clearing, and/or the impact of introduced animals.

The Giant Barred Frog's abundance has declined throughout its entire range (particularly NSW), including local extinctions from localities where it was once well known. In Queensland it appears to have disappeared from Bunya Mountains and Cunningham's Gap. It was once thought to have disappeared from the Conondale Ranges, however, a few specimens were found in 2001.

The occurrence of Giant Barred Frogs within the broader study area surrounding the inundation area and the Mary River catchment area are described in Section 18.4.2.1 of the SREIS. The combined findings of surveys by Mary River Catchment Coordinating Committee and to inform the EIS identified 12 Giant Barred Frogs within the study area, with only two of these being outside of the inundation area. The survey sites where the species was recorded within the study area were stream sites within both remnant and non remnant riparian vine forest and gallery forest adjacent to Belli Creek, Happy Jack Creek, Skyring Creek, Mary River and Coonoon Gibber Creek. It was located adjacent to the Mary River at only two locations, at the confluence with Happy Jack Creek and with Belli Creek. A number of submissions advised me that the surveys may underestimate the true importance of the area to frogs since the surveys were conducted in drought conditions.

The Mary Valley is clearly of significance for the Giant Barred Frog. There are many Wildnet records of the frog in the Valley, in part due to the dedicated record-making efforts of the Mary River Catchment Coordinating Committee. Records of the frog include areas well upstream of the Project. At the time of the EIS, the proponent considered that the Skyring Creek-Belli Creek vicinity in the study area around the inundation zone represented the most northern point of the frog's range. However, on the basis of advice from submitters, the proponent has now identified that there are Giant Barred Frogs present to the north in the Mary River catchment and outside of Maryborough in the Burrum River Catchment. Additional information obtained from the then EPA indicates that there is a substantive presence of the species within Blackfellow Creek, Kilcoy Creek and (to a lesser extent) Yabba Creek. I do not consider that the identification of these additional areas of presence diminish the need for substantive mitigation and offset effort by the proponent in relation to the habitat in the proximity of the Project. However, it is a potentially significant development in terms of providing some additional areas for habitat enhancement activities to be applied to via the Catchment management program required by Condition 5, Schedule C, Appendix 1.

There is limited scientifically-verified information relating to the microhabitat used by this species. However, eggs are thought to be thrown out of the water by the female onto overhanging or steep banks (Knowles et al. in prep cited in Patterson et al. 2002) and daytime shelter positions are either under leaf litter or under vegetation (Lemckert and Brassil 2000). Eggs take several weeks to develop, with tadpoles hatching and falling or wriggling down to the water below. The species has an extended larval (tadpole) stage which may last up to 18 months (Anstis 2002). Metamorphosis has been observed in summer and autumn.

It would appear that the Giant Barred Frog prefers small stream areas involving permanent or semi-permanent shaded pools with particular features (e.g. undercuts, exposed roots and/or fallen branches) on the banks.

Given that Giant Barred Frogs use overhanging banks, steep banks, and deep pools, the retention of these micro-habitat structures within the creeks they inhabit is likely to be important.

Whilst experience has shown that the Giant Barred Frog is sensitive to disturbance in its habitat, the frog does seem able to exist in narrow bands or riparian vegetation surrounded by cleared paddocks of livestock. There is also anecdotal evidence indicating it has returned to locations restored after logging activity.

A preliminary tracking study suggests that the Giant Barred Frog rarely ventures far from the stream, but will move short distances up and downstream. The proponent's analysis within section 5.3.1.1 of the Response to Reviewers Report indicates that the Giant Barred Frog has adapted to periodic flooding over its preferred habitat and is therefore likely to disperse from inundated locations if there is suitable adjacent riparian vegetation and survive the initial inundation. However the proponent does concede the Project may result in a loss of a number of individuals within the lower reaches of Coonoon Gibber, Skyring, Happy Jack and Belli Creek after initial inundation. The proponent has committed to translocate as many individuals as possible from these areas to the protected and rehabilitated habitat upstream (as indicated on the Habitat Rehabilitation Area map in Schedule F). The Upstream Riparian Protected Habitat Area must be established prior to Principal Construction Works in accordance with Conditions 4(b) and 4(i), Schedule C, Appendix 1. In addition, Conditions 21(j)(ix) and 21(j)(x), Schedule C, Appendix 1 require the proponent to document baseline population's statistics and monitoring-based-thresholds that will trigger a requirement for specific mitigation measures to address adverse population changes.

A total of approximately 116.6 ha (proponent estimate in the Response to Reviewers' Report) of the Giant Barred Frog's riparian habitat will be impacted by the Project at FSL (100% full) along the creeks identified above. However, it should be noted that riparian zones below 1.5 m FSL will not be cleared within the inundation area and that the inundation area will only be 100% full 23% of the time; and the water level will be below approximately 2 m of FSL approximately 80% of the time. Therefore, shallower water depths (similar to those currently existing) will be prevailing in most of the key tributary areas for large periods of time. The proponent has indicated that in some of the locations where the Giant Barred Frogs were found close to FSL, and the existing riparian vegetation will continue to extend above and below FSL, some of the frogs may be able to persist, close to, or within their current range.

I requested the proponent to consider whether the calculation of the habitat area to be offset should be larger due to the fact that two Giant Barred Frogs were recorded from two sites on the Mary River during the baseline surveys conducted for, and reported in, the EIS. DERM suggested to me that a patch of remnant vegetation of 114.5ha in area associated with these sites should be considered for inclusion in the calculation of habitat for the Giant Barred Frog. The proponent advised in response to my query that these patches should not be included in the calculation of existing quality habitat for the Giant Barred Frog because it is located on the main channel of the Mary River in an area which does not contain habitat attributes such as slow moving water and likely breeding pools, and is highly fragmented in relation to the identified patches of high quality habitat.

Breeding sites for the Giant Barred Frog are typically located on, or near, permanent deep pools on slow moving reaches of streams. These areas are also characterised by steep, overhanging and undercut banks and relatively intact riparian vegetation (providing cover and leaf litter inputs). These sites primarily occur on the tributaries of the Mary River and not the main stream of the Mary River itself.

As discussed in the proponent's Habitat Restoration Plan, the Giant Barred Frog has been recorded within remnant riparian vine forest and gallery forest (including REs 12.3.1, 12.3.2 and 12.3.7) on Belli Creek, Happy Jack Creek, Skyring Creek, Mary River and Coonoon Gibber Creek. I accept the proponent's view that the relevant patches of potential habitat on the Mary River are of considerably lower quality than the habitat adjacent to the creeks mentioned above.

Fortunately upstream of the inundation area within the creeks, suitable Giant Barred Frog habitat would remain and the proponent has produced a detailed plan (as per Habitat Restoration Plan within the Response to Reviewer Report) including identified priority areas for rehabilitation, to enable the recovery of the local population of the species.

The proponent is committed to rehabilitating habitat along Belli Creek, Happy Jack Creek, Skyring Creek, Coonoon Gibber Creek and some parts of the Mary River. A principal outcome of this work will be to increase the connectivity of habitat between the known habitats adjacent to the creeks. In the areas that are subject to only moderate levels of inundation, this restored riparian habitat is likely to be suitable habitat (particularly with the establishment of the Waterhousea and Lomandria).

At Condition 21(c), Schedule C, Appendix 1, I am requiring the proponent to offset the quantity of lost habitat that the proponent has estimated. This offset is to be created through the rehabilitation and protection of suitable microhabitat in areas approved by the agency responsible for the NC Act and adjacent to current habitat used by the species. These offset areas are to total at least 174.89 ha (i.e. 1.5 x 116.6 ha) reflecting a loss to offset ratio of 1:1.5, consistent with the ratio required by the VM Act for mapped essential habitat. In relation to the DERM suggestion that additional sites be considered in the calculation of habitat to be offset, I note that the more extensive areas of protected riparian habitat to be created and protected adjacent to the Mary River and tributaries, in accordance with Conditions 4 and 5 of Schedule C, Appendix 1, will mean that considerably more potentially suitable habitat, will be available for the Giant Barred Frog in the future. I consider that suitable quantities of offsetting habitat will be generated as a result of my conditions which extend the commitments already provided by the proponent. This view has been reached having regard to:

- The additional benefits (i.e. extended areas of potential habitat in the Project Area) that are likely to arise due to the vegetation creation and protection requirements of Conditions 4 and 5 as mentioned above
- the arguments presented by the proponent in its Response to Information Requests, relating to my information request about DERM's suggestion that the creation and protection of new habitat should be on lands totalling more than 174.89 ha
- the additional benefit to the species that will arise from the research imposed at Condition 11 Schedule C, Appendix 1 as mentioned below
- the required implementation of a monitoring program and a management plan with the specific aim to assist the Giant Barred Frog as detailed in the Habitat Restoration Plan within the Response to Reviewer Reports. I have required at Condition 21 (j) (x) the specification of monitoring based thresholds that will trigger further specific mitigation measures to address adverse population changes.

In addition, the EIS and my conditions at Condition 11 Schedule C, Appendix 1 commits the proponent to fund and otherwise support research into the captive husbandry of frogs and mitigation measures involving the translocation of at risk individuals and the maintenance of genetic diversity in isolated populations if monitoring reveals this to be a problem. Based on the opinions of Dr Hero (as quoted in the Response to Reviewer Report) and DERM advice as to the appropriate extent of research and restoration, I expect the applied research program and other requirements to greatly aid the long-term viability of Giant Barred Frog.

I acknowledge a number of the submitters to the EIS were sceptical about the potential for mitigations involving activities such as captive husbandry or translocation. One submitter advised me there has been no previous example of a successful program of adaptive management strategies and captive husbandry for Giant Barred Frog. However, the proponent has cited (in its Response to Reviewer Report) the use of such programs elsewhere and has developed a comprehensive set of impact mitigation measures relating to the relevant formal recovery plan (Recovery Plan for Stream Frogs of SEQ). I am confident that such measures will only be implemented in conjunction with suitable oversight of DERM as per its involvement in the research program required by Condition 11, Schedule C, Appendix 1.

It is important to note that the Recovery Plan for Stream Frogs of SEQ identifies that the majority of the known populations for the Giant Barred-Frog in south-east Queensland occur on unprotected private land. The Giant Barred Frog mitigation program to be implemented as part of this Project would result in populations of Giant Barred Frogs receiving protection through the creation of substantial new protected areas.

I also draw attention to the importance of the proponent's commitment to ensure the project's environmental management plan prevents works leading to increased sedimentation, erosion, weed invasion and nutrient and chemical pollution that could otherwise harm Giant Barred Frogs and their habitat.

In conclusion, there are risks to Giant Barred Frogs arising from the Project and ongoing threatening processes that warrant substantial habitat creation and other activities (e.g. the funding and other support for necessary research into the characteristics of the species). Without suitable mitigation, existing land uses and inundation associated with the Project will place favoured habitat at risk and may further fragment the lowland population. Maintaining a sustainable population of Giant Barred Frogs in the vicinity of the Project site is a significant challenge requiring substantial resources. However my conditions, particularly at Conditions 4,5,11 and 21, Schedule C, Appendix 1, bind the proponent to the necessary substantial mitigation actions that focus on habitat enhancement and completing necessary research. I consider that these actions have considerable potential to play a major role in the recovery of the Giant Barred Frog in the longer term.

EVR mammals

The Grey-headed flying fox (Pteropus poliocephalus) is a vulnerable species under the EPBC Act since the species population is believed to have decreased by roughly 30% during the 1990s. The species forages on a wide variety of flowering plants and fruits (including exotic).

The EIS submissions identified a colony of Grey-headed flying fox (several thousand individuals) within the study area. Whilst the colony is located outside of inundation area, the project would lead to a loss of foraging grounds for the flying foxes. The colony is also located around 250 metres from the proposed Gympie-Brooloo Highway.

The EIS indicates that the loss of the inundated feeding areas is unlikely to have a significant impact on this species as it feeds on a wide variety of plants and is capable of flying up to 50km on occasions to feed. The proponent proposes to implement noise controls during the breeding season to reduce the risk to the colony. Furthermore, the Grey-headed flying fox has demonstrated an ability to cope with traffic noises close to its colonies.

I am confident that the Grey-headed flying fox will not be significantly affected by the Project. They are highly mobile and the loss of 302ha of remnant forest within the inundation area will only represent a small portion of their potential foraging area and is unlikely to significantly diminish the size of the colony. Unless and until more precise accounting of the net gain situation for this species emerges as required by Condition 21(e), Schedule C, Appendix 1, my vegetation creation conditions (e.g. at schedule A and conditions 4 and 5 of Schedule C) require the proponent to include at least 453ha of broadly suitable remnant forest habitat for the species within the areas it has to restore to satisfy VMO requirements and Conditions 4 and 5, Schedule C, Appendix 1.

My requirements at Condition 21(i), Schedule C, Appendix 1 also prohibit road works or placing of stockpiles in the patch of vine forest occupied by the colony to ensure roosting and breeding habitat is protected. Further, works in this vicinity must not occur in the key breeding months of the year.

Little is known about the habitat needs of the Large-eared pied bat (Chalinolobus dwyeri). There is no evidence that the Large-eared pied bat is with the study area, as it was not identified in the EIS study (through analysis of bat calls) nor are there records of this bat within the study area. Consequently the likelihood of this bat utilising the study area is considered low. However, the proponent indicates that the rocky areas surrounding the Project Area may provide appropriate roosting and the Project Area may provide foraging opportunities.

The EIS concludes that if the Large-eared pied bat exists at the site, it is at very low densities and should be able to sustain itself on alternative foraging areas. I also note that DEWHA report that some of the (few) recent reports of the Large-eared pied bat in SEQ have emerged from areas within the vicinity of constructed dams - Wivenhoe Dam and Moogerah Dam.

The Spotted tailed quoll is the largest species of quoll and will feed on rabbits, possums, gliders, bandicoots, and birds. Its population is in decline and there have been many localised extinctions within their range.

There is a Wildnet record of the Spotted tailed quoll close to the study area, and a submission claimed they are known at Chinaman's Creek. Additionally, they can be found in a range of forest types including riparian forests. However, despite the deployment of elliot and nose hair traps, the Spotted tailed quoll was not identified during the field study. It seems highly unlikely that the current site could support a population of spotted tailed quolls. The EIS concludes that, at best, that Spotted tailed quoll would only be a transient visitor to the Project Area.

The quality and quantity of the present habitat within the Project Area is unlikely to sustain a Spotted tailed quoll. In the longer term, the rehabilitation measures I have mandated and VMO requirements may improve the habitat for quolls. One crucial step in returning the quolls to this site is re-establishing wildlife corridors to the upland habitat (which possibly does support the quoll). Furthermore appropriate feral animal management program would be important for this animal.

The conditions relating to the VMO, riparian restoration and fauna corridors will be a small but positive mitigation for the Spotted tailed quoll. The installations of logs and log piles in the VMO areas could provide micro habitat for the quoll. Furthermore feral management (with no, or highly controlled use of poisons that can be used for this purpose) will also be of benefit.

EVR birds

I do not believe the proposed Project will adversely impact on the conservation of any of the EVR birds of moderate or high likelihood to be present within the vicinity. In some cases, the mitigation may result in better habitat within the Project Area for these birds.

The Painted snipe is vulnerable under the EPBC Act. I do not believe that this species will be significantly impacted by the Project, and given my extensive requirements (e.g. Condition 4, Schedule C, Appendix 1) detailed above for the creation and protection of new areas of vegetation, there is a strong possibility that the Project will be beneficial for this species.

The Australian cotton pygmy-goose utilises deep water and as such may inhabit the additional ponded habitat provided by the Project, particularly given my requirements for the control of water weeds such as water hyacinth in Condition 21(k), Schedule C, Appendix 1.

The Red goshawk is vulnerable under the EPBC Act. At best, the Red goshawk would be a seasonal visitor during winter when it moves into coastal plains. A breeding pair may have a territory as large as 20,000 hectares and they will hunt in a variety of habitats such as open forests, rainforest edges, rivers, swamps, grazing areas and wetlands. As a result, the Project is unlikely to have a significant impact upon its habitat.

A number of submitters raised concerns about the Coxen's Fig Parrot and Swift Parrot, that are endangered listed threatened species under the EPBC Act. There are no records of these species in the broader study area. It is possible that these species may be occasional visitors to the Project Area. I consider that the Project Area does not provide any notable habitat values for these species. I do not believe these species will be significantly impacted by the Project, and given my extensive requirements (e.g. Condition 4, Schedule C, Appendix 1) for the creation and protection of new areas of vegetation, there is a possibility that the Project will be beneficial for these species.

I do not believe the Project will adversely impact on the conservation of any of the EVR birds of moderate or high likelihood to be present within the vicinity of the study area. In most cases, the mitigation is likely to result in better habitat within the Project Area for these birds, particularly in relation to my requirements in Condition 21 (c), 21 (e), 21 (h) and 21 (i), Schedule C, Appendix 1. These conditions will enhance suitable habitat (including artificial hollows) for any EVR birds that are assessed as being present or (moderately) likely to be in the Project Area as summarised in the above table relating to EVR birds. These conditions also require that suitable checks of vegetation to be cleared are undertaken before clearing and that, as necessary, action is taken to ensure any identified fauna is relocated and otherwise protected.

I consider the provision of habitat for the water birds as a priority for the proponent's restoration work. Additionally, the VMO and creek restorations will be of some benefit to almost all the EVR birds. To maximise the effectiveness of the VMO and riparian restoration works, the proponent is also required by Conditions 4 and 21(k), Schedule C, Appendix 1, to eradicate and control weeds and feral animals and prevent agricultural animals from accessing protected areas within the inundation area buffer.

Queensland Lungfish and Mary River Cod

Project impacts on freshwater EVR fish are discussed in detail at section 3.1, 3.2 and 3.4 of this report. A detailed summary is provided below.

The Lungfish (Neoceratodus forsteri) and Mary River Cod are the only two fish species that are listed threatened species in the vicinity of the Project Area.

Both species attracted considerable comment and advice in the submissions on the EIS.

For over a century the Lungfish species has had an iconic status and it is clear that sections of the community view potential threats to its sustainability as cause for serious alarm.

The species has benefited from legislative protection since 1914. Today it is protected under the *Fisheries Act 1994* and is listed as vulnerable under the EPBC Act. Protection is achieved through the implementation of requirements such as those relating to fishing restrictions and for the installation of fishways on new in-stream barriers. The Lungfish is also listed in relation to the Convention of International Trade in Endangered Species of Wild Fauna and Flora.

I concur with the proponent that the Lungfish listings as an EVR species essentially arise from the limited extent of its geographic distribution and potential threats to habitat and recruitment, rather than because there is a small population size in its geographical range. There appears to be a sound basis upon which to describe Lungfish as being quite common within many of the freshwater reaches of the Burnett, Mary and Brisbane River catchments.

The EIS indicates that Lungfish are quite abundant in and around the inundation area. It would appear that the site's range of hydraulic habitats and macrophyte species provides habitat value for Lungfish.

The understanding of the Lungfish lifecycle and habitat needs have significantly developed over the last decade, although the species has characteristics which appear to make it difficult for researchers to reach firm conclusions about its biology. The Lungfish species is characteristically slow growing with a potential life span of 50 plus years and individuals are thought to reach sexual maturity in around 15 years. Juveniles older than a few weeks are notoriously difficult to find. Collectively, these factors mean that it is difficult to monitor and determine the recruitment success of a Lungfish population.

It is well accepted the Lungfish have a preference for sites with good availability of submerged macrophytes, (e.g. Ribbon Weed) both for feeding and breeding. They are known to feed on Ribbon Weed and Hydrilla, which are two of the most common native plants in the Mary River, as at the time of the EIS. They are opportunistic omnivores and will also feed on the macroinvertebrates that colonise the macrophytes. Importantly, they also adhere their eggs to Ribbon Weed and other aquatic plants and in some cases submerged terrestrial plants.

It is thought that the hatched juveniles remain close to their spawning location, depending upon the macrophytes for cover from predators, potentially including mature Lungfish.

As discussed above in the section entitled aquatic habitats, well over half of the inundation area is currently comprised of run and riffle habitats inter-dispersed with pools. Macrophytes (e.g. ribbon weed) favoured by Lungfish are well represented within the inundation area. Even given the habitat degradation associated with the loss of much of the riparian vegetation in the area, the current mix of hydraulic and macrophyte habitat is at least reasonably supportive of Lungfish. At FSL almost all of the other in-stream habitat types within the inundation area will be converted to ponded habitat. However, as around a quarter of the inundation area will be less than 2m depth at FSL, I consider that it is highly likely that ribbon weed will continue to be present in substantive quantities around the shallower parts of the inundation area's periphery.

While adults appear to have successfully colonised a variety of in-stream hydraulic habitats, they are thought to prefer deeper pools particularly if there is opportunity to shelter under partially submerged riparian vegetation, woody debris, undercut banks, or amongst rocks. There is anecdotal evidence of Lungfish in good condition living within ponded storage, particularly in the Brisbane and Burnett Rivers. I am advised that DEEDI researchers, who have been undertaking well focused data collation exercises about Lungfish in the Burnett catchment since the mid-1990s, consider that no discernible changes have occurred to the population structure following the development of new water storages during this period.

The annual spawning season can commence as early as July and continue until January. However, the majority of spawning occurs between August and November. The eggs which are attached to vegetation may be lost if water levels change and the eggs are exposed above the water line or inundated at unsatisfactory depths. Ideally, water levels should periodically remain relatively stable through the abovementioned spawning months, at depths favourable to ribbon weed, noting that this tends to only naturally occur in a minority of years reflective of the natural variability of flows in the system. It is also believed that high turbidity, low DO, or algae will also compromise the viability of the eggs/hatchlings. I have set flow related conditions to address these matters at Condition 8, Schedule C, Appendix 1.

Some researchers believe successful recruitment is dependent upon Lungfish finding appropriate vegetated, flowing, and shallow water for breeding. In addition to the depth requirements, the EIS suggests there is sufficient evidence to support a view that that Lungfish can breed in appropriately vegetated ponded habitat.

Advice from the then DPIF (now DEEDI) is not inconsistent with the proponent's view about ongoing Lungfish presence in impoundment areas. However, it is important to recognise that, in terms of impoundments generally, I consider that it is appropriate to emphasise the likely less-than-optimal breeding conditions that are usually present. The following is a key extract from the advice from the then DPIF on the matter:

> "*Australian Lungfish have highly specialised spawning requirements characterised by shallow water and submerged aquatic vegetation. Lungfish breeding predominantly occurs in shallow river margins where eggs are laid between August and December amongst dense beds of submerged macrophytes. Suitable breeding habitat is often widespread during this period after low, stable winter flows have provided opportunities for aquatic plant communities to flourish. Lungfish breeding habitat is highly susceptible to flow changes and current evidence from the Burnett River suggests that breeding rarely in occurs in the deep, steep-sided pools created by dams and weirs*."

Further, the then DPIF (now DEEDI) provided me with a confidential draft of the Survival Strategy for the Australian Lungfish for my consideration. In assessing the potential impacts and mitigation measures for the Project, I have considered the draft Survival Strategy, and particularly the identified risks and management measures for the Lungfish.

I believe that the conservation management of the Lungfish would benefit from a species specific management plan. I recommend that DEEDI work with the proponent and operators of other infrastructure in the Burnett and Mary River Catchments to prepare a management plan for the Lungfish. The management plan for the Lungfish should include consideration of the draft Survival Strategy for the Australian Lungfish and should also include mapping of habitat, monitoring (tagging, tracking, surveys etc) as well as research priorities as outlined in Appendix 1, Schedule E.

I consider that there is little doubt that with appropriate controls and upstream habitat enhancement activities, Lungfish will survive within the inundation area. However, I further consider that there is likely to be a reduction in optimal breeding conditions and other factors could impact sustainability of the local population following Project construction. It is therefore appropriate for the purposes of my assessment to assume that breeding conditions within the inundation area will not be optimal.

It is also important to emphasise that there has been considerable degradation to shallow and macrophyte habitat throughout the catchment. To reverse degradation it would be essential to at least partially constrain the numerous causes including livestock trampling, desnagging, erosion, increased sedimentation and land clearing in some key areas. Livestock watering is widespread throughout the distribution of Lungfish. According to the then DPIF's advice, livestock drinking in the shallows have been observed trampling Lungfish eggs and breeding habitat. Reduced habitat availability is likely to expose juvenile Lungfish to increased predation.

Given these important factors, I consider it essential that a precautionary approach is taken in the form of rehabilitation efforts being applied to actual and potential breeding habitat. It is clear that there has been considerable degradation to these habitats over a long period of time and there are ample opportunities for rehabilitation given the dedication of substantial resources as required by my conditions.

The extensive requirements for the riparian vegetation restoration and the creation of new protected riparian habitat (i.e. areas of protected and restored vegetation and associated in-stream habitat creation) at Conditions 4 and 5, Schedule C, Appendix 1 are designed to mitigate risks to Lungfish (and other species).

The **Mary River Cod** (macculochella peeli mariensis) species is endemic to the Mary River. Based on the EIS, I consider that Mary River Cod populations are largely restricted to sub-catchment refuges including Tinana/Coondoo Creek, Six Mile Creek and Obi Obi Creek with possibly other self reproducing populations in Amamoor, Widgee and Munna Creeks. There is anecdotal evidence to support a conclusion that populations in the Mary River main channel are likely to be relatively small and that these populations may have been generated through the stocking of hatchery reared cod.

The EIS indicates that the Project will have no direct impact on the recognised core populations nor will it directly affect the flow regime in the relevant locations as they are on tributaries.

Mary River Cod populations in Tinana/Coondoo, SixMile and possibly in Amamoor, Widgee and Munna Creeks, are on downstream tributaries. The Obi Obi Creek population is on a tributary upstream of the inundation area. The potential further separation of the Obi Obi Creek population from the Six Mile Creek population by the Project is to be addressed as discussed below.

I consider that it is particularly notable that, according to the Mary Cod Recovery Plan, that the Tinana-Coondoo Creek system (which is not linked in any direct way to the other populations) provides the best refuge for cod in the Mary River catchment. Importantly, the subcatchment is well forested (including extensive areas of exotic pine trees), and human population density is low. Significant riparian buffer strips of tall, native vegetation remain intact in most areas. These are considered to be important because they provide abundant shading of the streambed, a diversity and abundance of instream cover (logs, logjams, branches, overhanging vegetation) and help to maintain bank stability. Further, large, deep, permanent pools are present throughout Coondoo Creek, and Tinana Creek below its junction with Coondoo Creek. According to Simpson (1994), streams in this area have not been affected by siltation to the extent seen in many parts of the Mary catchment. Simpson also indicates that 75% of the sites throughout the broader Mary River catchment where cod habitat can be rated as very good were bordered by State forest reflecting the importance of riparian forest and large woody debris they produced. The main channel of the Mary River is described as having no habitat in the good or very good categories and approximately 70% in the poor to very poor categories. However, I consider that is likely that the Mary River once contained good habitat for the species and it contains areas that can be rehabilitated. The Mary River Catchment Coordinating Committee (MRCCC) has identified in advice provided to me that up to 10 locations represent “known cod holes” in the Mary River between approximately Yabba Creek and Amamoor Creek.

It seems commonly accepted that riparian zones throughout the 9,600km^2 catchment have been significantly degraded by 150 years of intensive utilisation of the floodplain for forestry and agricultural purposes, combined with a lesser period of mining of instream resources.

A consideration of the history of land uses and riverine changes that have occurred since the 1840s leaves a clear impression of enormous degradation to main channel habitats that would have otherwise been favoured by the Mary River Cod.

As summarised in the MRCCC’s Mary River and Tributaries Rehabilitation plan of 2001 a local historian summarised the extent of the historic impacts in 1994 when he wrote, that the river; “Changed beyond comprehension of those who knew it even 50 years ago. It has changed from a deep clean stream guarded by shaded scrub (rainforest) which reached back to the ranges, or by the open forest flats saddle high in the native kangaroo grass, to a sand clogged watercourse fighting for its life between eroded banks held by thinly scattered trees.”

On the basis of these accounts, and advice from the proponent and the then DPIF, I consider there is a sound basis to conclude that the Mary River main channel has become so degraded that it retains minimal useful habitat for the Mary River Cod and, if the recovery of the species is to occur, there is a clear need to initiate large-scale efforts to partially reverse this degradation. This view underpins, and is reflected in, the conditions I have established and explain further in the aquatic fauna refuge section below. I consider that the priority that I am affording such action has already been well-justified and emphasised by the Mary River Cod Recovery Plan, particularly given that the yet-to-be-initiated required action 5 from the Recovery Plan is to restore cod habitats through a large-scale program for riparian habitats.

While it is likely that historic overfishing and de-snagging actions have also had substantial adverse effects over time, I consider that there is a high probability that the past loss of vegetation and the related infilling and loss of pools through siltation in response to land clearing and associated agricultural practices are the key issues affecting the sustainability of Mary River Cod and constraining the recovery of the species. These threatening processes appear to be the most common reason given in the literature for the decline of the species, particularly in the main Mary River channel. I have established comprehensive precautionary requirements relating to the key threatening processes for the species, particularly loss of habitat and water quality. These requirements are specified at Conditions 4, 5, 8, 9, 11, 21(j), 22, 23 and 31 (d) (ii) and (iii), Schedule C, Appendix 1, as summarised above.

I do not consider that barrier effects on the Mary River itself have played a significant role in the decline of the Mary River Cod in the past as the main channel is largely free of such barriers above the Mary River Barrage. However, barrier effects on tributaries may be important issues of at least second order importance and I consider that the measures outlined below suitably address risks relating to flows, barrier effects and movement. I consider that the inclusion within the Project of substantive measures targeting large-scale revegetation and addressing tributary barrier effects as part of the Project, not only represents reasonable and necessary measures to address Project-related risks but also a valuable opportunity to catalyse and enhance the Mary River Recovery Plan and at least partially reverse the ongoing threats to the sustainability of the Mary River Cod.

There have been past successes associated with the Mary River Cod Recovery Plan. However, many required actions, particularly relating to habitat restoration, research and monitoring, have not been able to be implemented. The advent of this Proposal provides the opportunity to attract additional resources and initiate and substantially advance the outstanding required measures.

In the absence of this catalyst investment that I am requiring through conditions to be embedded within this Project, based on the past ability to attract resources, I am not confident sufficient resources will be otherwise be forthcoming for the community to deliver on the intentions set out in the recovery plan.

I consider that DPIF advice identifies what actions need to be implemented in relation to treating risks associated with the Project while also advancing the recovery of Lungfish and Mary River Cod.

Fish spawning, movement and flow requirements

Many species (e.g. Lungfish) require moderate or low flow conditions and/or stable water levels to spawn on macrophytes or in shallow habitats. Spawning in response to rising temperatures in spring is common. Mary River Cod spawn in spring when water temperatures rise above 20 degrees. Up to 9 fish species are likely to be catadromous migratory species in that they spend most of their life cycle in freshwater and migrate to estuaries or the sea to breed. Up to 13 species may be potamodromous in that they are expected to undertake migrations within rivers to move between feeding and breeding areas. The proponent indicates that Lungfish and Mary River Cod are regarded as facultative potamodromous species in that large scale movements are not required for spawning but may be undertaken in certain circumstances, such as to move between good quality habitats or away from areas where water quality is deteriorating. I therefore concur with the proponent that the opportunity for Lungfish and Mary River Cod to pass the Project's in-stream barrier should be provided for.

Within my conditions at Schedule A (Operational works that is constructing or raising of a waterway barrier works), Appendix 1, I am requiring that the proponent to construct and operate a fishway in accordance with performance criteria to be refined in consultation with experts from DEEDI. The performance criteria must be finalised in accordance with comprehensive design process requirements as specified in Schedule D. Within Fishway Design Documentation that must be developed and approved prior to the commencement of the Principal Construction Works, the proponent must identify how non-compliance with necessary performance criteria will need to be rectified. This must include the identification of triggers for the initiation of rectification to ensure compliance with performance criteria.

There are currently some dam and weir structural barriers to fish passage in the Mary River catchment, mainly on tributaries. Two major barrages exist in the upper estuary, one is on the Mary River downstream from Tiaro and the other is on Tinana Creek. The two barrages have fishways that provide some but not optimal passage opportunities for fish. Tinana Creek passage is also affected by Teddington Weir and Tallegalla Weir. The Borumba Dam (Yabba Creek), Imbil Weir (Yabba Creek) Lake MacDonald (on Six Mile Creek), Cedar Pocket Dam (Deep Creek), Kandanga Weir (Kandanga Creek) and Baroon Pocket Dam (Obi Obi Creek) structures all form barriers to fish movement in tributaries within the upper catchment. The impact of Baroon Pocket Dam is probably minimal given that there is a waterfall downstream of the dam that forms a natural barrier. None of these structures have effective fishways, although Imbil Weir, along with the Gympie Control Weir (on the Mary River) and Jimna Weir (Yabba Creek) are likely to be barriers to fish movement only during very low flow periods.

<u>I am requiring</u> the proponent to work with the chief executive administering the *Fisheries Act 1994* to select the most problematic existing barrier (in terms of constraining ecologically important fish movements) and construct or otherwise arrange the retrofitting of an effective fish transfer device.

Given the risk of the new dam introducing reduction in movement opportunities into the catchment, I consider it is appropriate for the proponent to construct at least one fishway retrofit project on a barrier in the catchment in consultation with the chief executive administering the *Fisheries Act 1994*. This has been imposed at Condition 23, Schedule C Appendix 1.

In the absence of analysis that there is a better candidate(s) on ecological and/or technical practicality grounds, <u>I consider</u> that Imbil Weir should be targeted for the retrofitting of a fishway that is capable of moving Lungfish and Mary River Cod. This is based on its location close to the inundation area and on a stream which is known to contain habitat values for Mary River Cod and Lungfish. It is also recognised that it is possible one or more smaller projects may be identified as being preferable.

This fishway requirement is in addition to ensuring that Lungfish, Mary River Cod and Gudgeon (which I consider to be likely to be suitably representative of the requirements of all present species) are able to move upstream and downstream from one side of the Project dam wall to the other in most flow conditions above 10cm flow measured at a gauging station at Dagun Pocket. I have conditioned at Schedule A, Appendix 1 (operational works that is constructing or raising a waterway barrier works) and Condition 8, Schedule C, Appendix 1 that these flows are to be achieved or exceeded at least 97% of the time during the operation of the Project, and that fish movement must be provided during these times, with some limited exceptions as outlined below. These requirements are to apply except when:

- during a period of no more than 15 days per calendar year, when equipment needs to be temporarily decommissioned to allow structural improvements or maintenance activities required or approved by the chief executive administering the *Fisheries Act 1994*
- during large floods when infrastructure may be at risk
- for a single period of up to 60 days for initial commissioning

Given characteristics of adult Lungfish, including their relatively large size and slow moving nature, if the fishway can accommodate Lungfish, it is highly likely to be able to accommodate all other native species in the Mary River. <u>I understand</u> smaller fish species within the Mary River and neighbouring catchments have been found to readily utilise fishways.

In terms of Lungfish movement, while there is variation between the habits of individual fish, tracking of movement has revealed the Lungfish are capable of travelling many kilometres. However, it would appear that the majority of Lungfish remain within a contained range, when appropriate shelter, feeding and breeding habitats are close. In optimum territory adult fishes are found congregating together.

Advice from the then DPIF indicates that:

In flowing river sections, Australian Lungfish exhibit largely localised movements around a distinct home range typically 1-1.5km in length. The home range is typically centred on a small number of regular refuges, where individuals shelter during the day. Movements outside of the home range are rare and only observed in a small proportion of the population. In contrast, Lungfish in impounded waters can be highly mobile. During late autumn and winter Lungfish tagged by Brooks and Kind (2002) moved out of instream impoundments on the Burnett River to seek out suitable spawning habitat in shallow pools and glides. This included sections upstream of the impoundments and in tributary streams, up to 35km from the impoundment. Following the spawning period, return movements occurred on a staggered basis with individuals often utilising small flow events to assist their downstream passage (Brooks and Kind 2002). Berghuis and Broadfoot (2004) reported that Lungfish downstream of Ned Churchward Weir also made upstream movements during minor flow events, taking advantage of increased connectivity to move between pools.

In order to accommodate the movement requirements of Lungfish, Mary River Cod and other fish species, the proponent is committed to developing a fishway system. This commitment to design and construct a functioning fishway is imposed along with functionality requirements within my conditions as discussed further below in this section. The design involves water flowing almost continuously through the fish passage down the Mary River to attract fish.

I note that the EIS indicates that storage volume will need to be at minimum of 30% capacity for the fish passage to work. However, I am requiring at Schedule A, Appendix 1, that fish passage be made possible in both directions for all native species present in the Mary River when releases are being made in accordance with the requirements in Condition 8, Schedule C, Appendix 1, less the specified small allowances of time for fish transfer downtime during large floods and for temporary decommissioning for structural improvements, maintenance and/or equipment failure.

I acknowledge that the provision of upstream fish passage for large-bodied species (>1m) has been problematic worldwide. However, on balance, I consider that there is a strong likelihood that the proposed fishway will be capable of being designed to enable some of the relatively uncommon larger scale movements undertaken by Lungfish. This is based on my understanding that:

- Lungfish do utilise fishways on existing dams and weirs (e.g. Paradise Dam, Ned Churchward weir and Claude Wharton Weir)
- the rate of advancement in knowledge about fishways through practical application over the past decade
- substantial resources will be deployed in relation to developing the fishway, informed by specific trials as per Condition 23, Schedule C, Appendix 1, prior to commencement of Principal Construction Works
- DEEDI experts will be closely involved in the development of the detailed fishway design.

No information is currently available on use of fishways by Mary River Cod. Of the existing man-made barriers to fish passage in the Mary River Catchment identified above, only two are fitted with operational fishways. The fishways are located at tidal barrages on the main river channel and Tinana Creek and, because of their position in the catchment, cod would rarely if ever encounter these fishways.

However, there is information available on movements of other closely related freshwater cod species in Australia, particularly Murray Cod and to a lesser extent Trout Cod. According to advice from the then DPIF, there are also a growing number of studies examining movements of these species through fishways within the Murray-Darling Basin. For example, I understand that Lock 8 on the Murray River passed 29,500 fish over a 55-day period, and on average 500 fish use the fishway daily, ranging from large Murray cod over 900 mm in length to small Australian smelt around 30 mm. Other fishways further upstream on the Murray River are also helping reconnect native fish populations, with the Denil fishway at Euston weir passing Murray cod up to 1 m long and the fishway at Torrumbarry Weir passing Trout cod.[34]

I note that Professor Walker (within his Commonwealth Reviewer Report) also considers that, based on the Murray Cod, it is likely that adult Mary River Cod will be able to use the fish passage, although he is concerned that they may not utilise the device in sufficient numbers to overcome adverse genetic isolation impacts.

The operation of the fishway needs to be considered in the context of other Project outcomes supporting improved connectivity, including large-scale riparian habitat restoration and protection and reintroduction of snag habitat (Conditions 4 and 5, Schedule C, Appendix 1), improved flow conditions (Condition 8, Schedule C, Appendix 1) and the retrofit of a fishway on an existing barrier in the catchment (Condition 23, Schedule C, Appendix 1).

I consider that the fishway, in combination with these requirements, will improve the movement opportunities for Mary River Cod (between its strongholds in Obi Obi Creek and Six Mile Creek) and other native aquatic species, relative to the pre-Project situation.

As a result of the above considerations, I conclude that it is likely that native fish species including Lungfish and Mary River Cod will be able to move as necessary between the upstream and downstream rehabilitated riparian and in-stream refuge areas that I am requiring to be secured in key areas within the catchment. The proponent is also required to, in conjunction with DEEDI, monitor the use of the fishway by Lungfish and Mary River Cod and make adjustments as necessary to ensure native fish species, particularly Lungfish and Mary River Cod, are able to move from one side of the dam barrier to the other so as to remove any substantive prospect of genetic isolation arising.

In addition, given approval conditions reflecting the optimised flow scenario presented in the SREIS, I consider that the Project's impact on the seasonal flow pattern of the Mary River has the potential to benefit aquatic fauna such as Lungfish in the most heavily impacted area immediately downstream of the Project's dam wall.

As summer and autumn flows tend to have much greater volumes, the trend in these months overshadow the trends in winter and spring in relation to reported annual results. However sustained lower and more stable flows during winter and spring, along with ongoing periodic large flows in summer/autumn, are particularly important for sustaining and generating macrophyte coverage and hence general aquatic life. As depicted in Figure 15-14 of the SREIS, stable base flows and minimal extraordinary large flows during winter and spring are desirable factors in relation to Lungfish, Mary River Cod and the broader fish community. In addition, the EIS and SREIS indicate that the reduced overall flows (i.e. on a whole of year basis) in the most impacted section of the river downstream of the Project will also result in an increased percentage of combined riffle and pool habitat, at the expense of some run habitat.

This means that the more regular winter and autumn flows that are proposed in the proponent's Optimised Flow Scenario are likely to provide improved conditions for ribbon weed and therefore a range of native fish, particularly Lungfish.

In my view, implementation of key elements of the Optimised Scenario, detailed in the Response to Reviewer Reports and the Response to Information Requests Report, will mean that flows during July, August, September, October and November will improve from the current situation and enable a return towards the larger winter and spring flow patterns experienced prior to agricultural development in the Mary River catchment. In conjunction with this increased winter and spring flow pattern and overall increase in pool/riffle habitat, I consider that there will be an enhanced ability to manage releases so as to produce greater water level stability in the relevant stretch of river during the key lower flow months of July through to January, which contains the majority of the breeding season for fish species such as Lungfish and the majority of the Mary River Turtle nesting season.

I have conditioned default flow measures that must be adhered to unless research and/or optimisation in the future demonstrates an alternative set of measures that will better protect ecological values such as

[34] Murray Darling Basin Commission Native Fish Strategy Annual Implementation Report 2004–2005

those depicted in Figure 15-14 of the SREIS and explained further in the Response to Reviewer Reports and the Response to Information Requests Report. The default flow measures are specified within Condition 8, Schedule C, Appendix 1.

In relation to EVR fish species, past large-scale riparian vegetation clearing and ongoing large-scale cattle access to waterways (and associated increases in sedimentation, pool habitat infill, nutrient level increases and reductions in DO etc) have had considerable adverse impacts over many years. These factors have undoubtedly caused major adverse changes in the abundance, diversity and composition of the fish communities through altered food and habitat availability (e.g. shelter) and other impacts. For example, in terms of shelter, the availability of woody debris appears to be particularly important, with Mary River Cod usually found within metres of large woody debris. Continued supply of large woody debris requires riparian vegetation cover to be maintained. In my view, efforts to substantially improve the degraded nature of the riparian zone is the key to improving the health of the fish community and the prospects for threatened aquatic species generally in the Mary River catchment.

I consider that the Project represents a unique opportunity to substantially improve riparian vegetation and therefore the in-stream habitat conditions for aquatic species in general as well as EVR species such as the Mary River Cod and Lungfish. The need for substantial actions to improve the condition of the Mary catchment riparian zone has been known at least as far back as the 1990s when the Mary River Cod Recovery Plan was developed. While some notable and commendable community rehabilitation efforts have ensued, there is no reason to support confidence that the large-scale action that is required has any real prospect of being initiated in the absence of this Project. Such action is warranted by the threats to species that the Project would generate in the absence of mitigation measures as proposed by the proponent and the requirements of my conditions as well as by the accumulated pre-existing threatening processes and limited achievement of recovery actions to date.

In this regard, I am requiring (particularly at Conditions 4, 5, 8, 9, 11, 21(j), 22, 23 and 31 (d) (ii) and (iii), Schedule C, Appendix 1, a series of interconnected and extensive risk mitigation and habitat improvement measures that will lead to:

- the revegetation, rehabilitation and protection of considerably more high quality riparian and in-stream habitats than those being in inundated by the Project via the creation of protected riparian habitat areas (Condition 4 and 5, Schedule C, Appendix 1)
- improved flow conditions downstream of the Project, particularly in terms of improving water quality outcomes and aquatic fauna movement opportunities (condition 8 and 9) to coincide with two new fishways and two new barrier bypass systems for turtles (Condition 22, 23 and Schedule A (Operational works that is constructing or raising of a waterway barrier works)
- an applied research program to help resolve residual scientific uncertainties relating to the biology of EVR fish, frog and turtle species and measures that may improve aid their recovery within the Mary Catchment (Condition 11, Schedule C, Appendix 1)
- specific and targeted measures to treat and reduce injury, disease and other risks for fish, frogs and turtles (Condition 21(j), Schedule C, Appendix 1)
- the application of active aquatic weed control activities to ensure no sustained aquatic weed outbreaks throughout the Project's inundation area, which extends for over 30km in relation to the main Mary River channel (Conditions 4 and 21(k), Schedule C, Appendix 1)
- the development of individual property managements systems and funding for associated capital investments targeted at properties within the Mary River Valley to optimise catchment water quality and riparian vegetation outcomes (Conditions 31(d)(ii) and 31(d)(iii), Schedule C, Appendix 1).

Mary River Turtles

I understand that that the Mary Catchment, along with the Fitzroy Catchment, has the highest biodiversity of freshwater turtles in Australia with six species from five genera of chelid turtles (Legler and Georges, 1993; Cann, 1998). The six species and the numbers of each species identified during the EIS survey within the inundation area are listed below.

Name		Endemicity	Status	EIS Survey inundation area
Common	**Scientific**		**EPBC and NCWR**	**Numbers**
Southern Snapping Turtle	Elseya albagula	Occurs only in Mary Catchment, SE Qld	Not Listed	229
Mary River Turtle	Elusor macrurus	Wide spread, Mary River to Cape York Peninsula, Qld	Endangered	179
Krefft's Turtle	Emydura macquarii kreftii	Wide spread, northern NSW, QLD & eastern NT	Not Listed	123
Saw-Shelled Turtle	Wollumbinia (formerly Elseya) latisternum	Wide spread, SA, Vic, NSW, and sth Qld	Not Listed	8
Broad-Shelled Turtle	Chelodina expansa	Wide spread, SA, Vic, NSW, and sth Qld	Not Listed	7
Eastern Snakenecked turtle	Chelodina Longicollis	Wide spread, SA, Vic, NSW, and sth Qld	Not Listed	0

The Krefft's Turtle, Saw-Shelled Turtle, Broad-Shelled Turtle, Eastern Snakenecked Turtle are widespread relatively adaptable species and are thought to have healthy populations within the catchment. I consider there can be confidence that the populations of these species would not be adversely affected, and in some instances the populations may increase (particularly Krefft's Turtle given that the impoundment will represent favourable habitat).

In contrast to the other four species, the Southern Turtle and the smaller Mary River Turtle (Elusor Macrurus) have a range that is restricted to the region. The Mary River Turtle species has been a particular focus in my evaluation of the EIS. I anticipate that many of the required mitigations in my conditions, focusing particularly on the Mary River Turtle, will also be of benefit to the Southern Snapping Turtle.

The Mary River Turtle species is restricted to the Mary River catchment and it is the largest freshwater turtle in the catchment. It is thought to occur along 200km of the Mary River from Kenilworth to the Mary River Tidal Barrage at Tiaro as well as inhabiting some of the River's larger tributaries including Yabba Creek.

The Mary River Turtle is listed as endangered under the EPBC Act. The Mary River Turtle is also listed as endangered under the *Nature Conservation (Wildlife) Regulation 2006*.

The Mary River Turtle is considered to be the rarest turtle in Queensland, although there are no soundly based estimates on total population numbers. The proponent estimates that there is a local population in and around the inundation area of between 895 and 3580.

The Mary River Turtle, with a particularly large tail and back legs, is a relatively strong swimmer and the species uses a cloacal respiration system (i.e. they have the ability to spend extended periods underwater by extracting DO through cloacal cavity). Despite these notable traits, the species wasn't described in science until 1994. It was however well known to the pet trade and sales of hatchlings were common in the 1960s and 1970s.

Information presented to me explains that since the 1960s, the Mary River Turtle population is considered to have fallen by up to 95%. During the 1960s and early 1970s, Mary River Turtles were subject to excessive egg harvesting for the pet trade. Having a long lifespan, (females do not reach breeding maturity until at least 15 years) the impact would not have been immediately evident. However, it is now clear to researchers this was a primary cause in the substantial population decline. Evidence from collectors active in the 1960s, suggest that hundreds of females once laid around 2000 eggs a year at popular nesting bank near Tiaro. By the end of last century, egg production at the site was found to be as few as 150 eggs in only ten nests.

In 1974, harvesting and sale of eggs was prohibited. However, there is currently no evidence to support a confident view that the success of recruitment of hatchlings into the population has improved since 1974. The current population appears to continue to have an unacceptably low proportion of juveniles. Based on the advice of DERM experts, I consider this is primarily because, even though most females produce viable eggs annually, without direct human intervention very few, or possibly no, eggs are hatching. DERM experts have advised me that there is no evidence to support the conclusion that reduced sub-adult and/ adult survivorship has contributed to the population decline, as suggested by submitters including one of the Commonwealth reviewers.

I have concluded from the information provided to me that the Mary River Turtle numbers have declined due to both increased impacts within the catchment, including habitat destruction, and the extensive harvesting of eggs for commercial purposes in the 1960s and 1970s. The reduced population due to these factors appears to have been unable to extensively regenerate, due to habitat reduction, ongoing and increased predation especially from non-native species, and the disruption of nesting areas through stock access. In terms of these ongoing adverse impacts, I have imposed conditions at Conditions 4 and 5, Schedule C, Appendix 1 that will provide a strong measure of response to these existing issues within the catchment in order to promote increases in Mary River Turtle numbers as a mitigation for any residual risks that may be presented by the Project.

The EIS material indicated that there are three potential risks to the Mary River Turtles that are directly related to the Project. Without suitable mitigation, these risks include the change of habitat associated with clearing and inundation, the potential for trauma caused by contact with the dam infrastructure (such as turtles falling from the spillway or being crushed by moving parts within the dam structure) and the barrier effect created by both the dam wall and the inundation area. The mitigations required by my conditions to address these risks are:

- Change of habitat associated with clearing and inundation
    - artificially introducing snag habitat into the inundation area to create suitable turtle habitat (and for other species) and enhancement of aquatic habitat within the restoration areas
    - the protection of existing turtle nesting areas both within the Project Area and in the downstream catchment, and the relocation of impacted turtle nesting areas within the inundation area
    - riparian and aquatic habitat restoration works (both upstream and downstream) to be completed in association with the protected riparian habitat areas detailed in Condition 4, Schedule C, Appendix 1, including controlling, and where possible, eradicating weeds and pest animals
    - retention of vegetation areas within the inundation area to 1.5 m of FSL
    - a documented habitat restoration plan that sets out auditable rehabilitation benchmarks, with interim benchmarks to be achieved prior to the commencement of Principal Construction Works for both habitat restoration works within the Project Area and the greater catchment
- Potential for trauma associated with the dam infrastructure
    - a turtle bypass trial for cloacal breathing turtles

- a turtle bypass system designed for the safe movement of turtles that is informed by the bypass trial, all available information including agency advice, be developed in consultation with the chief executives administering the *Nature Conservation Act 1992*, the *Fisheries Act 1994* and the *Water Act 2000*, and that must be approved by the Coordinator-General before the commencement of Principal Construction Works

- Project design must minimise the risk of injury of death to wildlife, particularly in regard to inlet and outlet structures, the fishway and spillway structures

- Connectivity past the dam wall and through the inundation area

  - a turtle bypass trial for cloacal breathing turtles

  - a turtle bypass system designed for the safe movement of turtles, that is informed by the bypass trial, all available information including agency advice, be developed in consultation with the chief executives administering the *Nature Conservation Act 1992*, the *Fisheries Act 1994* and the *Water Act 2000*, and that must be approved by the Coordinator-General before the commencement of Principal Construction Works

  - a monitoring program to monitor the effectiveness of the turtle bypass system, with the results of the monitoring program informing the specific research outcome targets. In addition provision must be made for continuous improvement of the turtle bypass system in response to the outcomes of research undertaken the creation of aquatic and riparian habitat within the inundation area that is supportive of turtle movement through and around the inundation area

  - the protection and enhancement of aquatic and riparian habitat upstream and downstream of the Project that is supportive of turtle movement thorugh and around the inundation area, including controlling, and where possible, eradicating weeds and pest animals

  - the provision of riparian habitat around the turtle bypass system to provide refuge and protection for turtles and other native species

  - a documented habitat restoration plan that sets out auditable rehabilitation benchmarks, with interim benchmarks to be achieved prior to the commencement of Principal Construction Works for both habitat restoration works within the Project Area and the greater catchment

The protection and enhancement of aquatic habitat downstream is also dependent on the optimisation of flows to enhance important dependent aquatic ecological outcomes. These matters are discussed in section 3.2 of this report. I have set at Condition 8(b), Schedule C, Appendix 1, FPIs to be observed at Dagun Pocket based on the understanding of the species requirements, including those of the Mary River Turtle, and an analysis of the flow regimes before water resources development and under current extractions. In general, statistics closer to pre-development conditions have been set to improve the existing flow regime.

The outcomes of optimisation modelling with the FPIs implemented further support the conclusions made within the EIS and SREIS regarding the capacity of the Project to successfully manage environmental flows across all months and seasons and will improve upon conditions currently experienced within Dagun Pocket section of the Mary River with those conditions containing measures specifically targeted at the protected and enhancement of both instream and adjacent riparian habitat that supports the Mary River Turtle.

I have imposed conditions, to address these risks, including Conditions 4, 5, 8, 9, 11, 21(j), 22, 23 and 31(d)(ii) and (iii), Schedule C, Appendix 1. In determining the suitability of these conditions, I have taken into account all advice received, especially that provided by the Department of Environment and Resource Management. That advice suggests that turtles do attempt to climb infrastructure and it appears certain that a bypass that is appropriately designed would be used by turtles. The key issue appears to be that existing fish transfer systems have not been designed to accommodate safe passage for non-fish species including turtles. The agency recommendation is that effective turtle passage ways need to be developed and implemented in new and existing impoundments to allow the safe passage of turtles in both directions past infrastructure barriers.

I have set out below the key issues that I have taken into account when setting my conditions in regards to the Mary River Turtle.

The number and content of submissions focusing on issues associated with this species suggest a high level of concern in the community about the Mary River Turtle. A primary concern in the submissions relates to a view that Mary River Turtles (particularly juveniles) prefer riffles and will not inhabit or breed in substantial numbers or at all in impoundments. Submitters therefore argue that the Project will cause a further loss of habitat, centred on the one area the Mary River Turtle appears to be doing well, and will therefore push the species closer to extinction. A common theme within submissions was the argument that the EIS assessment is unsatisfactory as there is inadequate knowledge of the Mary River Turtle's lifecycle and habitat needs (particularly relating to recruitment from birth through to adulthood) to make any predictions of impacts or statements on the effectiveness of proposed mitigations. It appears that the proponent, DERM (i.e. the agency responsible for the NC Act) and submitters all generally agree that there is relatively limited available information on this species, its lifecycle and its habitat needs.

In light of this, I have taken a precautionary approach to requiring impact mitigations. I am satisfied that this approach will ensure that the risks in this regard are suitably treated.

In particular, the potential of the proposed applied research program, required by Condition 11, Schedule C, Appendix 1, to assist in developing a better understanding of the Mary River Turtle and to refine mitigation measures over time is a particularly important element of the Project in that one of the main impediments to the effective conservation of the Mary River Turtle is the lack of understanding of the species habitat needs.

I agree with advice from experts within from DERM that the recovery of the species can be achieved with appropriate planning and application of resources to the outcomes of planning. In this regard, I consider my requirements for the research, the provision of bypass systems for turtles both across the dam wall and on one other existing barrier within the Mary River catchment, the habitat restoration and protection and the other threat reduction measures (inclusive of pest control) to be delivered in accordance with my conditions, present a unique opportunity to facilitate the recovery of this species.

In terms of habitat requirements, I note that the proponent challenges the view the species is a riffle hydraulic habitat specialist largely on the basis of inconsistency with the findings of the EIS survey and the then EPA's 2007 *"Freshwater Turtles in the Mary River"* report.

DERM advice indicates that the species utilises pool as well as riffle habitat and that Mary River Turtles "appear to be functioning well in shallow, slowly flowing impoundment habitats". Their report also indicates that cloacal breathing turtles have been recently found in impoundments that were constructed decades ago. Furthermore, after identifying over 170 Mary River Turtles in and around the Project Area, the proponent noted, Mary River Turtles have "a marked preference for deeper water localities" and were found in ponded water up to six metres deep. Another study that utilised radio tracking and was referenced in the EIS also indicated that males and females spent the majority of their time within pools.

It may be that the Mary River Turtle was originally believed to be riffle specialist because researches found the species easier to identify and catch when in the riffle zone. In the absence of further empirical evidence it appears the riffle specialist tag has become an accepted but potentially false hypothesis.

One submitter argued that Mary River Turtle prefers habitat with a mix of riffles and deep ponds, possibly because upstream ripples discharge into the ponded habitat water with high DO as well as food. Furthermore, the submission considered Mary River Turtle females choose to breed near riffles and that it is likely that hatchlings are dependent upon riffles for food.

Adult Mary River Turtles are known to feed on macrophyte vegetation and algae. The EIS indicates that ribbon weed is a preferred food source. It also appears that Mary River Turtles may also feed on riparian vegetation (particularly fruit) that falls into the waterway, i.e. fruit from various lillypilly, fig, or blackbean trees.

Younger Mary River Turtles are likely to principally feed on the macro invertebrates that live in the macrophyte beds. Information on the habits and needs of juvenile Mary River Turtles is mostly speculation based on knowledge of similar species. Mary River Turtle juveniles have been observed in very shallow water as well as deeper pools. It is assumed that, as with adults, good levels of DO and healthy macrophyte beds (that include aquatic insect larvae) are important. The proponent in the EIS indicates that it considers young Mary River Turtles could be more abundant in areas with a high proportion of riffles.

In addition, I note that the EIS and SREIS present a strong case that it is likely to be the actual physical characteristics of the impoundment, not its hydraulic habitat type, which determines the suitability for Mary River Turtles. I consider that Cloacal breathing species require good levels of DO. Water bodies with low levels of DO, will limit the foraging time of Mary River Turtles. It may also force them to the surface and expose them, particularly the young, to predation.

I note that the upper layer of water and the periphery of the impoundment are expected to be of similar water quality to the contributing river and tributaries. It is not expected that the turtle would utilise the poorer water quality in the deep water layers (Hypolmnion).

The proponent is required by Condition 7(b), Schedule C, Appendix 1 to remove most of the vegetation that would otherwise immediately break down during the initial inundation, thereby minimising the related potential for increased nutrient loads. Furthermore, the filling is expected to be relatively rapid (as indicated above) with a potentially available contingency strategy involving the release of water from Borumba Dam to dilute poor quality water within the inundation area during filling.

In addition, to help maintain the oxygen in released flows downstream, the Project's outlet release design includes a device to increase the oxygenation of the water.

Low DO levels may also eventuate if excessive levels of floating macrophytes (particularly weeds such as Eichhornia crassipes and Salvinia molesta) develop over the dam. However, the proponent has committed to, and I have imposed at Condition 21(k), Schedule C, Appendix 1, vigilant and early control of macrophyte weeds. As discussed above in the subsection entitled macrophyte responses, I consider there is a high chance of success.

Based on EPA/DERM findings and advice, I consider that it is likely that the impoundments that are not suitable for Mary River Turtles are those that substantially have low DO and limited micro habitat characteristics. I do not consider that a substantial proportion of the inundation area will be in this category. As per pages 20-64 and 20-65 of the SREIS, favourable characteristics will be present within the inundation area. For example, around 60% of the impoundment area will be within the identified optimal depth range. While inundation without suitable mitigation could potentially remove Mary River Turtle microhabitat that provides shelter, the proponent is required by Conditions 21(j) and 7 (a) and 7(b) to introducing a range of snags at different levels within the inundation area, as well as leaving the riparian vegetation at 1.5 metres from FSL will help to provide micro habitat Mary River Turtles. A variety of macrophytes, including ribbon weed, are expected to quickly recolonise. Flow conditions downstream, consistent with my requirements at Condition 8 Schedule C, Appendix 1, are also expected to enhance habitat conditions and involve more protection to any nesting areas that occur immediately downstream as well as help create healthy beds of ribbon weed (a food source for the Mary River Turtles).

Also, the proponent is required to restore and enhance riparian vegetation, including the establishment of species important for particular species (e.g. lillypilly, fig and blackbean species) around the impoundment and in new areas of protected riparian habitat.

I further consider, as discussed above in relation to Lungfish and Mary River Cod, that there are considerable opportunities to create protected riparian habitat areas and associated in-stream refuge areas with characteristics that will be favourable to Mary River Turtles (as well as Mary River Cod and Lungfish) and other turtle species in accordance with my requirements throughout Conditions 4 and 5, Schedule C, Appendix 1. The most likely essential habitat factors that will need to be included within these areas involve parallels with those relating to Lungfish and Mary River Cod and/or factors that can readily co-exist within proposed refuge areas. A key exception is the need to maintain sparsely vegetation sand banks within areas of otherwise high quality overhanging riparian vegetation adjacent to well-oxygenated pools. I consider that it will be important for the new habitat refuge sites to include complex microhabitat features such as snags and rock crevices, particularly for younger turtles and suitable sand banks to encourage nesting.

From the EIS material and submissions, I consider that the following important nesting-related factors can be assumed with some confidence:

- Female Mary River Turtles produce one clutch of eggs annually
- Eggs are laid in mid October to end of November
- The incubation period for eggs is around 50 days
- Hatchlings emerge throughout December until February.

Flooding during the incubation period is a constant threat to Mary River Turtles, with an entire breeding population able to be lost in a year with considerable flood events from October through to January/February. However current observations indicate that even without floods, the majority of eggs are being either trampled by cattle or alternatively consumed by feral dogs, foxes, pigs, goannas or water rats. It is also possible that illegal egg harvesting is continuing.

In recent years an EPA (now DERM-QPWS) supported Tiaro community nest protection project has actively intervened to save Mary River Turtle hatchlings. The Project involves erecting protective cages over nests to prevent cattle or predators destroying Mary River Turtle eggs. Eggs are also placed in incubation should there be a risk of flood. Additionally, a captive breeding program released hatchlings in 2007. The impact of the apparently successful intervention actions is not known as a scientific assessment has not been commenced.

The Project represents an opportunity to enhance the resources dedicated to protecting eggs through measures which keep water and pests away from nests in key times and that lead to the creation of new refuge areas with favourable characteristics. This will be accommodated and encouraged through the activities to be implemented to address the requirements of Conditions 5, 11 and 21, Schedule C, Appendix 1.

While it is not known with certainty what makes an attractive egg laying site, it is seemingly well established that eggs are buried in sparsely vegetated sand banks approximately between 2 to 50 metres from the water edge, and about 1 to 3.5 metres above the water level. It appears that females remain loyal to the same hatching location throughout their life. I am satisfied that the proposed large-scale riparian vegetation restoration proposed by the proponent, in consultation with the chief executive administering the *Nature Conservation Act 1992* will suitably accommodate these requirements and not result in the loss of key sparsely vegetated sand banks.

Experts from DERM have advised that it is highly likely that the majority of nesting (both historically and presently) occurs well downstream of the Project Area, particularly in the vicinity of Tiaro. Cattle trampling and predation are ongoing challenges to the hatchling success at known nesting sites.

I understand that Mary River Turtles have been considered to not be a particularly mobile species, although there is insufficient available data to confirm migration requirements at the various life stages, particularly during the pre-adulthood stages. Mary River Turtles do not appear inclined to travel overland. Adult turtles are believed to move on average less than 200 m per day. Even during the breeding season, when the females venture to their preferred hatching locations, Mary River Turtles still manage to stay within the same 2 km stretch of the River.

Survey results and analysis from the EIS and the then EPA suggests that the proportion of juveniles in the population upstream of Gympie may have increased and be increasing relative to the proportion downstream of Gympie (i.e. the area associated with the key nesting banks).

This may be due to one or more of the following factors:

- differences in sampling techniques and/or
- better recruitment success upstream due to land use related water quality variations between localities and/or
- improved predator control in upstream locations and/or
- juvenile migration from the Tiaro nesting banks

The proponent's analysis relating to juvenile turtles in section 4.3.1.3 of the Response to Reviewer Reports, and advice from DERM, emphasises the need for caution in choosing among four potential factors and explanations for the survey results indicating greater juvenile presence in the Project Area.

Given the uncertainty associated with juvenile migration and factors affecting the survival of juveniles after hatching (as per the analysis in section 4.3.1.5 of the Response to Reviewers), it is therefore prudent, in terms of conditioning, to assume:

- that immature turtles do migrate upstream from the Tiaro vicinity as far as Kenilworth
- that juvenile recruitment has improved generally in the Project Area in recent years
- that juveniles may have difficulties surviving in considerable proportions of the impoundment (particularly deeper parts) for sustained periods (noting however, as discussed above, the characteristics of the impoundment area suggesting that the key DO and water quality levels will not be permanently diminished in the shallower areas of the impoundment through which turtles are more likely to pass through and/or occupy at least temporarily).

In the absence of new information coming to light to demonstrate that one or more of the above factors or assumptions are not important or are incorrect, I must assume that all of the factors are important and the assumptions are relevant. This means I am obliged to place comprehensive requirements on the proponent to allow for all possibilities and to therefore comprehensively address risks associated with Project and ongoing threatening processes applying to the species.

I consider that a precautionary approach must be taken and therefore I must assume that all of the abovementioned factors are important. This means that I am requiring the proponent to apply considerable resources to accommodate or treat each of the factors as relevant through my relevant imposed conditions, particularly those at Conditions 5, 11, 21, 22 and 23 Schedule C, Appendix 1. These relate to, among other items, the undertaking of a trial bypass for turtles, the construction of a turtle bypass system to allow turtle movement past the dam wall informed by that trial and a second turtle bypass system on an existing barrier within the Mary River catchment, an applied research program to improve understanding of the biological requirements of the species, monitoring and data-logging procedures, monitoring against thresholds for the triggering of further specific mitigation measures to address adverse population changes and substantial habitat restoration and protection within the inundation area buffer and elsewhere (e.g. in the vicinity of Tiaro).

The EIS identified 64 potential nesting sites (sand banks above the river) around the inundation area of which 32 would be lost to the inundation. It was not known, which or if any of the sites are being utilised for laying. The EIS indicates that nesting sites were also lost after the completion of the Mary River Barrage and that females responded to the inundation by selecting new nesting areas immediately upstream of the inundation area.

The proponent has committed to move sand banks that will be inundated to new locations. Development of these artificial sand banks will be part of the waterway restoration. In addition, the Project will create a number of islands, the proponent will develop nesting banks for breeding on these islands. The islands' separation may provide a location for egg incubation safe from predators and cattle.

Another key issue raised by submissions related to concerns about the potentially fatal injuries that spillways, release valves, and fishways may cause to turtles. There is evidence that freshwater turtles in the vicinity of dams are more likely to suffer fractures to their shells from trauma. Life threatening injuries may result from the turtles being caught in the fishway mechanism or the flows over the spillway. Protective trashracks/trash filter screens are also known to contribute to injuries.

The proponent is required, by Condition 21(j)(viii) Schedule C, Appendix 1, to complete the design of protective measures within the design of Project structures such as the spillway during the detailed design process and then construct those designed structures in a manner that will minimise harm to turtles.

Under the existing situation, the continued viability of Mary River Turtles is of concern and even with continued human intervention numbers may still continue to fall. The EIS process has confirmed that the areas below, within, and upstream of the proposed inundation contain Mary River Turtles. Furthermore it would appear that, while nesting may be limited, successful recruitment of juvenile turtles into adulthood could be taking place within the Project Area.

By implication the inundation area must have at least reasonable habitat values. In itself, the inundation of the Project Area would probably result in a reduction of population size. However, the Project includes specific aspects (e.g. extensive areas within the impoundment of suitable depth range, instream snag habitat creation, maintenance of sand banks and riparian revegetation) that will mitigate the impact upon Mary River Turtles. Furthermore, the Project and my conditions include large-scale threat reduction requirements (e.g. habitat restoration, applied research activities and feral predator and cattle access controls) that will directly address the major known threats to the Mary River Turtles that exist whether or not the Project proceeds.

<u>I consider that</u> the provision of additional and enhanced existing aquatic and riparian habitat will mitigate and offset the loss of habitat within the inundation area. However, in order to ensure that connectivity is maintained with both the aquatic habitat to be created within the inundation area and the existing (and to be enhanced) aquatic habitat that exists upstream of the Project Area, I have required that certain mitigations (that must be provided before construction is able to proceed) are provided in regard to passage across the dam wall and measures to support movement thorugh the inundation area.

<u>I consider that</u> the Project, without the mitigation measures proposed by the proponent and the additional measures that I have required through conditions, could have caused overall adverse impacts on Mary River Turtles. However, the proponent has proposed measures within the Project, which taken together mean that, on balance, the Project is likely to produce net benefits for the species. The current uncertainty about some aspects of the lifecycle and habitat needs of Mary River Turtles has led me to require further comprehensive and precautionary mitigations over and above those proposed by the proponent to provide certainty that the potential impacts of the Project have been managed.

Listed migratory species

The SREIS and EIS identified the following listed migratory species that have been recorded in the study area as including:

- fork-tailed swift (Apus pacificus);
- great egret (Ardea alba);
- cattle egret (Ardea ibis);
- white-bellied sea-eagle (Haliaeetus leucogaster);
- white-throated needletail (Hirundapus caudacutus);
- rainbow bee-eater (Merops ornatus);

- black-faced monarch (Monarcha melanopsis);
- spectacled monarch (Monarcha trivirgatus);
- satin flycatcher (Myiagra cyanoleuca); and
- rufous fantail (Rhipidura rufifrons).

The following listed migratory species were found to be likely to occur in the study area:

- Coxen's fig parrot (Cyclopsitta diophthalma coxeni)
- Latham's snipe (Gallinago hardwickii)
- Bar-tailed godwit (Limosa lapponica)
- Whimbrel (Numbenius phaeopus) and
- Painted snipe (Rostratula benghalensis s. lat.)

The study area is not known to contain any area of important habitat for migratory species, and is not known to contain an ecologically significant proportion of the population of any migratory species.

In some cases, the habitat restoration requirements in my conditions, including Condition 21 (c), 21 (e), 21 (h) and 21 (i), Schedule C, Appendix 1 may provide a benefit to migratory species that forage in the Project Area.

In addition, the proponent identified in the EIS a number of migratory and marine species within the Great Sandy Strait region. Given my findings above that the Project will have any impact upon Fraser Island, the Great Sandy Strait and that any Project impact on the Estuary will be negligible, I am satisfied that the Project will not have a significant impact on migratory or marine species that rely on this environment.

4.8. Project Alternatives

A detailed assessment of project alternatives, including where relevant the impacts on matters of national environmental significance, are discussed in detail at section 1.4 of this report.
As per my concluding remarks in section 1.4, I accept that the QWC's water supply strategy considered a range of alternative supply options and appropriate proportions of each supply option, while noting that sections of the community have varied views of the preferred mix of measures. I note the QWC's determination that the portfolio supply approach adopted under the strategy satisfactorily reduces the risk of failure resulting from the current narrow supply basis, both from the geographic location of the source and the method of supply perspective, and as such additional surface water supplies are considered a necessary component of the portfolio approach to required new supplies.

In this context, one of the key criteria in achieving a balance between water supply and demand is availability of a reliable volume. The QWC's approach essentially assessed the contribution that could reasonably be achieved with each proposed option, then to select for further consideration the projects with the best potential to contribute a reliable volume of water to address the overall water supply shortfall. I note that the approximate contribution of the various components of the strategy in meeting demand in 2026 will consist of 51% by existing supplies, 18% through demand management, 16% by desalination and recycling together and 15% by new surface water supplies.

As part of the analysis conducted at section 1.4, consideration was given to environmental impacts in relation to surface water alternatives to the Project. This analysis indicated that it is likely that similar or greater environmental impacts would result with the adoption of alternative surface water supply options that would satisfy the Project yield. This was primarily because alternative surface water supply options would require multiple barriers to be put in place in geographically dispersed locations.

I consider that desalination can and does form an important component of the State's water supply strategy, however, I consider it is reasonable for Government authorities to decide to defer further reliance on desalination, particularly as the use of an increased proportion of desalination to satisfy demands in the region would present challenges, such as the following:

- It is highly likely that delivered water costs to the serviced community may, especially in the longer term, be greater for water provided from a portfolio of water supply infrastructure that includes an increased proportion of desalination infrastructure, imposing an increased economic burden on the serviced community
- The increased composition of water sourced from desalination in the overall water supply portfolio may change the serviced community's water supply risk profile, with a resulting increased economic burden for additional supply 'risk protection'
- Energy requirements for desalination for each delivered unit of water is, at this time, orders of magnitude greater than that provided from a dam, with correspondingly greater levels of production of greenhouse gas emissions
- Environmental impacts of any desalination project are specific to the location of a particular plant.

In consideration of these factors, increasing the proportion of desalination to provide an equivalent yield to the Project is not a preferred alternative at this time. However, desalination is likely to form an important complementary component of the regional water supply in the future.

4.9. Social and economic considerations

I note that one of the Commonwealth Environment Minister's considerations in making his decision under section 133 of the EPBC Act is social and economic matters (see section 136 EPBC Act). Social and economic considerations are discussed in detail at sections 3.10 and 3.11 of this report.

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

The Project will require the purchase of significant numbers of properties in addition to those already purchased by the Queensland Government. Approximately 80% of required properties have now been purchased and approximately 75% of these are currently being leased back to the original owner. In the majority of cases, the properties are continuing to be used for the same purpose as prior to sale to the proponent.

The loss of property will result in changes to property use and management. Further, the acquisition of property for the Project has and will lead to uncertainty and concern to affected property owners. Impacts on these property owners in-particular include the emotional impacts to property owners, including changes to and uncertainty about future plans, severance of family history and ties, and disruption to lifestyle.

During construction of the Project there will be localised negative impacts, particularly for the directly impacted property owners or due to road diversions or changes stemming from construction activities, however, with proactive management and conditioning these impacts can be minimised.

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 including schools and sporting clubs.

The requirement to house a proportion of the workforce in a construction camp will help to mitigate the impact of an influx of people into the local housing market in the shorter term.

At the regional level, the impacts of the Project will be largely positive, with the completed dam expected to improve the supply and reliability of water. The dam operation is likely to provide positive benefits for the community as a tourism or recreation attraction.

Negative impacts during operation of the Project will be mainly associated with the ongoing impacts of changed farm management practices for property owners directly affected by the Project.

The announcement of the Project has had a significant impact on the wider Mary Valley community. I acknowledge that there is significant community opposition to the Project reflected in the SIA survey responses, the organised opposition to the dam and the large number of submissions received in response to the EIS.

Notwithstanding a lack of empirical data to support a detailed assessment of mental health issues, the SIA found clear anecdotal evidence that psychological distress and the incidence of mental illness increased in the Mary Valley in the twelve months post the dam announcement.

The EIS acknowledges the impact to community health the announcement of the Project has caused. The EIS also found that for some people opposed to the Project, information provided by the Queensland Government and the proponent has not, and may never satisfy all their concerns and questions.

Substantial mitigation measures have been implemented since the announcement of the Project including additional community services, programs and facilities to provide access to information and support services for residents and businesses.

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

Having regard to numerous submissions received and the findings of the EIS, I concur with the proponent's assessment in the SREIS that the only way to resolve uncertainty and perceived threats to security and local values, for some residents, would be to rescind the Project.

However, I have weighed the benefits of secure water supplies to the wider community of SEQ against the negative impacts the Project will have for some people.

While accepting there will be negative impacts for some in the local community, it is apparent from the Proponent's mitigations and the extensive conditions I have imposed that there will be substantial localised benefits resulting from the Project.

Localised negative impacts include:

- The loss of property will result in changes to property use and management; and
- Uncertainty and concern to affected property owners – including the emotional impacts to property owners, including changes to and uncertainty about future plans, severance of family history and ties, and disruption to lifestyle.

Positives for the local area and wider Mary Valley catchment include:

- Agricultural programs to that will offset lost agricultural output and create new industries replace declining ones
- Establishment of a timber plantation for the area

- Establishment of Tourism and Recreation opportunities
- Increased business activity resulting from construction
- Increased job opportunities and training for local workers involved in the construction activity
- Flood mitigation benefits for Gympie
- An extensive farm management planning program; and
- Extensive increases in terrestrial and aquatic habitat quality.

Additional to these mitigations is the benefit to the expanding population of SEQ of secure water supplies.

I conclude that on balance, the regrettable negative impacts of the individuals concerned are outweighed by the long term benefits to the wider SEQ region.

5. Conclusions & recommendations

The Project is a key component of the Queensland Government's strategy to provide secure water supplies for SEQ. The Project will contribute to addressing the medium to long term water supply shortfall and in particular, provide a prudent increase in surface supply options as part of the overall diversified supply strategy.

The Project would complement other water supply related projects and demand management initiatives either completed (e.g. Cedar Grove Weir, Bromelton Offstream Storage, Tugun Desalination Plant), planned (e.g. Northern Pipeline Interconnector Stage 2), or underway (e.g. Wyaralong Dam).

In undertaking my evaluation of the EIS, I have considered the EIS, issues raised in submissions, the SREIS, the Commonwealth Reviewer Reports, the proponent's Response to Information Requests and Response to Commonwealth Reviewer Reports, and the advice I have received on a range of key issues from State agencies and DEWHA. In addition, I received a range of communications outside of the submission period from a number of community groups and individuals, which have been considered in my evaluation.

I am satisfied that the requirements of the SDPWO Act have been satisfactorily fulfilled, and that sufficient information has been provided to enable me to finalise the required evaluation of the potential impacts, attributable to the Project.

The various impacts, identified in both the EIS and the SREIS, are recognised. I consider that those impacts are acceptable having regard to the significance of the Project in terms of ensuring security of water supply for South East Queensland and the mitigation and offset measures that will be provided by the Project. Those mitigation and offset measures are considered particularly significant in terms of the provision of extensive and connected habitat in the context of an existing degraded environment within the Mary River catchment.

While I am mindful that the people of the Mary Valley are being asked to cope with substantial disruption to deliver water security for the SEQ region, I am satisfied that the requirements of my conditions, including the implementation of a community and economic development program including the implementation of a recreational tourism program as well as a series of programs targeted at supporting and encouraging the sustainable growth of the local economy, especially agricultural enterprises, will result in acceptable, and, over time, beneficial outcomes.

I recommend that the Project, as described in this Evaluation Report, proceed, subject to the conditions in Appendix 1, the updated commitments made by the proponent in the Response to Reviewer Reports, and my recommendations.

The conditions that are set out in Appendix 1 of this Evaluation Report include:

- conditions that must be imposed on development approvals for the Project (Schedule A). While these conditions must attached to a development approval under the *Integrated Planning Act 1997*, the statement of these conditions does not limit the assessment manager's power to assess the development application and impose additional conditions not inconsistent with my conditions

- recommendations for other State approvals that will be required for the Project (Schedule B), where the decision maker must take my Evaluation Report into account and

- imposed conditions under the SDPWO Act, which are enforceable through the SDPWO Act (Schedule C)

I have required at Condition 1, Schedule C, Appendix 1 that if the Project does not substantially start within 10 years of the date of this Evaluation Report, this report lapses unless the Coordinator-General fixes a later time for the report to lapse.

In order to ensure that my conditions are applied in a systematic, auditable manner, I have required at Condition 12, Schedule C, Appendix 1 that the proponent submit to me for approval a Project environmental management plan (EMP) within 6 months of the date of this Evaluation Report. I have further required that prior to completion of construction, a major update of that Project EMP be provided to me for approval. In particular these conditions are directed at ensuring an integrated implementation of my conditions, and establishing a monitoring, independent auditing and reporting regime to ensure compliance.

In addition to my conditions in Appendix 1, I make the following recommendations in relation to the Project:

Recommendation 1: Recognising the requirement for ongoing provision of additional services for the Mary Valley Region as a result of the Project and the anticipated ongoing role of particular organisations as part of a regional cross- agency working group, I recommend that the proponent work with government agencies to establish a cross-agency working group to ensure government provided services, including education and local community health services (within GRC LGA) are maintained as necessary and secure additional funding if required.

Recommendation 2: The continuation of the Business Adjustment Scheme would appear to be beneficial in assisting those businesses not directly affected by the property purchases but experiencing losses in revenue relating to the economic changes associated with the Project. The program includes exit assistance for those businesses in circumstances where this is the only realistic option. As discussed in the section on agricultural impacts, I recommend the Queensland Government extend the former DTRDI's (now the responsibility of DEEDI) Traveston Crossing Dam Business Adjustment Scheme (delivered by QRAA) for an additional 4 years.

Recommendation 3: I concur with advice provided by DERM that the conservation management of the Mary River Turtle and Giant Barred Frog would benefit from preparation of a species-specific management plan. I recommend that DERM work with the proponent to prepare management plans for these species. The management plan for the Mary River Turtle should include consideration of all freshwater turtles and similarly the plan for the Giant Barred Frog should be relevant to all frogs in the lower half of the Mary River catchment. These management plans should include mapping (habitat, nest areas, etc) monitoring (tagging, tracking, surveys etc) as well as research priorities as outlined in Appendix 1, Schedule E.

Recommendation 4: I believe that the conservation management of the Lungfish would benefit from a species specific management plan. I recommend that DEEDI work with the proponent and operators of other infrastructure in the Burnett and Mary River Catchments to prepare a management plan for the Lungfish. The management plan for the Lungfish should include consideration of the draft Survival Strategy for the Australian Lungfish and should also include mapping of habitat, monitoring (tagging, tracking, surveys etc) as well as research priorities as outlined in Appendix 1, Schedule E.

Recommendation 5: I acknowledge the extensive work that has been presented by the proponent as part of the Response to Reviewer Reports in relation to the application of the water resource planning process in refining the optimal release strategy for the Project to protect environmental values while recognising the existing obligations in the Water Resource Plan and my requirements in Condition 8, Schedule C, Appendix 1. I recommend that the Department of Environment and Resource Management work with the proponent to implement the suggested augmentation to the water resource planning process illustrated in figure 2-9 of the Response to Reviewer Reports. This process has been designed to provide a continuous improvement approach to the protection and enhancement of ecological values for all native species in the downstream catchment, particularly in relation to the ecological requirements of the Mary River Turtle, the Lungfish and the Mary River Cod.

Recommendation 6: I note that Stage 2 would significantly adversely impact on many of the mitigations I have imposed, making the achievement of the Stage 2 project more difficult. In light of my observations, I therefore recommend that the Government should reflect on the suitability of the potential Stage 2 project, that the strategy for long term water supply for SEQ should not rely upon Stage 2, and Government should consider alternative water supply measures to address identified long term water supply requirements.

Recommendation 7: Given the jurisdiction of the Commonwealth Environment Minister, I believe that there is substantial benefit in early consultation between the proponent and DEWHA in the development of documentation required by Conditions 4, 5, 11, 22, 23, Schedule C, Appendix 1. I recommend that both the proponent and DEWHA engage during initial development of this documentation, and well prior to submission of this documentation for approval, in order to ensure that the Commonwealth's views can be considered at an early stage of development.

Recommendation 8: I recommend that the proponent develop a strategy to engage broadly with the community in regards to noise, vibration and blasting issues.

This report will now be provided to the Commonwealth Minister for the Environment, Heritage and the Arts, pursuant to section 17(2) of the SDPWO Regulation and the Bilateral Agreement between the State of Queensland and the Australian Government as the assessment report to enable a decision on approval of the controlled action for this Project pursuant to section 133 of the EPBC Act.

The proponent will also be required to obtain a number of State approvals, including for environmentally relevant activities, and interim resource operations licence and operational works approvals for clearing native vegetation and construction of a referable dam.

A copy of this report will be provided to the proponent and advisory agencies and will be made publicly available on the Department of Infrastructure and Planning website, at www.dip.qld.gov.au.

Appendix 1: Conditions that apply to the Project

Schedule A: Conditions under section 39 of the *State Development and Public Works Organisation Act 1971*

Schedule B: Recommended conditions under section 52 of the *State Development and Public Works Organisation Act 1971*

Schedule C: Imposed conditions under Part 4, Division 8 of the *State Development and Public Works Organisation Act 1971*

Schedule D: Fishway Design Documentation

Schedule E: Priority Research Activities

Schedule F: Habitat Areas

Schedule G: Grey-headed flying fox colony

Schedule H: Definitions for Appendix 1

Schedule I: Jurisdiction for Conditions

Schedule A: Conditions under section 39 of the State Development and Public Works Organisation Act 1971

Schedule A contains the conditions that must attach to a development approval issued under the *Integrated Planning Act 1997* (Qld) for the Project. The conditions are taken to be concurrence agency conditions under the *Integrated Planning Act 1997* (Qld).

The conditions imposed do not limit the assessment manager's power to assess the development application and impose conditions not inconsistent with the conditions in this Schedule A.

Schedule I states the entity that is to have jurisdiction for the condition after the development approval has taken effect.

The development approvals under the Integrated Planning Act 1997 for which I have set conditions are:

- Making a material change of use of premises for an environmentally relevant activity
- Making a material change of use for land on the environmental management register or premises used for a notifiable activity
- Operational work that is the clearing of native vegetation
- Operational work that is the construction of a referable dam as defined under the *Water Supply (Safety and Reliability) Act 2008*
- Operational work that allows the taking, or interfering with, water under the *Water Act 2000*
- Operational work that is the constructing or raising of a waterway barrier works

Making a material change of use of premises for an environmentally relevant activity

(Schedule 8, Part 1, Table 2, Item 1 *Integrated Planning Act 1997*)

Environmentally Relevant Activities

The proponent has indicated that Environmentally Relevant Activities (ERAs) 8, 16, 21, 43, 56, 57, 63 will be triggered during the construction phase of the Project. The proponent has also identified that ERA 61 may be triggered by the Project. Where ERAs are triggered the following conditions apply for a material change of use for an ERA. Based on the EIS and the SREIS the following ERAs may be triggered during the construction phase of the Project.

The ERAs that will be triggered may change depending on the detailed development of the Project.

Where ERAs are triggered, this schedule sets out the conditions that must be imposed on a development approval for a material change of use of premises for an ERA.

The following is a brief description of the ERAs as set out in full in Schedule 2 of the *Environmental Protection Regulation 2008* (Qld).

ERA 8 Chemical storage—Chemical storage consists of storing:

(a) 50t or more of chemicals of dangerous goods class 2 or class 2, division 2.3 in containers of at least 10m^3; or

(b) 50t or more of chemicals of dangerous goods class 6, division 6.1 in containers capable of holding at least 900kg of the chemicals; or

(c) 10m^3 or more of chemicals of class C2 or C3 combustible liquids under AS1940 or dangerous goods class 3; or

(d) the following quantified of other chemicals in containers of at least 10m^3 –

    (i) 200t or more, if they are solids or gases;

    (ii) 200m^3 or more, if they are liquids.

ERA 16 Extractive and screening activities - Extractive and screening activities consists of any of the following:

(a) dredging a total of 1000t or more of material from the bed of naturally occurring surface waters, in a year;

(b) extracting, other than by dredging, material from a wild river area;

(c) extracting, other than by dredging, a total of 5000t or more of material, in a year, from an area other than a wild river area;

(d) screening 5000t or more of material in a year.

ERA 21 Motor vehicle workshop operation - Motor vehicle workshop operation consists of operating a workshop on a commercial basis or in the course of carrying on a commercial enterprise involving any of the following relating to motor vehicles -

(a) maintaining mechanical components, engine cooling radiators or body panels;

(b) spray-painting body panels;

(c) detailing or washing.

ERA 43 Concrete batching - Concrete batching consists of producing 200t or more of concrete or concrete products in a year, by mixing cement with sand, rock, aggregate or other similar materials.

ERA 56 Regulated waste storage - Regulated waste storage consists of operating a facility for receiving and storing regulated waste for more than 24 hours.

ERA 57 Regulated waste transport - Regulated waste transport consists of:

(a) transporting on a non-commercial basis 250kg or more of regulated waste in a vehicle; or

(b) transporting on a commercial basis any quantity of regulated waste in a vehicle.

ERA 63 Sewage treatment - Sewage treatment consists of:

(a) operating 1 or more sewage treatment works at a site that have a total daily peak design capacity of at least 21EP; or

(b) operating a sewage pumping station with a total design capacity of more than 40KL in an hour, if the operation of the pumping station is not an essential part of the operation of sewage treatment works to which paragraph (a) applies.

The following ERA may also be triggered:

ERA 61 Waste incineration and thermal treatment—operating a facility for incinerating or thermally treating waste.

Department of Environment and Resource Management (DERM) Interest – General

Scope of approval

(A1) This approval authorises the ERAs to be carried out for and during the construction phase of the Project.

Prevent and/or minimise likelihood of environmental harm.

(A2) In carrying out an activity to which this approval relates, all reasonable and practicable measures must be taken to prevent and / or to minimise the likelihood of environmental harm being caused.

NOTE: This development approval authorises the ERAs. It does not authorise environmental harm unless a condition contained within this development approval explicitly authorises that harm. Where there is no condition or the development approval is silent on a matter, the lack of a condition or silence shall not be construed as authorising harm.

Display of Development Approval

(A3) A copy of this development approval must be kept at the site on a location readily accessible to personnel carrying out the activity.

Environmental Management Plan (EMP)

(A4) An Environmental Management Plan (EMP) must be implemented that provides for the effective management of the actual and potential environmental impacts resulting from the carrying out of the activities to which this development approval relates. Documentation relating to the EMP must be kept. The EMP must ensure and demonstrate that best practice environmental management is achieved at all times.

(A5) The EMP required by condition (A4) must provide for at least the following functions:

- The environmental policy of the registered operator including a commitment by senior management to achieve specified and relevant environmental goals;
- Organisational structure and responsibility to ensure that roles responsibilities and authorities are appropriately defined to ensure effective management of environmental issues;
- Identification of environmental issues and potential impacts of the proposed activities;
- Control procedures to be implemented for routine operations for day to day activities to minimise the likelihood of environmental harm, however occasioned or caused.
- Contingency plans and emergency procedures to be implemented for non-routine situations to deal with foreseeable risks and hazards, including corrective responses to prevent and mitigate environmental harm (including any necessary site rehabilitation);
- Effective communication procedures to ensure two-way communication on environmental matters between operational staff and higher management;
- Obligations with respect to monitoring, notification and record keeping obligations under the EMP and relevant development approval(s);
- Monitoring of the release of contaminants into the environment including procedures, methods and record keeping;
- The conduct of periodic reviews of environmental performance and procedures adopted, not less frequently than monthly , and a program for continual improvement in environmental management; and
- Training staff in the awareness of the above to ensure that all persons that carry out the activities are aware of relevant commitments, objectives and targets of environmental management.

Where relevant, the EMP may incorporate specific management plans required by other conditions of this approval, including the:

- Dust Management Plan required by condition *Air (6)*
- Stormwater Management Plan required by condition Water (11)
- Noise Management Plan required by condition Noise (3)
- Sewage Treatment Plan required by condition Land (2)
- Recycled Water Safety Plan required by condition Land (5)

- Irrigation Management Plan required by condition Land (7)
- Site Rehabilitation and Decommissioning Plan required by condition Land (21)
- Waste Management Plan required by condition Waste (4); and
- Emergency Response Plan required by condition Waste (15)

(A6) A copy of the EMP and any amendments of the EMP must be kept at the site and available for examination by an authorised person under the Environmental Protection Act 1994, on request.

(A7) The registered operator must not implement or amend an EMP (including any other associated EMP) that contravenes any condition of this development approval.

(A8) Trained/Experienced Operator(s)

The operation of the plant and equipment, including associated pollution control equipment, must be carried out by a person with appropriate experience and/or qualifications to ensure the effective operation of the plant and equipment.

(A9) Maintenance of Measures, Plant and Equipment

The registered operator must:

- install all measures, plant and equipment necessary to ensure compliance with the conditions of this approval; and
- maintain such measures, plant and equipment (including for example construction equipment, monitoring equipment, bunding, stormwater management systems, remote performance monitoring and alarm systems and associated response measures) in a proper and efficient condition; and
- ensure that such measures, plant and equipment are implemented and operated in a proper and efficient manner.

Monitoring

(A10) A suitably qualified person(s) must conduct any monitoring required by these conditions of approval.

Equipment Calibration

(A11) All instruments, equipment and measuring devices used for the measuring or monitoring in accordance with any condition of the approval must be calibrated, and appropriately operated and maintained.

Sample Analysis

(A12) All analyses and tests required to be conducted under these conditions of approval must be carried out by a laboratory that has NATA certification for such analyses and tests, except as otherwise authorised by the administering authority.

Alterations

(A13) No change, replacement or operation of any plant or equipment is permitted if the change, replacement or operation of the plant or equipment increases, or is likely to substantially increase, the risk of environmental harm above that expressly provided for by these conditions of approval.

Records

(A14) The registered operator must record, compile and keep all monitoring results and reports required by the development approval and present any monitoring results of reports to the administering authority when requested.

(A15) All records required by this development approval must be kept for at least five (5) years.

Notification

(A16) The registered operator must notify the administering authority as soon as practicable after becoming aware of any release of contaminants that occurs otherwise than in accordance with the conditions of this approval or any event where environmental harm has been caused or may be threatened.

Note: The Pollution Hotline (1300 130 372) is the appropriate contact for pollution incidents.

(A17) Written advice detailing the following information must be provided to the administering authority within fourteen (14) days following any notification in accordance with condition (A17):

- the name of the registered operator of the activity to which this approval relates, including the development approval number;
- the name and telephone number of a designated contact person;
- the location of the release/event;
- the time of the release/event;
- the time the registered operator became aware of the release/event;
- the suspected cause of the release/event;
- a description of the resulting effects of the release/event;
- the results of any sampling performed in relation to the release/event,
- actions taken to mitigate any environmental harm (including environmental nuisance) caused by the release/event; and
- proposed actions to prevent a recurrence of the release/event.

Incident Reporting

(A18) A record must be kept of:

- any uncontrolled release of contaminants that exceeded, or was likely to exceed, limits specified in this approval;

- any other unauthorised release of contaminants;
- the time, date and duration of equipment malfunctions where the failure of the equipment resulted in the release of contaminants which caused, or was reasonably likely to cause, environmental harm.

Spill Kit

(A19) An appropriate spill kit, personal protective equipment and relevant operator instructions/emergency procedure guides for the management of wastes and chemicals associated with the ERA must be kept at the site, and in each vehicle used if the activity is a mobile ERA.

Spill Kit Training

(A20) Anyone operating under this approval must be trained in the use of the spill kit.

DERM Interest: AIR

Nuisance

(B1) The release of noxious or offensive odours or any other noxious or offensive airborne contaminants resulting from the activities to which this development approval relates, must not cause a nuisance at any nuisance sensitive or commercial place.

Dust Nuisance

(B2) The release of dust and/or particulate matter resulting from the activities to which this development approval relates must not cause an environmental nuisance at a nuisance sensitive or commercial place.

(B3) When requested by the administering authority or as a result of a complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer), dust and particulate monitoring must be undertaken, and the results thereof notified to the administering authority within fourteen (14) days following completion of monitoring. Monitoring must be carried out at a place or places relevant to the potentially affected sensitive place and at upwind control sites. Dust and particulate matter must not exceed the following levels when measured at any sensitive or commercial place:

(a) Dust deposition of 120 milligrams per square meter per day, when monitored in accordance with *Australian Standard AS 3580.10.1 of 2003* (or more recent editions); and

(b) A concentration of particulate matter with an aerodynamic diameter of less than 10 micrometer (µm) (PM10) suspended in the atmosphere of 50 micrograms per cubic meter over a 24-hour averaging time, at a sensitive or commercial place in proximity to the site:

(i) Australian Standard AS 3580.9.6 of 2003 (or more recent editions) Ambient air - Particulate matter - Determination of suspended particulate PM10 high-volume sampler with size-selective inlet - Gravimetric method; or

(ii) any alternative method of monitoring PM10 which may be permitted by the *Air Quality Sampling Manual* as published from time to time by the administering authority.

(B4) Monitoring undertaken for the purpose of meeting the requirements of this approval must be undertaken in accordance with the methods prescribed in the latest edition of the EPA's "*Air Quality Sampling Manual*"

Dust Management Plan

(B5) Prior to the commencement of any ERA, the registered operator must develop a Dust Management Plan to ensure that activities will be located a sufficient distance from nuisance sensitive places and carried out by such reasonable and practicable means necessary to prevent the emission of dust that constitutes an environmental nuisance.

The Dust Management Plan must include, but may not be limited to, the following:

- identification of potential sources of dust emissions from works associated with the construction of the Project;
- an assessment of the potential impact that these dust emissions will have on the nearest nuisance sensitive places, including predicted dust deposition rates, total suspended particulate and PM10 concentrations;
- a monitoring program sufficient to determine representative background ambient dust levels within the vicinity of the project sites prior to the commencement of the approved works;
- details of proposed dust control or abatement devices and strategies that will be implemented during works to minimise dust emissions from identified sources;
- provision of an ongoing air quality and meteorological monitoring program to gauge the effectiveness of dust control measures during construction works, which include sufficient spatial and temporal replicate sampling at representative locations; and
- a program to train staff involved in carrying out dust generating activities, in dust management practices.

Examples of dust mitigation strategies that may be incorporated into the Dust Management Plan are provided below.

Stockpiles

Stockpiles must be maintained using all reasonable and practicable measures necessary to minimise the release of wind blown dust and particulate matter to the atmosphere. Reasonable and practicable measures may include but are not limited to:

- orienting stockpiles of sand, gravel or other materials in a direction that reduces exposed surfaces to prevailing winds where possible;
- watering product stockpiles to maintain a moisture content that minimises dust generation where possible;
- use of dust-suppressants;
- storage of materials in bunkers;
- establishing a cover crop/grasses on topsoil stockpiles

Haul roads and transport of aggregates and sand

- watering haul roads regularly;
- use of dust suppressants;
- ensuring that trucks transporting fine materials are covered or that the load is wet down prior to transport;
- clearing of spillage from side rails, tail gates and draw bars of vehicles prior to and after movement of materials.

Crushing, screening and concrete batching plant and equipment

- employing water sprays as required to ensure that the moisture content of the material being processed is suitable to minimise dust during crushing and material handling;
- assessing wind direction prior to undertaking work that is likely to generate large quantities of dust and postponing works if wind is blowing towards a nuisance sensitive place;
- locating stationary dust generating activities (including concrete batching / rock crushing) as far as practical from sensitive places;
- ensuring that any dust collection systems including filters fitted to plant and equipment are maintained and cleaned as required to ensure their effective operation;
- use of windshields or barriers.

Trafficable Areas

- keeping surfaces clean;
- sealing with bitumen or other suitable material;
- using water sprays;
- installing an effective truck body and wheel wash facility; and
- using dust suppressants and wind breaks

Blasting and Rock Drilling

- Dust collectors must be used as necessary to minimise the release of wind blown dust to the atmosphere while rock drilling is carried out.
- Dust deposits must not smother or damage vegetation.
- Blasting must be restricted when strong winds are blowing in the direction of nuisance sensitive places.
- Dry and fine material within the blasted area should be wetted down to suppress dust evolution.

Incinerating vegetation

(B6) Vegetation must not be burned other than in the designated pit burner, unless otherwise authorised under the *Fire and Rescue Service Act 1990 (Qld)*

(B7) The pit burner may only be used to incinerate vegetation from land clearing undertaken within the inundation area, rehabilitation areas and construction footprint for the Project.

(B8) The amount of vegetation to be incinerated must be minimised as much as possible; e.g. by mulching or harvesting timber where possible.

(B9) Visible contaminant releases from the pit burner must not occur except:

- during the start up procedure for a maximum period of 15 minutes; and
- subsequent to start up procedures, for a continuous period of not more than one (1) minute per hour.

(B10) The pit burner must be designed and operated in such a way that the generation of smoke is minimised. Design and operational measures must include but not necessarily be limited to the following:

- The pit must not be located in an elevated position where burning may be affected by strong winds;
- Orienting the long axis of the pit at 90 degrees to prevailing winds;
- Sizing the air blower such that it distributes air evenly to the base of the pit to ensure a clean burn;
- Ensuring that the timber is sufficiently dried prior to burning;
- Removing excess soil from tree roots;
- Splitting large tree roots as required to aid combustion;
- Ensuring that the pit is filled in a manner that allows good air circulation.

Spray Drift – Treated sewage effluent

(B11) The registered operator must ensure that the system for irrigation of treated wastewater is designed such that spray draft and airborne contamination is prevented (e.g. sub-surface irrigation).

Concrete batching

(B12) The registered operator must ensure that any dust collection system, including filters, fitted to plant and equipment are maintained and cleaned as required to ensure their effective operation.

Agency Interest: WATER

Release to waters

(C1) Contaminants other than those specified in Condition (C2) must not be released to waters.

(C2) Contaminants may only be released to waters from the discharge location(s) and in the type of release specified below and if the release limits stated in Table 1 are complied with for each quality characteristic:

Discharge Location W1(n) [35].– the "final release outlets of all discharge structures". [36]

Type of Release: settled/treated stormwater runoff or water obtained as a result of any dewatering associated with the approved extraction on dredging activities.

Discharge location W2(n) [37] - each "area of disturbance in the river"[38].

Type of Release: water impacted by approved dredging activities within the Mary River.

Table 1 – Release limits

			Release limit	
Monitoring point	**Discharge location**	**Quality characteristic**	**Maximum**	**Monitoring frequency**
M1(n) M2(n)	W1(n) W2(n)	Turbidity (NTU)	40	Daily
M1(n) M2(n)	W1(n) W2(n)	Suspended solids (mg/L)	6	immediately prior to planned discharges, immediately prior to unscheduled discharges, and at sufficient intervals during discharges to demonstrate compliance with the release limit.
M1(n) M2(n)	W1(n) W2(n)	Oil, grease, floating scum or litter	Not visible	Daily
M1(n) M2(n)	W1(n) W2(n)	Electrical Conductivity (µS/cm)	No significant change to background levels. (Note 1)	immediately prior to planned discharges, immediately prior to unscheduled discharges, and at sufficient intervals during discharges to demonstrate compliance with the release limit.
Monitoring point	**Discharge location**	**Quality characteristic**	**Range**	**Monitoring frequency**
M1(n) M2(n)	W1(n) W2(n)	pH (pH units)	6.5 - 8	Daily

Note 1: A background value is the value obtained for a water quality characteristic at a sampling point(s) located in the receiving waters at an upstream location unaffected by dredging or other construction activity (including vegetation clearing). Background samples collected to satisfy the requirements of the background water quality above must be sampled from mid depth in the water column.

Toxic substances (acute and chronic)

(C3) Notwithstanding any other condition of this approval, there must be no discharge of any toxic substance in any amount or concentration, either alone or in combination

[35] W1(n) indicate that there will be a number of discharge locations i.e. (n) (to be finally confirmed in the monitoring program required by condition (C6) prior to construction).
[36] "final release outlets of all discharge structures" is defined in the Definitions provided at the end of the ERA section of this schedule.
[37] W2(n) indicates that there will be a number of discharge locations i.e. (n) (to be finally confirmed in the monitoring program required by condition (C6) prior to construction) associated with the treatment of water potentially affected by activities in each area of disturbance in the river caused by dredging.
[38] "area of disturbance in the river" is defined in the Definitions provided at the end of these ERA conditions.

with substances already in the receiving water or discharge, that are likely to cause acute toxicological effects to biota in the receiving environment.

Monitoring

(C4) Monitoring of contaminant releases to waters must be undertaken at the monitoring points described below for each discharge location and records kept, for the quality characteristics and at the frequency specified in Table 1 of this schedule.

Monitoring Points: M1(n) – Monitoring samples must be taken from the "final release outlets of all discharge structures" as identified for discharge points W1(n)[39].

Monitoring Points: M2(n) - Monitoring samples shall be taken from less than 100 m downstream of each "area of disturbance in the river"[40].

(C5) All determinations of the quality of contaminants released must be made in accordance with methods prescribed in the latest edition of the administering authority's Water Quality Sampling Manual, and carried out on samples that are representative of the discharge.

Water monitoring program

(C6) Prior to the commencement of construction of the dam a Surface Water Monitoring Program must be developed and implemented and a copy must be provided to the administering authority. The Surface Water Monitoring Program must:

be designed by a person possessing appropriate qualifications and experience in the field of surface water monitoring program design to be able to competently make recommendations about these matters;

(a) detail where all discharge locations W1(n) and W2(n) and associated monitoring points M1(n) and M2(n) are located;

(b) record the quality of the surface water at the monitoring points as required by this approval and at locations upstream and downstream of the activities associated with the construction of the dam and be undertaken for, but not limited to, the parameters defined in Table 1 and for the following water quality characteristics:

(i) oils and total petroleum hydrocarbons (mg/L);

(ii) total metals (mg/L);

(iii) total nitrogen and total phosphorous (mg/L);

(iv) total dissolved solids (mg/L);

(v) conductivity; and

(vi) dissolved oxygen (mg/L).

[39] M1(n) indicate that there will be a number of monitoring points i.e. (n) (to be confirmed in the monitoring program required by condition (C6) prior to construction).
[40] M2(n) indicates that there will be a number of monitoring points i.e. (n) (to be confirmed in the monitoring program required by condition (C6) prior to construction) associated with the treatment of water potentially affected by activities in each area of disturbance in the river.

(c) include a sufficient number of monitoring locations to establish background water quality and water quality in sections of the Mary River potentially affected by the ERAs; and

(d) provide representative water sampling for the Mary River carried out with sufficient regularity and spatial and temporal replication to make statistically valid conclusions about the water quality for the duration of the ERAs; and

(e) give consideration to relevant methodology and water quality criteria specified by the Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand in "Australian Guidelines for Water Quality Monitoring and Reporting 2000" and "Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000";

(f) include a quarterly assessment by a suitably qualified and experienced person to determine whether there has been any statistically significant adverse change in water quality for each characteristic specified in (iii) and Table 1 of this schedule, compared to background values.

(C7) If the quarterly assessment of surface water quality undertaken under condition (C6) indicates statistically significant changes in water quality, the registered operator must advise the administering authority and commission an investigation by a suitably qualified person. The investigation shall review the potential for environmental harm, outline possible mitigation measures and be provided to the administering authority.

(C8) A record of the results of the surface water monitoring program including background water quality monitoring must be kept and forwarded to the administering authority on request.

Stormwater Management

(C9) Diversion drains and or contour banks must be designed, installed and maintained to minimise the potential for stormwater runoff to enter areas disturbed by the ERAs.

(C10) Prior to the commencement of an ERA, a Stormwater Management Plan must be developed which details how the contamination of stormwater will be prevented and/or minimised. The Stormwater Management Plan must address at least the following matters:

- prevention of stormwater and stormwater runoff from contacting contaminants and disturbed areas;
- minimising runoff from disturbed areas;
- details of sediment control measures;
- separation of clean and contaminated storm waters (including the division of clear and uncontaminated stormwater away from any sedimentation ponds);
- treatment measures used to treat sediment laden stormwater, including performance indicators to achieve compliance with release limits specified in this schedule, water quality objectives and environmental values;
- measures for continuous improvement; and

- measures for periodic reporting and implementation of continuous improvement measures.

Prior to the use of flocculants to treat sediment laden stormwater, the registered operator must notify the administering authority of the chemical flocculent proposed to be used, the dosing rate and method to be used, and what measures will be implemented to ensure that the use of the flocculants will not cause environmental harm.

Erosion Protection Measures and Sediment Control

(C11) Effective erosion and sediment control structures must be designed, installed and maintained wherever necessary to prevent the erosion of disturbed areas and the release of sediment to waters.

(C12) All structures used for the storage or treatment of contaminants at the site subject to this approval must be designed:

- so as to prevent and/or minimise the likelihood of any release of contaminated stormwater from storage structures to any waters (including groundwater), other than permitted by this approval: and

- so as to ensure the stability of the structure.

(C13) Erosion control and sediment control structures must be maintained at all times, including during site clearing, construction, dredging operations and rehabilitation works, and be checked, repaired or replaced as required after each rain event.

(C14) All sediment ponds must be designed by a suitably qualified and experienced engineer to achieve the objectives of the Stormwater Management Plan and compliance with the conditions of this approval.

(C15) The total storage volume of any sedimentation basin for the place of works must be the larger of:

- $450m^3$ for every hectare of the catchment area of disturbed land; or

- one and a half times the volume of water that will enter the basin during six minutes of a five year AEP one hour rain event.

The storage depth must be at least one metre over two thirds of the basin area. Sediment must be removed when accumulated sediment reaches 33% of the total volume. A depth indicator for 33% must be set into the internal banks of sedimentation basins and a spillway at 100% with a minimum 750 mm freeboard for the banks above the spillway

Preventing contaminant release to water

(C16) In the event that a release from any dam spillway required for the conduct of the ERAs is necessary, the release must be managed in such a manner that prevents or minimises erosion of any watercourse or areas affected or potentially affected by the release.

(C17) Any spillage of wastes, contaminants or other materials must be cleaned up as quickly as practicable. Such spillage must not be cleaned up by hosing, sweeping or otherwise releasing such wastes, contaminants or material to any external storm water drainage system, roadside gutter or waters.

(C18) All un-washed empty chemical, oil and fuel drums must be stored on a concrete hardstand area and so as to not contaminate stormwater.

(C19) Washing, degreasing, servicing, cleaning or other maintenance of vehicles, plant, or other equipment must not occur in any area where resulting contaminants will or may be released to any storm water drain, land or waters.

(C20) Regulated wastes, chemicals (including paints and solvents), fuels (and other hydrocarbons), cement and concrete must be stored and handled so as to prevent the release or likelihood of release of contaminants. Such materials must be stored well away from stormwater drains and pits.

(C21) The daily volume of contaminants released from the site to waters must be determined or estimated by an appropriate method for each release point and records kept of such determinations.

Motor Vehicle Workshop

Oil Separators

(C22) Collected waste oil and sludge removed from each separator must be disposed of in a manner which does not cause contamination of any waters or land.

(C23) A record must be maintained of the time and date of the desludging and maintenance of each oil interceptor.

(C24) Collected waste oil and sludge is to be removed from site by an approved licensed waste contractor.

(C25) Detergents or other emulsifying agents must be prevented as far as practicable from entering the separator.

Agency Interest:- NOISE AND VIBRATION

(D1) All noise from the ERAs must not exceed the levels specified in Table 2 at any noise sensitive or commercial place.

(D2) Notwithstanding condition (D1), noise from the ERAs must not cause an environmental nuisance at any sensitive place or commercial place.

Table 2 - Noise limits

Noise level dB(A) measured as	Monday to Saturday			Sundays and public holidays		
	7am - 6pm	6pm - 10pm	10pm - 7am	9am - 6pm	6pm - 10pm	10pm - 9am
	Noise measured at a 'Noise sensitive place'					
$L_{Aeq, 1hr}$	Bg* + 10	Bg + 5	Bg + 3	Bg + 5	Bg + 3	Bg + 0
$L_{A1, adj, 10 mins}$	Bg + 15	Bg + 10	Bg + 6	Bg + 10	Bg + 6	Bg + 0
	Noise measured at a 'Commercial place'					
$L_{Aeq, 1hr}$	Bg + 15	Bg + 10	Bg + 6	Bg + 10	Bg + 6	Bg + 0

* Bg is the background sound pressure level, $L_{A90,15 min}$

(D3) **Noise Management Plan**

A Noise Management Plan is to be developed and submitted to the Administering Authority at least 30 days prior to the commencement of the ERAs. The noise management plan must address at least, but not be limited to, the following matters:

- identification of component noise sources and activities at the place(s) which impact on noise sensitive areas;
- the measured and/or predicted level of these noise sources and activities at noise sensitive places;
- the reasonable and practicable control or abatement measures that can be undertaken to reduce identified intrusive noise sources;
- the level of noise at noise sensitive places that would be achieved from implementing these measures;
- providing at least 5 day advance notice to people at noise sensitive sites that may be affected by scheduled activities that are likely to cause a significant increase in noise or vibration above what is usually being generated. The notice should describe the projected noise (and other nuisance) levels, characteristics, duration and recurrence of the noise that may occur;
- the handling of noise complaints;
- community liaison and consultation; and
- training of staff in noise management practices.

(D4) Notwithstanding Table 2, the operation of rock breaking, rock hammering, crushing or screening equipment which result in impulsive or tonal noise shall not be carried out:

- (a) outside the hours of 7.00 am to 6.00 pm Mondays to Saturdays;
- (d) on Sundays and public holidays.

Noise Control Measures

(D5) The environmentally relevant activities must be carried out by such reasonable and practicable means necessary to minimize the noise generated. The reasonable and practicable measures adopted must be incorporated in the relevant procedure(s) implemented under the Environmental Management Plan required by condition A4 and must include, but not necessarily be limited to, the following noise abatement measures:

- ensure that any equipment to be used on the site is assessed for potential noise nuisance impacts and appropriately attenuated;
- ensure that all plant and equipment is operated and maintained in a proper and efficient manner;
- ensure that engine cowlings and high efficiency silencers are fitted to all the engines of all plant and equipment identified as impacting on noise sensitive receivers;
- ensure that noise generating activities are not undertaken in close proximity to noise sensitive places or commercial places;

- ensure that noise abatement barriers are sited such that they effectively intercept the sound transmission path between the sources of noise and receptor premises;

- locate haul and access routes within the premises as far away from the boundaries of the site as is practical having regard to operational convenience; and

- where operation of reversing beepers is likely to cause environmental nuisance, taking measures to ensure mitigation of the nuisance, for example by de-tuning the reversing beepers, replacing the reversing beepers with other warning devices and/or replacing reversing beepers with alternative reversing beepers which adjust their noise level output in accordance with the prevailing background noise level; and

- minimise the night time movement of heavy vehicles along the access road to the dam construction site (i.e. on the road past affected residences)

Noise Monitoring

(D6) When requested by the administering authority, noise monitoring must be undertaken to investigate any complaint of noise nuisance, and the results notified within 14 days to the administering authority following completion of monitoring.

Monitoring must include:

- air blast overpressure [dB (Lin) Peak] (for blast monitoring only);
- peak particle velocity (for ground vibration monitoring only);
- LAeq, 1hr;
- LA 1, adj, 10 mins;
- L A90,15 min;
- the level and frequency of occurrence of impulsive or tonal noise;
- atmospheric conditions including wind speed and direction;
- effects due to extraneous factors such as traffic noise;
- location, date and time of recording; and
- details of measurement instrumentation and measurement procedure.

(D7) Where it is determined by an authorized person under the EP Act that monitoring results indicate environmental nuisance, the registered operator for the works must:

- address the complaint including the use of appropriate dispute resolution if required; or

- immediately implement noise abatement measures so that emissions of noise from the ERAs do not result in further environmental nuisance.

(D8) The method of measurement and reporting of noise levels must comply with the Environmental Protection Agency Noise Measurement Manual, Third Edition, March

2000, or more recent additions or supplements to that document as become available.

Explosive blasting nuisance

(D9) **Vibration nuisance**

Vibration emitted from activities must not cause a nuisance at any vibration sensitive place.

(D10) **Blasting**

Blasting is permitted on the site once per day within the hours of 09:00 am and 06:00 pm Monday to Saturday, excluding public holidays, unless approved from time to time by the administering authority.

(D11) Every explosive blast for the ERA shall be designed by a suitably qualified person.

Noise Limits – Blasting

(D12) Blasting activities must be carried out in such a manner that if blasting noise should propagate to a noise sensitive place, then the air blast overpressure:

- must be not more than 115 dB (Z Peak) for nine out of any ten consecutive blasts initiated, regardless of the interval between blasts; and
- must not exceed 120 dB (Z Peak) for any blast.

Vibration – Blasting

(D13) Blasting operations must be carried out in such a manner that if ground vibration should propagate to a noise sensitive place, the ground borne vibration:

- must not exceed a peak particle velocity of 25 mm per second for vibrations of more than 35Hz; and
- must not exceed a peak particle velocity of 10 mm per second for vibrations no more than 35Hz.

Explosive blasting monitoring

(D14) When requested by the administering authority, monitoring must be undertaken for explosive blasting. For the purposes of this condition monitoring must be done by a suitably qualified person in accordance with Australian Standard 2187.2 – Explosives Storage, Transport and Use - Part 2 Use of Explosives, assessed in accordance with Australian Standards AS 1259 and include:

- peak particle velocity (mm/s);
- air blast overpressure level (dB linear peak);
- location of the blasting within the site;
- atmospheric conditions including temperature, relative humidity, wind speed and direction;
- affects due to extraneous factors; and

- location, date and time of measurements.

DERM Interest: LAND

(E1) There must be no release of contaminants to land except as authorised by condition E3 and condition E30.

Treated sewerage effluent – land disposal

(E2) The sewerage treatment plant must be designed and operated to treat sewerage effluent to Class A+ quality specifications.

(E3) Treated sewerage effluent from the sewerage treatment plant may be discharged to land provided that it complies with the quality criteria specified in Table 3 of this schedule and the conditions of the development approval.

Table 3 Release limits – Treated sewerage effluent to land

Quality Characteristic	Quality Limit	Limit Type	Monitoring Point	Monitoring Frequency
BOD_5	5mg/L	Maximum	Representative sample from holding tank	Weekly
pH	6.5 – 8.5	Range	Representative sample from holding tank	Weekly
E. coli	<1cfu per 100 mL	median value Note 1	Representative sample from holding tank	Daily for the first three (3) months following plant commissioning and weekly thereafter
	<10cfu per 100 mL	95^{th} percentile		
Viruses (bacteriophages as indicators)	Log 6 removal from influent	Treatment objective	Representative sample from holding tank	Monthly
Protozoan parasites (Clostridium perfringens as indicator)	Log 6 removal from influent	Treatment objective	Representative sample from holding tank	Monthly
Turbidity	2NTU	Maximum	Prior to disinfection	Continuous
Suspended Solids	5mg/L	Maximum	Prior to disinfection	Weekly

NS = Not Specified

cfu = colony forming units

Note 1: (minimum of 5 samples taken at not less than half hourly intervals in any one day, with 4 out of 5 samples containing less than 20 organisms per 100mL).

(E4) Not withstanding the quality limits provided in Table 3, treated effluent must not have any properties nor contain any organisms or contaminants in concentrations that are capable of causing environmental harm or posing a risk to site users.

(E5) Prior to commencement of sewerage treatment, a Recycled Water Safety Plan must be developed in accordance with the *Queensland Guidelines for the Safe Use of Recycled Water* (Public Consultation Draft, 2004) and submitted to the administering authority.

The Plan must address, as a minimum, the risks associated with production and use of recycled water in terms of:

- source control
- treatment
- disinfection
- transport
- storage
- use (including both on site and off site health and environmental impacts), including reference to the Recycled Water Use Agreement required to be prepared by condition E6 of this schedule.

(E6) If it is proposed to supply treated sewerage effluent to a third party, the registered operator must develop a *Recycled Water Use Agreement* detailing conditions under which recycled water will be supplied and used. This agreement must:

- include reference to the Recycled Water Safety Plan prepared under condition (E5);
- be signed by each party that will have access to recycled water;
- detail how each user will comply with the general environmental duty provided for by section 319 of the EP Act in respect of the use of such effluent disposal (e.g. via garden watering), protection of public health and protection of environmental values of water (including groundwater); and
- require that, upon becoming aware that a person using treated effluent is not or is not likely to comply with the general environmental duty (GED) provided by section 319 of the EP Act, supply of such effluent is ceased, until such time as it can be demonstrated by the person, that compliance with the GED will be achieved.

(E7) Prior to commencing any disposal of treated sewerage effluent to land, the registered operator must provide an Irrigation Management Plan (IMP) to the administering authority. The IMP must describe reasonable and practicable measures to ensure the sustainable release of contaminants to the land and must include but not be limited to:

- the identification of a sufficient area of land that is suitable for irrigation and that has a minimum 100 m setback distance from any watercourse;
- an assessment of the soils in the irrigation area including types, structure, phosphorous absorption capacity, nutrient status, salinity and sodicity, cation exchange capacity and sodium absorption ratio (SAR) of the irrigation area;
- consideration of the quality and quantity of wastewater produced by the activities;
- the occurrence, depth and characteristics of groundwater on the site together with known uses of this groundwater resource;
- conducting daily time step monitoring (using MEDLI or similar) to estimate at least wastewater irrigation and the volume of wet weather storage required, taking into account at least:

- local climatic conditions;
- soils in the wastewater irrigation area;
- vegetation within the wastewater irrigation area;
- predicted effect on soil conditions of long-term irrigation with consideration being given to nutrient balance, including loads of Nitrogen and Phosphorous, and salt balance; and
- impacts on groundwater.

- an irrigation program developed considering information collected for points above, that is based on the sustainable long-term use of the contaminant release areas, and addresses at least the following matters;
  - irrigation scheduling;
  - effluent allocation to the contaminant release areas;
  - management of the predicted effect on soil conditions;
  - management of the nutrient balance, including sustainable loads of Nitrogen and Phosphorous;
  - management of the salt balance; and
  - managing impacts on existing native vegetation.

(E8) The discharge of effluent to the designated disposal area(s) must be carried out in a manner such that:

- vegetation is not damaged;
- soil erosion and soil structure damage is avoided;
- there is no surface ponding or runoff of effluent;
- percolation of effluent (used for irrigation) beyond the plant root zone is minimised;
- the capacity of the land to assimilate nitrogen, phosphorus, salts, organic matter as measured by oxygen demand and water is not exceeded; and
- the quality of ground water is not adversely affected.

(E9) Pipelines and fittings for the release of contaminants to land must clearly be identified. Standard water taps, hoses and cocks must be fitted to contaminant release pipelines, and the contaminant release system must not be connected to other service pipelines. Lockable valves or removable handles must be fitted to contaminant release pipelines where there is public access to the designated disposal area(s).

(E10) Irrigation systems must be sited so as to minimise the likelihood that people will come into contact with treated wastewater.

(E11) Notices must be prominently displayed on any designated effluent irrigation area(s) warning that the area is used for the irrigation of effluent and not to use or drink the effluent. These notices must be maintained in a visible and legible condition.

(E12) When conditions prevent the absorption of treated effluent to land (such as during rain events), alternative measures must be taken to store/dispose of effluent (such as wet weather storage or tinkering off site). There must not be any release of effluent from any wet weather storage to any waters or storm water drain.

(E13) Irrigation of treated effluent/stormwater must not result in runoff beyond the boundary of designated irrigation areas.

Monitoring

(E14) Monitoring must be undertaken and records kept of the release of treated sewerage effluent to land for the parameters at the frequency specified in Table 3 of this schedule. All determinations of the quality of contaminants released must be:

- made in accordance with methods prescribed in the latest edition of the EPA's Water Quality Sampling Manual; and
- carried out on samples that are representative of the discharge.

Quantity of contaminants released to land

(E15) The daily volume of recycled water released to land or used for other uses permitted by this approval must be determined or estimated by an appropriate method, for example a flow meter, and record kept of such determinations and estimates.

(E16) All chemicals, fuels and other liquid contaminants must be contained within an on site containment system(s) and controlled in a manner that prevents environmental harm and is in accordance with any relevant Australian Standards; for example:

AS4326 – Storage and Handling of Oxidising Substances,

AS1940 – Storage and Handling of Flammable and Combustible Liquids; and

AS3780 – The Storage and Handling of Corrosive Substances

Bunding

(E17) All bunding must be roofed where practicable.

(E18) Where it is impractical to completely roof a bunded area the registered operator must ensure that any stormwater captured within the bund is free from contaminants or wastes prior to any release.

(E19) The base and walls of all bunded areas must be maintained free from gaps or cracks.

(E20) The registered operator must ensure effective and appropriate measures are in place to prevent the overfilling of vessels or containers containing petroleum products or chemicals and to prevent the spillage of material during material transfer operations. Effective and appropriate measures may include but are not limited to the use of high level alarms and operator diligence.

Land Rehabilitation

(E21) Within six (6) months of the commencement of the ERAs to which this approval relates, the Registered Operator must submit a draft Site Rehabilitation and Decommissioning Plan to the administering authority in respect of the ERAs The Site Rehabilitation and Decommissioning Plan must address at least the following matters:

- description of what land use is ultimately proposed for the site, having regard to the Land Use Masterplan in Condition 2, Schedule C, Appendix 1 of the Coordinator-General's Evaluation Report;
- where appropriate revegetation of the site, including ground preparation, species used, methods, density, irrigation, weed control, use of native species endemic to the area where appropriate, staging and timing of revegetation works;
- the proposed landform design to be implemented, including design profile and batter slopes;
- nature of materials utilised and techniques to be employed for any proposed backfilling of extracted areas such as filling, compaction, topsoiling, overburden return and any other soil amelioration leading to vegetation establishment;
- stability of the final landform, including assessment of any changes to the flood gradient, assessment of the stability of slopes and susceptibility to soils slumping;
- stability of the final land surface (i.e. erosion control) including assessment of susceptibility of soils to erosion and anticipated erosion control measures;
- provision and protection of riparian and wildlife corridor widths and any appropriate linkages to other habitat areas;
- identification of any habitat areas that have been formed either directly or indirectly as a result of the extractive works or associated activities that may be adversely affected by decommissioning works, for example, any habitat pools upstream and downstream of a weir or causeway, and measures to protect these areas;
- potential long term impacts on environmental values and measures proposed to address these, for example, restoration of desired environmental values;
- expected short term and long term water quality within any lakes or ponds, with reference to likely uses of the waters, environmental values, appropriate water quality criteria, proposed remedial measures in the event that criteria are not met, and who will be responsible for maintenance of the water bodies in the long term;
- a proposed maintenance program, including maintenance of erosion control measures, vegetation being established (e.g. watering, weed control, fencing, site security) and water quality of any lakes or ponds;
- prevention or minimisation of windblown dust from overburden stockpiles, remnant raw material stockpiles and rehabilitation earthworks;

- prevention or treatment of the release of contaminated stormwater runoff from remnant material stockpiles, disturbed areas and any lakes or ponds created to the bed or banks of any watercourse;

- a proposed monitoring program, for example, plant growth, plant health, stormwater quality, water body water quality, erosion protection measures and stability;

- records to be kept and reporting of outcomes, including the monitoring program results and rehabilitation outcomes achieved;

- the staging and timing of the expected work; and

- an implementation program which will ensure that the requirements of conditions E23 and E24 are met

(E22) In finalizing the plan required by condition E21, the registered operator must have due regard of any comments made by the administering authority.

(E23) Rehabilitation of areas disturbed for the undertaking of the ERAs, apart from those areas currently being utilised for the ERAs, must take place progressively and must commence within three months of cessation of the ERAs in an area.

(E24) All areas disturbed for the undertaking of the ERAs must be rehabilitated in accordance with the final Site Rehabilitation and Decommissioning Plan such that:

- the land is suitable for the final uses proposed in the final Site Rehabilitation and Decommissioning Plan;

- suitable native species of vegetation are planted and established;

- effective erosion control measures are implemented in rehabilitated areas;

- the quality of stormwater, other water and seepage released from the site is such that releases of contaminants such as suspended solids, turbidity, total dissolved salts, pH, total iron, total aluminium and total manganese are not likely to cause environmental harm;

- the likelihood of environmental nuisance being caused by release of dust is minimised;

- the water quality of any residual water body meets relevant criteria for the post-site use and does not have the potential to cause environmental harm;

- the final land form is stable and not subject to slumping; and

- any actual and potential acid sulphate soils in or on the site are either disturbed; or submerged, or treated so as to not be likely to cause environmental harm.

(E25) Topsoil must be removed and stockpiled for areas to be rehabilitated, prior to carrying out the ERAs.

(E26) Endemic native seeds must be collected and propagated for use in re-vegetation.

(E27) Excavations as a result of the ERAs that are to remain after cessation of the ERAs on the site must be made safe to native animals.

(E28) The only material to be used for the filling of voids created by the ERAs must be clean rock, clay, gravel, sand or soil (excluding any contaminated rock, clay, gravel, sand or soil):

- obtained from the place of works; or
- another uncontaminated source.

(E29) At the cessation of all of the ERAs, the registered operator must provide a report to the administering authority which details the decommissioning and rehabilitation works that have been undertaken in respect of the ERAs.

Motor vehicle workshop

(E30) All water generated by the wash down of vehicles or plant must be treated through an appropriate oil / water interceptor. The treated water may be disposed of to land provided that it complies with quality criteria specified in Table 4 of this schedule.

Table 4 – Release of treated vehicle wash down water to land

Quality characteristic	Quality limit	Limit type	Monitoring point	Monitoring frequency
pH	6.5 – 8.5	Range	Discharge point	Immediately prior to releasing the treated water to land
Oil and Grease	5 mg/L	Maximum	Discharge point	Immediately prior to releasing the treated water to land

(E31) The discharge of treated wash down water authorised by condition E30 must be carried out in a manner such that:

- vegetation is not damaged
- soil erosion and soil structure damage is avoided
- there is no surface ponding or runoff of treated wash down water
- percolation of treated wash down water beyond the plant root zone is minimised
- the capacity of the land to assimilate the water and any contaminants it may contain is not exceeded and
- the quality of groundwater is not adversely affected.

Contaminated Land

(E32) Undertake site history investigations of the site to identify areas of potential contamination. Land suspected of being contaminated must be adequately investigated by a suitably qualified person in accordance with the EP Act.

(E33) Investigations must be undertaken in locations where earthworks or inundation may potentially encounter contaminated soils (i.e. land that is listed on the Environmental Management Register (EMR) or land that is subject to a notifiable activity, or identified areas from a site history and observations analysis). The Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland May 1998 and the National Environmental Protection Measure (Assessment of Site Contamination) must be adhered to in these investigations. Any land identified as having contaminated soil must be notified to the DERM Contaminated Land Unit.

- Contaminated soil can only be removed form land listed on the EMR or Contaminated Land Register (CLR) with prior DERM Contaminated Land Unit approval and under a disposal permit in accordance with the EP Act.
- Prepare and implement a Site Management Plan for contaminated land in the Project Area where that land is not being removed from the EMR or CLR prior to any surface disturbance of the soil or inundation of the land, in accordance with:
  - Australian and New Zealand Environment and Conservation Council/National Health and Medical Research Council – Guidelines for Assessment and Management of Contaminated Sites; and Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland May 1998 and the National Environmental Protection Measure (Assessment of Site Contamination)
  - the EP Act.

(E34) For both managed sites and sites without a Site Management Plan that are listed on the EMR or CLR, validation sampling and appropriate analysis must be conducted following remediation or covering. Analysis must be undertaken by a suitably qualified person in accordance with the EP Act.

DERM Interest: WASTE

(F1) Waste must not be released to the environment, stored, transferred or disposed of contrary to any conditions of this approval.

(F2) Waste generated in the carrying out of the ERAs must be stored, handled and transferred in proper and efficient manner.

(F3) The registered operator must not (unless expressly authorised by this approval):

- burn waste at or on the site; or
- allow waste to burn or be burnt at or on the site; or
- remove waste from the site and burn such waste elsewhere.

(F4) A Waste Management Plan must be developed and implemented from the commencement of ERAs to which these conditions relate. The Waste Management Plan must address at least the following matters:

- the types and amount of waste generated by the activity;
- how the waste will be dealt with, including a description of the types and amounts of waste that will be dealt with under each of the waste

management practices mentioned in the waste management hierarchy(section 10 of the Environmental Protection (Waste Management) Policy 2000);

- procedures for identifying and implementing opportunities to improve the waste management practices employed;
- procedures for dealing with accidents, spills and other incidents that may impact on the waste management;
- how often the performance of the waste management practices will be assessed(at least annually); and
- the indicators or other criteria on which the performance of the waste management practices will be assessed.

(F5) **Waste Handling**

All regulated waste removal from the site must be removed by a person who holds a current approval to transport such waste under the provisions of the EP Act.

(F6) **Notification of improper disposal of regulated waste**

If a person removes regulated waste associated with activities at the approved place and disposes of such waste in a manner which is not authorised or is improper or unlawful then, the registered operator must notify the administering authority of the unauthorised, improper or unlawful disposal as soon as possible. Notification must include all relevant facts, matters and circumstances known to the registered operator concerning the disposal.

(F7) **Cleared Vegetative Material**

Vegetation cleared for the carrying out of the ERAs including trees, shrubs and under growth should be recycled where possible, including selling any millable timber and mulching of suitable vegetation (non-weed) for rehabilitation and erosion control on site, consistent with the Waste Management Hierarchy.

(F8) **Use and handling of fly ash**

Notwithstanding the conditions of this approval, the use of fly ash must comply with the requirements of any approval granted with respect to this resource for beneficial use under provisions of the *Environmental Protection (Waste Management) Regulation 2000.*

Regulated Waste Transport[41]

(F9) Regulated wastes are only authorised to be transported by road vehicles (not by train, boat, aircraft, pipeline or other means).

(F10) Regulated waste transport must be carried out in accordance with the *Code of environmental compliance for certain aspects* of regulated waste transport (ERA 83) –Regulated Waste Transport*.

[41] Note that if the proposed activity meets the appropriate criteria, the code – Code of environmental compliance for certain aspects of regulated waste transport EPA July 2006 Version 1 – may apply.

(F11) The registered operator must monitor, keep and maintain permanent records of every load of regulated waste transported off the site, and must include the following information:

- the date of transport;
- description of waste (including classification under ANZECC code);
- name of the waste transporters and/ or disposal operator that removed the waste;
- cross reference to relevant waste transport documentation;
- quantity of the waste
- destination of the waste;
- results of analysis (where applicable); and
- method of waste storing treatment, recycling or disposal to be used (where applicable).

Note: Records of documents maintained in compliance with a waste tracking system established under the EP Act or any other law for regulated waste will be deemed to satisfy this condition.

(F12) The registered operator must not accept at the site any container which, upon receipt at the premises, is found to be:

- Leaking
- damaged or corroded to the extent that leaks may occur during handling and storage to the site;

unless the container is immediately placed in an oversize receptacle.

(F13) A sufficient number of oversized containers must be available on the site at any time to contain wastes from any drums which are found;

- leaking; or
- damaging or corroded to the extent that leaks may occur during handling and storage at the approved place.

Waste loading and unloading

(F14) The registered operator must ensure that a facility or equipment is available for the contaminant and recovery of any spillages at the regulated waste loading and unloading points.

(F15) An emergency response plan and procedures must be developed to minimise the environmental impacts from any spillage from transport vehicles that collect waste from the approved place.

(F16) All spillages and wash downs from re-drumming and/or loading and unloading of regulated wastes and other process materials must be contained as soon as practicable and disposed of at a facility that can lawfully accept such waste.

Storage and handling of regulated wastes

(F17) There must be no visible leakage of the contents from any waste container.

(F18) All regulated waste generated by the storage operations must only be treated, reprocessed or disposed of at a facility approved by the administering authority to accept such waste.

(F19) The registered operator must take all practicable and reasonable measures to ensure incompatible wastes are not stored in a manner that would result in any mixing of such wastes.

Tyre Storage

(F20) Waste tyres must not be stored in the open for any length of time that exceeds five (5) days unless:

- the waste tyres are covered so as to totally exclude water; or
- waste tyres are made totally incapable of holding water; or
- the waste tyres are individually treated with larvicide. The concentration of the larvicide must always be of a strength to stop the breeding cycle of the mosquito.

(F21) All reasonable and practicable fire prevention measures must be implemented, including removal of grass and other materials within a 10 m radius of any scrap tyre storage area.

DERM Interest:– BIODIVERSITY

(G1) A qualified fauna spotter is to be engaged to work ahead of the site clearing works associated with the ERAs.

(G2) In the event that native fauna is present, clearing works are to cease until such time as the fauna spotter[42] is able to safely relocate the native fauna.

(G3) The authorised person must ensure any animals injured by activities undertaken in carrying out the ERAs are referred to an appropriate wildlife carer group or veterinarian (to be determined prior to the commencement of the ERAs) and DERM must be notified of any injuries or deaths.

DERM Interest – SOCIAL

(H1) **Complaint response**

The registered operator must record the following details for all complaints received and provide this information to the administering authority on request:

- time, date, name and contact details of the complainant;
- reasons for the complaint;
- any investigations undertaken;

[42] The fauna spotter would need to be an authorised person under the *Nature Conservation Act 1992* that is permitted to interfere with a protected animal or a protected animal's breeding place.

- conclusions formed; and
- any actions taken.

(H2) The registered operator must establish a community consultation program to inform the community of the environmental performance of the environmentally relevant activities carried out during the construction of the Traveston Crossing Dam, including the communication of information regarding:

- Environmental Nuisance and hours of operation (noise, dust, blasting and vibration etc.;
- Vegetation Management;
- Fauna Management; and
- Water Quality management.

(H3) The registered operator must develop and implement a community environmental liaison committee program in respect of the site that provides for:

- Conveying details of planned works;
- Effective communication of performance to affected persons and others who have registered an interest; and
- Effectively dealing with complaints in relation to the activities at the site.

DEFINITIONS for ERA Conditions

Words and phrases used for the ERA conditions in Schedule A are defined below. Where a definition for a term used is sought and the term is not defined within this Schedule the definitions provided in the *Environmental Protection Act 1994*, its regulations, and relevant Environmental Protection Policies shall be used.

"administering authority" means the chief executive administering the *Environmental Protection Act 1994 (Qld)* or its successor.

"**area of disturbance in the river"** means any area in the bed of the river disturbed for the purposes of the ERAs. Multiple areas of disturbance in the bed of the river that are not separated by more than 100 m shall be considered a single area of disturbance. Two areas of disturbance in the river separated by more than 100 m from each other must be regarded as two areas of disturbance in the river.

"background noise level" means either:

- $L_{A90,\,T}$ being the A-weighted sound pressure level exceeded for 90 percent of the time period not less than 15 minutes, using Fast response measured in the absence of the noise under investigation, or
- $L_{Abg,\,T}$ being the arithmetic average of the minimum readings measured in the absence of the noise under investigation during a representative time period of not less than 15 minutes, using Fast response.

"commercial place" means a place used as an office or for business or commercial purposes.

"commencement of works" means the first occasion that any works associated with the establishment of infrastructure or equipment required to conduct any environmentally relevant activities approved by the development approval are initiated.

"construction phase" means the period between commencement of works and the commissioning of the Traveston Crossing Dam.

"contaminant" can be:

- a gas, liquid or solid; or
- an odour; or
- an organism (whether alive or dead), including a virus; or
- energy, including noise, heat, radioactivity and electromagnetic radiation; or
- a combination of contaminants.

"final release outlets of all discharge structures" means:

- the overflow points for the sediment control structures not in the bed of the river from which settled/threatened stormwater is released to the Mary River or waters that flow to the Mary River; or
- the discharge point for any water extracted for dewatering associated with any extraction or dredging works.

"intrusive noise" means noise that, because of its frequency, duration, level, tonal characteristics, impulsiveness or vibration –

- is clearly audible to, or can be felt by, an individual;
- annoys the individual; and
- in determining whether a noise annoys an individual and is unreasonably intrusive, regard must be given to Australian Standard 1055.2 – 1997 Acoustics – Description and Measurement of Environmental Noise Part 2 – Application to Specific Situations.

"$L_{Aeq, 1hr}$" means the time average A-weighted sound pressure level, within the meaning given by AS 1055.1, for a one hour time interval.

"$L_{A90,T}$" Background sound pressure level $L_{A90,T}$ is the A-weighted sound pressure level obtained using time-weighting ‘F’ exceeded for 90 per cent of the measuring period ‘T’.

"$L_{A 1, adj, 10 mins}$" means the A-weighted sound pressure level, (adjusted for tonal character and impulsiveness of the sound) exceeded for 1 per cent of any 10 minute measurement period, using Fast response.

"land" means land excluding waters and the atmosphere.

"maximum" means that the measured value of the quality characteristic or contaminant must not be greater than the release limit stated.

"minimum" means the measured value of the quality characteristic or contaminant must not be less than the release limit stated.

"mg/L" means milligrams per litre.

“Particulate Matter” means total insoluble matter

"µg/L" means micrograms per litre.

"Noise Measurement Manual" means the following document or more recent additions or supplements to that document as such become available:

Environmental Protection Agency (2000). Noise Measurement Manual Third Edition, Environmental Protection Agency, Brisbane, Australia.

"noxious" means harmful or injurious to health or physical well being.

"NTU" means nephelometric turbidity units

"offensive" means causing offence or displeasure; is disagreeable to the sense; disgusting, nauseous or repulsive.

"protected area" means –

- a protected area under the Nature Conservation Act 1992;
- a marine park under the Marine Parks Act 2004; or
- a World Heritage Area.

"regulated waste" means non-domestic waste mentioned in Schedule 7 of the *Environmental Protection Regulation 2008* (whether or not it has been treated or immobilised), and includes -

- for an element - any chemical compound containing the element; and
- anything that has contained the waste.

"sensitive place" includes –

- a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
- a motel, hotel or hostel; or
- a kindergarten, school, university or other educational institution; or
- a medical centre or hospital; or
- a protected area under the *Nature Conservation Act 1992, the Marine Parks Act 2004* or a World Heritage Area; or
- a public thoroughfare, park or gardens.

"site" means the land on which it is proposed to carry out the ERA under this development approval.

"Total Nitrogen" means the sum of Organic Nitrogen, Ammonia Nitrogen, Nitrate plus Nitrate Nitrogen, which must be reported to the administering authority, expressed as mg/L as Nitrogen

"Total Phosphorous" means the sum of the relative phosphorus, acid-hydrolysable phosphorus and organic phosphorus, as mg/L of Phosphorous. This includes both the inorganic and organic fraction of phosphorus.

"vibration sensitive place" means a nuisance sensitive place or a commercial place.

"Water Quality Sampling Manual" means the following document or more recent additions or supplements to that document as such become available:

> Environmental Protection Agency. (1999). Water Quality Sampling Manual Third Edition, Environmental Protection Agency, Brisbane, Australia.

"waters" includes river, stream, lake, lagoon, pond, swamp, wetland, unconfined surface water, unconfined water natural or artificial watercourse, bed and bank of any waters, dams, non-tidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off, and groundwater and any part-thereof.

"Weekly" means that a sample is collected each week and the subsequent sample must be taken on the seventh day following that day and is exclusive of Saturdays and Sundays (i.e. day rolling forward each week this week Monday, next week Tuesday).

Operational works for clearing native vegetation

(Schedule 8, Part 1, Table 4, Items 1A to 1G *Integrated Planning Act 1997*)

A development approval for operational work that is clearing of native vegetation must be obtained prior to clearing assessable vegetation.

1. Site specific sediment, erosion and drainage controls must be implemented prior to commencement of clearing of assessable vegetation and remain in place during the construction phase and operational phase if sections of the Project area are still susceptible to erosion.

2. A property vegetation management plan, consistent with the *Vegetation Management Regulation 2000* must be provided with the development application to ensure the application is assessed against the Regional Vegetation Management Code for Southeast Queensland Bioregion. This property management plan must be consistent with any relevant Property Map of Assessable Vegetation that may result from an application to the chief executive administering the *Vegetation Management Act*.

3. The property vegetation management plan must detail the location and extent of the area proposed to be cleared, the purpose for clearing and the manner in which the proposed clearing meets the performance requirements of the Regional Vegetation Management Code for the construction and operational phases of the Project. The extent of clearing must be limited to that which is necessary for construction phase and operational phase Project.

4. The currency period for the development approval is 10 years.

5. Any clearing or activities associated with clearing within the Project Area must be by mechanical methods or inundation only.

6. Any clearing or activities associated with clearing within the Project Area must not adversely impact on native vegetation outside the Project Area.

7. All disturbed and excavated soil must either be contained within the Project Area or alternatively securely stockpiled or respread in a location where its placement will not result in the clearing of vegetation that is regulated under the *Vegetation Management Act 1999.*

8. All vegetation mechanically cleared must be stockpiled in a location where its placement will not result in the clearing of assessable vegetation.

9. Subject to Appendix 1, Schedule C, Condition 7(a) of the Coordinator-General's Evaluation Report, land clearing debris must not be pushed into gullies, watercourses, other drainage lines or waterlogged areas.

10. Where clearing occurs on unallocated State Land, Reserves or Trust land (as defined the *Land Act 1994*), the supervising DERM forest products officer must be contacted by the proponent and advised of the timing of proposed clearing activities 10 business days in advance of the commencement of clearing to allow the officer to organise any forest product of a merchantable size to be paint marked with a yellow “s” prior to clearing. The proponent must ensure that the marked trees are merchandised and placed in a cleared storage area owned by the proponent or the State which is accessible and contains a safe loading area.

11. Any harvested forest product of a merchantable size taken from unallocated State Land, Reserves or Trust land (as defined the *Land Act 1994*), must be harvested in

accordance with the Department of Environment and Resource Management forest products utilisations standards (NB: available from DERM and DERM will provide training if necessary). Logs must be cut to a minimum length of 2.4 metres and increase in intervals of 0.3 metres with a top end diameter of no less than 30 centimetres under bark.

12. Where clearing occurs on unallocated State Land, Reserves or Trust land (as defined the *Land Act 1994*), all miscellaneous timbers must be cut prior to the clearing of vegetation in accordance with DERM Forest products utilisations standards. These will be marked by the officer with an "r" or a "sp". The officer may organise a cutter to cut these products in consultation with the proponent.

13. Unless otherwise agreed by the chief executive administering the *Vegetation Management Act 1999*, the Vegetation Offset Proposal must:

    (a) be provided to the chief executive administering the *Vegetation Management Act 1999* with the development application to clear native vegetation or alternatively involve the finalisation of deed of agreement about offset activities with the chief executive administering the *Vegetation Management Act 1999* within 12 months of the final development approval under the *Vegetation Management Act* for the Project

    (b) address the requirements of the Policy for Vegetation Management Offsets to ensure compliance with the Regional Vegetation Management Code for Southeast Queensland Bioregion

    (c) involve revegetation, rehabilitation and associated management actions (e.g. fencing, weed and pest control) to enable the offset to be mapped as remnant within 20 years from the date of the final vegetation clearing approval by providing an offset of a minimum of 780 ha[43].

    (d) The offset land must:

        (i) be legally secured in accordance with the Policy for Vegetation Management Offsets

        (ii) not contain remnant vegetation

        (iii) ideally be within the Mary River Catchment area, but if that cannot be practically achieved, in other areas with the agreement of the chief executive administering the *Vegetation Management Act 1999*.

[43] The area of each regional ecosystem is to be based on the offset ratio of at least 1:3 and the regional ecosystem maps, or any subsequently approved Property Map of Assessable Vegetation

Operational work that is the construction of a referable dam as defined under the *Water Supply (Safety and Reliability) Act 2008*

(Schedule 8, Part 1, Table 4, Item 4(a) *Integrated Planning Act 1997*)

Referable Dam Category Assessment:

1. Failure Impact Assessment Category: Failure Impact Assessment Category to be determined via design process.

Basic Description of the Dam:

2. Location: Mary River (AMTD 207.6 km approximately)

3. Purpose: Urban Water Supply

EMBANKMENT

4. Construction Type: Roller Compacted Concrete (RCC) across the valley floor (main dam) with an earth embankment section on the left abutment (embankment dam)

5. Total Length: Approximately 760 m (RCC) and approximately 675 m (embankment dam). (An earth embankment dam could replace some or the entire RCC section based on construction and cost considerations)

6. Embankment Crest Level:

   - approximately 89.0 m (RCC); and

   - approximately 90.0 m (embankment dam)

7. Maximum Embankment Height:

   - approximately 52 m in river(RCC); and

   - approximately 18 m (embankment dam)

8. Full Supply Level: approximately 71.0 m

9. Storage Capacity FSL: approximately 152 429 ML

SPILLWAY

10. Spillway – Controlled Crest: Mass concrete ogee with 6 vertical gates on the right abutment, designed to safely pass the PMF without breaching the dam wall

11. Fixed Crest Level: approximately 67.0 m

12. Length: approximately 89.5 m (to be confirmed following detailed design)

NOTE: Levels quoted are to Australian Height Datum (AHD)

General

13. The dam must be kept safe and be maintained and operated in accordance with the following guidelines issued in Queensland under the *Water Supply (Safety and Reliability) Act 2008*:

    - Queensland Dam Safety Management Guidelines – February 2002;
    - Guidelines for Failure Impact Assessment of Water Dams - April 2002;
    - Guidelines on Acceptable Flood Capacity for Dams – February 2007.

14. The current Dam Safety Regulator in the State of Queensland is the Chief Executive of the Department of Environment and Resource Management or the department's delegated officers.

Documentation

15. Any documentation prepared in order to comply with these conditions must be stored securely until such time as the dam is decommissioned.

16. The documentation must be made available for inspection by the Dam Safety Regulator, within seven (7) days of a written request for access being received by the dam owner.

17. On change of ownership of the dam, all documentation prepared in compliance with these conditions must be transferred to the new owner.

Incidents and Failures

18. In addition to the requirements detailed within the Emergency Action Plan (EAP) required in accordance with condition 64 of this approval, the dam owner must report in writing all incidents and failures (as defined in the *Queensland Dam Safety Management Guidelines – February 2002)* to the Dam Safety Regulator, within seven (7) days of becoming aware of the incident or failure.

19. The dam owner must advise the Dam Safety Regulator, of any proposed remedial actions in writing within one (1) month of the incident or failure.

Design Report

20. The Preliminary Design Report for Traveston Crossing Dam was prepared in June 2007, by Sunwater. The detailed design report is yet to be submitted.

21. The dam owner must update this design report in accordance with this condition and the *Queensland Dam Safety Management Guidelines – February 2002*, and provide a copy of the updated design report to the Dam Safety Regulator, at the following times,

    - at least one (1) month prior to water being stored in Traveston Crossing Dam, and
    - within three (3) months of "practical completion of construction" of the dam.

22. The update of the Preliminary Design Report must detail changes since the previous version and show how the works will satisfy the design criteria given in the Preliminary Design Report. It should include:

- Results of any additional hydraulic model studies since the preliminary design phase;
- results of foundation and other investigations carried out since the investigation and preliminary design phase;
- complete set of construction drawings and specifications;
- final instrumentation arrangement for the dam;
- design modifications necessary as a result of information obtained during the construction phase; and
- managing risk during construction.

Design and Construction

23. The dam must be designed and constructed to comply with the relevant DERM and ANCOLD guidelines and statutory requirements (including requirements for the completion of a dam failure impact assessment).

24. The dam must be constructed as per the final design drawings approved by the Dam Safety Regulator.

25. The dam owner must advise the Dam Safety Regulator, of the ‘practical completion of construction’ of the works within seven (7) days of that point of construction being reached.

26. Construction of any temporary works must be carried out in accordance with current engineering practice and standards.

27. Any remedial works or reconstruction of the dam must be carried out in accordance with current engineering practice to ensure that the dam remains in accordance with the documentation listed within this condition.

28. Where remedial, reconstruction or upgrade works are proposed, a copy of the final design and construction methodology must be forwarded to the Dam Safety Regulator for consideration no later than thirty (30) days prior to commencement of any construction works.

Data Book

29. The dam owner must prepare a Data Book in accordance with the *Queensland Dam Safety Management Guidelines – February 2002.*

30. The Data Book must be prepared by no later than ninety (90) days after 'practical completion of construction' of the Traveston Crossing Dam.

31. The Data Book must include all information as is required in the *Queensland Dam Safety Management Guidelines – February 2002* including:

    - all pertinent records and history relating to the dam;
    - documentation of investigation, design, construction, operation, maintenance, surveillance, monitoring measurements and any remedial action taken during construction and subsequent operation of the dam; and

- known deficiencies such as seepage, cracking.

32. The dam owner must ensure the Data Book is reviewed (and if necessary updated) in accordance with the *Queensland Dam Safety Management Guidelines – February 2002* by the first day of October of each calendar year.

33. A written notification confirming that the Data Book has been reviewed (and if necessary updated) must be signed by the dam operator and submitted to the Dam Safety Regulator, by the 31st day of October of that same calendar year.

'As Constructed' Documentation

34. The dam owner must develop 'as constructed' documentation for Traveston Crossing Dam in accordance with the *Queensland Dam Safety Management Guidelines – February 2002.*

35. The owner must provide one (1) copy of the 'as constructed' documentation to the Dam Safety Regulator on or within three (3) calendar months of "practical completion of construction".

36. The 'as constructed' documentation must include:

    - a record of any decisions to adapt the nominated design to suit actual field conditions;
    - 'as constructed' drawings indicating the actual lines, levels and dimensions to which the structure is built;
    - a description of the construction process;
    - systematically compiled and comprehensive photographs of the construction;
    - material test results;
    - construction inspection reports;
    - initial instrumentation data; and
    - certification by Registered Professional Engineer of Queensland (RPEQ) that the works have been constructed in compliance with all relevant engineering standards.

Standard Operating Procedures

37. The dam owner must develop Standing Operating Procedures (SOP) in accordance with the *Queensland Dam Safety Management Guidelines – February 2002.* The SOP must include the following activities:

    - Personnel training and procedural issues:
        - operator training;
        - documentation control and review; and
        - setting of normal operation criteria.
    - Emergency Action and Incident Reporting;

- Accident and Incident Report;
- review of EAP including verification of emergency contact numbers;
- communication procedures and procedures covering loss of communication; and
- maintenance of Dam Log Book for recording of surveillance inspections, equipment testing, planned and unplanned maintenance and incident details.

- Critical Operating Procedures
  - inspection, testing and maintenance of critical mechanical and electrical equipment;
  - water level monitoring procedures; and
  - communication security and failsafe procedures.

- Monitoring and Surveillance
  - owner's routine dam safety inspection including check lists and reporting requirements;
  - dam safety five yearly Comprehensive Inspection (DS 11);
  - inspection during and after flood or seismic events; and
  - water level and piezometer monitoring procedures.

38. The dam owner must submit a copy of the SOP to the Dam Safety Regulator within one (1) month of the 'practical completion of construction'.

39. The dam must be operated in accordance with the SOP.

40. The dam owner must ensure the SOP are reviewed prior to Full Supply Level for Traveston Crossing Dam being achieved for the first time and by the 1st day of October of each calendar year, and updated and/or added to if necessary.

41. Where amendments are made to any SOP, the updated documents are to be forwarded to the Dam Safety Regulator, by the 31st day of October of that same calendar year.

42. Where no amendments are necessary, a written notification confirming that the SOP have been reviewed shall be signed by the dam owner and forwarded to the Dam Safety Regulator, by the 31st day of October of that same calendar year.

Detailed Operation and Maintenance Manuals

43. The dam owner must prepare detailed Operation and Maintenance Manuals in accordance with the *Queensland Dam Safety Management Guidelines – February 2002.*

44. The Operation and Maintenance Manuals must be prepared and finalised by three (3) months following the date of Practical Completion of Construction.

45. The dam owner must ensure that the Operation and Maintenance Manuals provide a comprehensive set of instructions on all equipment operated at the dam.

46. The dam must be operated and maintained in accordance with the Operation and Maintenance Manuals.

47. The dam owner must ensure the detailed Operating and Maintenance Manuals are reviewed, and if necessary updated, by the 1st day of October of each calendar year.

48. A written notification confirming that the Operating and Maintenance Manuals have been reviewed, and if necessary updated, shall be signed by the dam owner and forwarded to the Dam Safety Regulator by the 31st day of October of that same calendar year.

Special Inspections

49. When directed by the Dam Safety Regulator, a Special Inspection must be carried out at the cost of the dam owner and a report must be prepared in accordance with the *Queensland Dam Safety Management Guidelines – February 2002.*

50. The Dam Safety Regulator shall be advised in writing of the date of the inspection and may elect to observe any or all procedures involved in the inspection process.

51. The dam owner must provide one copy of the Special Inspection Report to the Dam Safety Regulator within thirty (30) days of completion of inspection.

Annual Periodic Inspections

52. The dam owner must undertake an annual (periodic) inspection of the dam in accordance with the *Queensland Dam Safety Management Guidelines* – February 2002 on or before the 1st day of October of each calendar year.

53. The Dam Safety Regulator shall be advised in writing of the date of the annual inspection and may elect to observe any or all procedures involved in the inspection process.

54. The dam owner must produce a written record of these annual inspections and each written record is to be incorporated into the Comprehensive Inspection Report.

55. A written notification confirming that the annual inspection has been carried out in accordance with the *Queensland Dam Safety Management Guideline – February 2002* shall be signed by the dam owner and forwarded to the Dam Safety Regulator by the 31st day of October of that same calendar year.

56. In addition to the items listed in the *Queensland Dam Safety Management Guidelines – February 2002,* the Annual Periodic Inspection Reports must address the following:

- evidence of any concrete cracking, spalling, or other identified deficiency;
- evidence of any leakage through the structure;
- test operation of all equipment;
- evaluation of all surveillance data; and

- any other issues the inspecting engineer considers appropriate.

Comprehensive Inspections

57. The dam owner must carry out a Comprehensive Inspection of the dam in accordance with the *Queensland Dam Safety Management Guidelines – February 2002*, within one (1) month of “practical completion of construction” of the Traveston Crossing Dam, and on or before every fifth anniversary thereafter.

58. The Dam Safety Regulator, shall be advised in writing of the date of the Comprehensive Inspection and may elect to observe any or all procedures involved in the inspection process.

59. The dam owner must ensure the Comprehensive Inspection Report incorporates a review of dam safety standards of the existing dam against current standards, a review of the adequacy of the dam safety documentation for the dam, and reviews of the status on recommended actions from previous inspections.

60. A Comprehensive Inspection Report detailing the findings of the Comprehensive Inspection in accordance with the *Queensland Dam Safety Management Guidelines – February 2002* must be submitted to the Dam Safety Regulator, within three (3) months after completion of the comprehensive inspection.

Safety Review

61. The dam owner must carry out a Safety Review in accordance with the Queensland Dam Safety Management Guidelines – February 2002 by the 1st day of October 2030.

62. The dam owner must prepare a Safety Review Report and provide one (1) copy of the Safety Review Report to the Dam Safety Regulator, within three (3) months of completing the review.

63. Further Safety Reviews are to be carried out at twenty (20) year intervals, but may be required at more regular intervals by the Dam Safety Regulator, in such cases as:

    - an absence of adequate documentation;
    - detection of abnormal behaviours of the structure;
    - changes to design standards, construction standards;
    - a regulatory requirement.

Emergency Action Plans and Event Reports

64. The dam owner must prepare and maintain an Emergency Action Plan (EAP) in accordance with the requirements of the *Queensland Dam Safety Management Guidelines – February 2002.*

65. The EAP must be in place prior to construction of the dam commencing and be progressively updated as the construction of the dam proceeds to meet the requirements of the *Queensland Dam Safety Management Guidelines – February 2002.*

66. The dam owner must provide a copy of the EAP to the Dam Safety Regulator prior to commencing Principal Construction Works.

67. The emergency events described in the EAP shall cover those events as outlined in the *Queensland Dam Safety Management Guidelines – February 2002,* and include such failure modes as:

- sunny day embankment failure;
- overtopping embankment failure; and
- failure of control structures such as intake and outlet works.

68. Inundation mapping shall be developed as outlined in the *Queensland Dam Safety Management Guidelines – February 2002*, and shall be at a sufficiently large scale to easily identify those areas subject to possible danger. Mapping shall be developed, for all failure modes described in the EAP, prior to commencing Principal Construction Works and submitted to the Dam Safety Regulator.

69. The EAP must be disseminated by the proponent to those who have responsibilities under the EAP prior to commencing Principal Construction Works and shall:

- determine and identify those conditions that could forewarn of an emergency and specify the actions to be taken and by whom;
- identify all jurisdictions, agencies and individuals who could be involved in the EAP (for example, local governments, the Queensland Police, State Emergency Services and downstream residents);
- identify primary and secondary communication systems, both internal (between persons at the dam) and external (between dam personnel and outside entities);
- identify all resources, special tools, equipment, keys and where they can be located if required in an emergency; and
- list and prioritise all persons and entities involved (including contact details) in the notification process and the roles and responsibilities assigned to them (eg. A flow chart may be useful).

70. The dam owner must ensure the EAP is reviewed by the 1st day of October of each calendar year.

- where amendments are made to any EAP, a copy of the updated document is to be forwarded to the Dam Safety Regulator by the 31st day of October of that same calendar year;
- where no amendments are necessary, a written notification confirming that the EAP has been reviewed shall be signed by the dam owner and forwarded to the Dam Safety Regulator, by the 31st day of May of that same calendar year;

71. If the EAP is changed between the normal review periods, the dam owner must provide one (1) copy of the changed EAP to the Dam Safety Regulator, within thirty (30) days of the changes being made;

72. The dam owner must ensure that in addition to any copy or amended copy of the EAP provided to the Dam Safety Regulator in compliance with this condition, current versions of the EAP are also provided to the following parties:

- Gympie Regional Council;
- Sunshine Coast Regional Council
- local Counter Disaster Coordination Committee; and
- any additional group with responsibilities under the EAP.

73. In all emergencies, the dam owner must respond in accordance with the EAP.

74. In the event of an emergency, the dam owner must notify the Dam Safety Regulator, within forty-eight (48) hours. The notification shall include a brief description of the event and the time of activation of the EAP.

75. Within thirty (30) days of the event, the dam owner must prepare an Emergency Event Report and provide a copy of the report to the Dam Safety Regulator. The Emergency Event Report must include:

- a description of the event;
- instrumentation readings (where appropriate);
- description of any observed damage;
- photographs;
- details of communication and actions which took place during the emergency; and
- how the EAP was implemented during the event and comment on the adequacy of the EAP and any changes proposed.

Decommissioning

76. The dam must not be taken out of service (decommissioned) except in accordance with a Decommissioning Plan submitted to and accepted by the Dam Safety Regulator.

77. The Decommissioning Plan must indicate how the dam is to be rendered safe in the long term and how the contents are to be drained in a controlled and safe manner.

78. The Decommissioning Plan must indicate how fish and turtle passage will be maintained during and after decommissioning.

Spillway Gate Operation

79. The dam owner must provide the following information in relation to the spillway gate operation:

- gate operation methodology during a flood and/or emergency event. Special emphasis will be required on gate operation in relation to both upstream and downstream river levels.
- details of any alternate or backup operating system should the primary method of gate operation fail.
- gate operation methodology during planned river releases.

- gate maintenance routines including gate exercise methodology and frequency.
- operator training procedures and frequency of training updates.
- details of personnel responsible for gate operations and the number of gate operators available for releases at any given time.

Documentation detailing the procedures as described in condition 79 is to be supplied to the Dam Safety Regulator at least one (1) month prior to the gates being brought into operation.

Definition

‘Practical completion of construction’. For the purpose of these conditions, the dam construction shall reach the stage of “practical completion of construction” when:

- the dam embankment is capable of storage to full capacity; and
- the inlet/outlet works are operational (minor components may not necessarily be installed).

Operational works for taking or interfering with, water from a watercourse, lake or spring under the *Water Act 2000*

(Schedule 8, Part 1, Table 4, Item 3 *Integrated Planning Act 1997*)

1. The permittee must notify the Chief Executive of the completion of the approved works within 30 business days after such completion. The notification must be given in writing to the Chief Executive administering the *Water Act 2000*.

2. The permittee must, to the satisfaction of the Chief Executive administering the *Water Act 2000*, and at the permittee's own expense, maintain the bed and banks of the watercourse adjacent to the permitted works.

3. The permittee must provide a copy of the permit to any person contracted to construct the works approved by this permit.

4. The works authorised by this permit must be located and constructed in accordance with the plan(s) and design reports identified in the Dam Safety Condition Schedule. Any plans in addition to those already mentioned will need to be included with the application for assessment.

5. The permittee must provide two (2) copies of the 'as constructed' documentation to the Chief Executive administering the *Water Act 2000* on or within three (3) calendar months of "practical completion of construction". These "as built" plans must be in the same scale and line form as the approved design drawings.

Operational works that is constructing or raising waterway barrier works

(Schedule 8, Part 1, Table 4, Item 6 *Integrated Planning Act 1997*)

The Coordinator-General's concurrence agency conditions below apply only to the development approval for operational works that is constructing or raising a waterway barrier works where the approval is for the principal dam wall for the Project

1. Unless otherwise agreed in writing by the chief executive administering the *Fisheries Act 1994*, transfer of native fish species in both directions across the dam wall must be provided at all times following the commencement of the Extraction of Project Yield and when:

    (a) releases are being made in accordance with the operating rules for the flow performance indicators in Condition 8, Schedule C, Appendix 1 of the Coordinator-General's Evaluation Report[44].and

    (b) flows are less than a flood AEP trigger level to be established during development of the Fishway Design Documentation in condition 6, in order to protect infrastructure

    less

    (c) a single allowance of up to 60 days for the initial commissioning of the fishway

    (d) an allowance of 15 days per calendar year for temporary decommissioning for structural improvements, maintenance, and/or equipment failure

2. A Fishway(s), as defined in the *Fisheries Act 1994*, must be incorporated into the waterway barrier or dam wall structural works.

3. The Fishway must be constructed and operated in accordance with the Fishway Design Documentation developed in condition 6.

4. The Fishway Design Documentation must include dam operating rules and/or procedures for both upstream and downstream passage of the native fish species (including the Mary River Cod and the Queensland Lungfish) present in the Mary River.

5. The proponent must provide the final Fishway Design Documentation to the Coordinator-General for approval prior to the commencement of the Principal Construction Works.

6. The Fishway Design Documentation must:

    (a) be developed at the proponent's cost in consultation with the chief executive administering the *Fisheries Act 1994* and the chief executive administering the *Water Act 2000* and up to three experts with experience or qualifications relevant to fish biology and/or fishway

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[44] This is designed to provide for transfer for large-bodied (e.g. Mary River Cod, Queensland Lungfish) and small-bodied (e.g. Gudgeon) native fish species across the dam wall consistent with the operating rules for the flow performance indicators in Appendix 1, Schedule C, Condition 8 of the Coordinator-General's Evaluation Report, especially in regards to the flow performance indicators for the 97-99% low flows.

engineering identified by the chief executives in consultation with the proponent

(b) include a description and record of completed design process activities and proponent undertakings that are generally consistent with the process requirements set out in Appendix 1, Schedule D of the Coordinator-General's Evaluation Report

(c) provide for the transfer of large-bodied (e.g. Mary River Cod, Lungfish) and small-bodied native fish species (e.g. Gudgeon) in both directions across the dam wall

(d) provide for the requirements in 6(c) to apply from the Commencement of Extraction of Project Yield

(e) be developed to take into account the potential use of the fishway by other native species

(f) include a description of fishway operation procedures, including flow requirements, for the movement across the dam barrier of native fish species present in the Project Area and a fishway commissioning plan

(g) demonstrate that the fishway operation procedures in 6(f) will be consistent with the requirements set out in Appendix 1, Schedule C, Conditions 8 and 23 and identify any supplementary management activities to be undertaken during periods of temporary decommissioning of the fishway

(h) include a monitoring and reporting regime for the operation of the fishway(s) and associated operating information (e.g. relating to flows or releases through or over the dam, headwater and tailwater levels, and maintenance, downtime and repair procedures)

(i) explain how non-compliance with any performance criteria within the fishway design documentation will be rectified, including triggers for the development of a rectification proposal for the consideration of the chief executive administering the *Fisheries Act 1994*

(j) document how the fishway design will minimise the risk of death and injury to wildlife, in particular the Lungfish, Mary River Cod, and Mary River Turtle

7. Prior to commencing the development of the Fishway Design Documentation detailed in Condition 6 (above), submit a Fishway Design Program to the Chief Executive for the *Fisheries Act 1994* for review and provision of written advice. Any views on the Fishway Design Program received from the Chief Executive must be included in the Fishway Design Documentation.

8. The Fishway Design Program must include, but is not limited to:

(a) activity descriptions and durations;

(b) activity milestones, such as those relating to required workshops;

(c) consultation exercises with experts; and

(d) expected timing for the finalisation of relevant documents and performance criteria.

9. The waterway barrier works, inclusive of the spillway, spillway gates or structures or devices that facilitate flow downstream of the waterway barrier must be designed to minimise the risk of injury to fish.

10. The proponent must make provision for ongoing fish transfer from one side of the dam barrier to the other from Commencement of Principal Construction Works until the Commencement of Extraction of Project Yield unless otherwise agreed in writing by the Chief Executive administering the Fisheries Act 1994

Material change of use for land on the environmental management register or premises used for a notifiable activity

(Schedule 8, Part 1, Table 2, Items 5 to 7 *Integrated Planning Act 1997*)

1. Undertake site history investigations of the Project Area to identify areas of potential contamination. Land suspected of being contaminated must be adequately investigated by a suitably qualified person in accordance with the *Environmental Protection Act 1994* (EP Act).

2. Investigations must be undertaken in locations where earthworks or inundation may potentially encounter contaminated soils (i.e. land that is listed on the Environmental Management Register (EMR) or land that is subject to a notifiable activity, or identified areas from a site history and observations analysis). The Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland May 1998 and the National Environmental Protection Measure (Assessment of Site Contamination) must be adhered to in these investigations. Any land identified as having contaminated soil must be notified to the DERM Contaminated Land Unit.

3. Contaminated soil can only be removed from land listed on the EMR with prior DERM Contaminated Land Unit approval and under a disposal permit in accordance with the EP Act.

Schedule B: Conditions under section 52 State Development and Public Works Organisation Act 1971

Riverine protection permit

Water Act 2000

The activity authorised must be undertaken in accordance with the relevant provisions of any environmental management plans(s) implemented for the Project.

1. The proponent shall give the Chief Executive administering the Water Act 2000 five business days notice before commencement of the approved activities.

2. The proponent shall give written notice to the Chief Executive administering *Water Act 2000* of the completion of activities within five (5) business days after completing operations at each of the watercourse sites at which activities are undertaken.

3. Activities for and associated with construction of works are to be carried out in a way that does not impound water or otherwise unduly interfere with the flow of water in the watercourse. Provisions will be made for the maintenance of low flows past the site of the activities.

4. Natural controls creating waterholes in the bed of the watercourse must not be lowered or otherwise destabilised by the activities.

5. Vehicle access tracks constructed within the watercourse must not exceed the minimum width necessary for the safe passage of vehicles and equipment using the crossings.

6. Where practicable, cuttings in watercourse banks necessary for vehicle access tracks are to be aligned in the downstream direction.

7. Native vegetation in the watercourse may be destroyed only to the extent that is reasonable and necessary for access and construction purposes. Where native vegetation is to be destroyed, it is to be cut off at ground level and the ground and root mass are not to be disturbed, except as required for excavation and construction.

8. Material may be excavated and fill may be placed in the watercourse only to the extent that is reasonable and necessary for access and construction purposes.

Interim Resource Operations Licence/Resource Operations Licence

Water Act 2000

Preamble

All volumes of water for any proposed additional take that are currently not covered by an existing authorisation under the *Water Act 2000*, require assessment and approval in accordance with the *Water Act 2000*, *Water Resource (Mary Basin) Plan 2006* and Mary Basin Resource Operation Plan (when finalised).

In accordance with the *Water Act 2000* assessment and approval requirements, operating rules, including environmental release rules for Traveston Crossing Dam and or any new infrastructure, require approval from the Chief Executive administering the *Water Act 2000*.

The proponent must provide a copy of the IROL/ROL approval to the Coordinator-General within 10 business days of receipt.

Works on a State controlled road

Transport Infrastructure Act 1994

Approval must be obtained from the chief executive of the Department of Transport and Main Roads under the *Transport Infrastructure Act 1994* (Qld) for carrying out works for connections to any State controlled road.

Schedule C: Imposed Conditions under Part 4, Division 8 State Development and Public Works Organisation Act 1971

Schedule C contains imposed conditions for the undertaking of the Project. These conditions apply to the extent that:

- the Project does not involve a material change of use that, under the *Integrated Planning Act*, is impact assessable; and
- part 4, division 4, subdivision 2 and divisions 5, 6, 6A and 7 of the SDPWO Act do not apply to the Project.

1. **Lapsing of Coordinator-General's evaluation report**

   If the Project does not substantially start within 10 years after the date of this Coordinator-General's Evaluation Report, the Coordinator-General's evaluation report lapses unless the Coordinator-General, by written notice to the proponent, fixes a later time for the report to lapse.

2. **Land Use Master Plan**

   Prior to the commencement of Principal Construction Works, the Proponent must submit a Land Use Master Plan that identifies the location of all proposed land uses in the Project Area, including:

   (a) all elements of the Project, including the dam wall, dam access road, fishway, turtle bypass, inundation area

   (b) inundation area buffer requirements (in accordance with condition 3)

   (c) protected riparian habitat and wildlife corridors (in accordance with condition 4)

   (d) design and management measures relating to visual impacts (in accordance with condition 6)

   (e) greenhouse offset areas (in accordance with condition 18)

   (f) vegetation offset areas (in accordance with Schedule A: operational works for clearing native vegetation)

   (g) non-indigenous cultural heritage (in accordance with condition 26)

   (h) accommodation areas (in accordance with condition 30(b))

   (i) the recreation and tourism program (in accordance with condition 31)

3. **Inundation Area Buffer**

(a) The proponent must hold appropriate tenure (e.g. freehold, easements) over all lands not retained by the State within the Approved Inundation Area Buffer prior to the commencement of the Principal Construction Works.

(b) Land within the Approved Inundation Area Buffer:

(i) subject to condition 3(b)(ii), must be contained within a perimeter boundary that is the greater of the 1 in 100 AEP inundation extent with the Project, adjusted to incorporate any changes that result from flood mitigation optimisation during detailed design, or 100 m (horizontally distant) from FSL

(ii) adjustments to the perimeter boundary in 3(b)(i) may be proposed to take into account topography, property boundaries and other features, and provided to the Coordinator-General for approval, in conjunction with the requirements of 3(b)(iii)

(iii) must be identified by coordinates and submitted to the Coordinator-General within 12 months of the date of this Coordinator-General's Evaluation Report (or an alternative date agreed in writing by the Coordinator-General), which upon the Coordinator-General's approval becomes the Approved Inundation Area Buffer

(iv) may incorporate areas of limited rotational grazing bounded by permanent fencing, controlled through the use of relocatable fencing to create small paddocks, and monitored to demonstrate that no adverse impacts occur in regards to native species, protected vegetation and water quality. Ongoing grazing access in these areas must be preceded by management trials that demonstrate vegetation management through grazing will provide benefits to native species, protected vegetation and water quality

(c) The Proponent must document on the Land Use Master Plan required in condition 2, and obtain the Coordinator-General's approval for, the location of any land uses (other than use for the storage of water, Project infrastructure and Protected Habitat) within the Approved Inundation Area Buffer.

4. **Protected Habitat within the Project Area**

(a) Protected habitat areas and wildlife corridors must be provided in accordance with the requirements below and:

(i) may be used for vegetation management offsets as required in Schedule A operational works for clearing native vegetation

(ii) must be identified by coordinates and submitted to the Coordinator-General within 12 months of the date of this Coordinator-General's evaluation report (or another date as agreed in writing by the Coordinator-General).

(b) The Upstream Riparian Protected Habitat Area must be Legally Secured and includes the banks and land adjacent to:

(i) the tributaries upstream of the inundation area (including Kandanga Creek, Blue Creek, Yabba Creek, Coonoon Gibber Creek, Belli Creek, Blackfellow Creek, Happy Jack Creek and Skyring Creek) to the upstream extent shown on the maps in Schedule F, and where achievable to the upstream extent of the Restoration Investigation Areas shown on Figure 2-1 of the Habitat Restoration Plan in the Proponent's Response to Reviewers Report; and

(ii) the Mary River upstream of the confluence with Yabba Creek to the upstream extent shown on the maps in Schedule F.

Within the Upstream Riparian Protected Habitat Area, the Proponent must ensure that an area of protected riparian habitat is established and maintained, with a minimum width of 60m from either FSL, or the waterway edge in areas upstream of the inundation area by:

(iii) protecting existing remnant native vegetation and

(iv) restoring native vegetation and

(v) developing areas adjacent to waterways in accordance with the guidelines in Abernethy and Rutherfurd (1999), Rutherfurd et al. (2000) and SEQ Water (2001) and

(vi) controlling, and where possible, eradicating weeds and pest animals and

(vii) where required to exclude stock and pest animals eg. deer and pigs, installing perimeter fauna friendly fencing

Within the Upstream Riparian Protected Habitat Area, the protected riparian habitat must be:

(viii) continuous along at least 90% of the length of both banks of the Mary River, with no significant interruption to connectivity along the Mary River and

(ix) continuous along both banks of all other waterways, with no significant interruption to connectivity, excluding existing and ongoing discontinuities associated with roads, streams etc..

(c) The Western Riparian Protected Habitat Area must cover at least 80% of the area adjacent to the western side of the inundation area from FSL to the limits of the Approved Inundation Area Buffer, from the dam wall upstream to the confluence of the Mary River and Yabba Creek.

Within the Western Riparian Protected Habitat Area, the Proponent must ensure that Protected Riparian Habitat is established and maintained by:

(i) protecting existing remnant native vegetation and

(ii) restoring native vegetation and

(iii) controlling, and where possible, eradicating weeds and pest animals and

(iv) where required to exclude stock, installing perimeter fauna friendly fencing

(v) providing a wildlife corridor at least 100m wide to connect the Kybong Riparian Protected Habitat Area, adjacent to the dam wall, to the confluence of the Mary River with Yabba Creek, with no significant interruption to that connectivity, excluding existing and ongoing discontinuities associated with roads, streams etc..

(d) The Eastern Riparian Protected Habitat Area must cover at least 30% of the area adjacent to the eastern side of the inundation area from FSL to the limits of the Approved Inundation Area Buffer, from the dam wall upstream to the confluence of the Mary River and Yabba Creek.

Within the Eastern Riparian Protected Habitat Area, the Proponent must ensure that Protected Riparian Habitat is established and maintained by:

(i) protecting existing remnant native vegetation and

(ii) restoring native vegetation and

(iii) controlling, and where possible, eradicating weeds and pest animals and

(iv) where required to exclude stock, installing perimeter fauna friendly fencing

(e) The Kybong Riparian Protected Habitat Area must be Legally Secured and must cover a width of at least 60m from the waterway edge includes both banks of the Mary River from the Project dam wall to one kilometre downstream, with no significant interruption to connectivity, excluding existing and ongoing discontinuities associated with roads, streams etc..

Within the Kybong Riparian Protected Habitat Area, the Proponent must ensure that Protected Riparian Habitat is established and maintained by:

(i) protecting existing remnant native vegetation and

(ii) restoring native vegetation and

(iii) developing areas adjacent to waterways in accordance with the guidelines in Abernethy and Rutherfurd (1999), Rutherfurd et al. (2000) and SEQ Water (2001) and

(iv) controlling, and where possible, eradicating weeds and pest animals and

(v) where required to exclude stock, installing perimeter fauna friendly fencing

(f) A wildlife corridor must be established with a width of at least 100 metres to provide linkages between the Protected Riparian Habitat abutting the Inundation Area and

(i) West Cooroy State Forest to the east of the Inundation Area Buffer, and

(ii) Imbil State Forest to the west of the Inundation Area Buffer or Amamoor State Forest to the north east of the Inundation Area Buffer.

Within the wildlife corridor, native vegetation must be protected and restored to enhance connectivity for terrestrial fauna species

(g) Within Protected Habitat areas all uses other than necessary for the establishment and maintenance of protected habitat must be excluded, including grazing which should be progressively excluded as establishment and maintenance of protected habitat occurs.

(h) For Protected Habitat areas, document in consultation with the chief executive administering the *Vegetation Management Act 1999*, regional ecosystem benchmarks (RE Benchmarks) identifying the mature characteristics for all vegetation to be established or enhanced in accordance with the Methodology for the Establishment and Survey of Reference Sites for Biocondition, 2006 and Biocondition: A Terrestrial Vegetation Condition Assessment Tool for Biodiversity in Queensland Field Assessment Manual 2008.

(i) Within 12 months of the date of this Coordinator-General's Evaluation Report (or an alternative date agreed in writing by the Coordinator-General), the Proponent must submit to the Coordinator-General for approval a Habitat Restoration Plan that:

(i) achieves the requirements for Riparian Protected Habitat Areas as described in conditions 4(b) - 4(h)

(ii) sets auditable rehabilitation benchmarks based on the RE Benchmarks established in condition 4(h), that describe the interim habitat characteristics and attributes to be achieved, including:

A. species diversity

B. species density

C. overstorey, understorey and ground cover

D. overstorey and understorey height

E. size class distribution

F. weed eradication

G. survival rates

(iii) defines the benchmark outcomes to be attained at the following milestones:

A. prior to the Commencement of Principal Construction Works

B. 5 years from the Completion of Construction Works

C. 10 years from the Completion of Construction Works

D. 20 years from the Completion of Construction Works.

(j) At least 28 days prior to the Commencement of Principal Construction Works, the proponent must provide a certification by an independent, appropriately qualified person approved by the Coordinator-General, that the 4(i)(iii)A rehabilitation benchmarks have been achieved.

5. **Protected Riparian Habitat Areas outside of the Project Area**

(a) The Proponent must develop a Catchment Enhancement Program for the Mary River Catchment, for the approval of the Coordinator-General prior to the Completion of Construction (Approved CEP).

(b) The CEP must be developed in consultation with a CEP steering committee[45] established by the Coordinator-General, comprising:

(i) a representative of the chief executive administering the *Nature Conservation Act 1992*

(ii) a representative of the chief executive administering the *Fisheries Act 1994*

(iii) a representative of the chief executive administering the *Water Act 2000*

(iv) at least two representatives of community groups involved in catchment management and/or land management in the Mary River catchment.

(c) The CEP must be funded by the Proponent to a total of at least $10 million and be designed and implemented to create Protected Riparian Habitat Areas

(d) The CEP must achieve the establishment of the Protected Riparian Habitat Areas in the Approved CEP within a maximum of 10 years from the date of the approval in 5(a).

(e) The proponent must provide an annual audit report to the Coordinator-General by an independent appropriately qualified person on the implementation progress of the Approved CEP for the life of the CEP. On acceptance by the Coordinator-General, the annual audit report must be made publicly available.

(f) The Protected Riparian Habitat Areas must be on land legally secured for the purposes set out in 5(g) and 5(h) below.

(g) The Protected Riparian Habitat Areas must preferably be distributed across all, but in at least 2, of the following locations:

(i) Mary River Turtle nesting areas on the banks of the Mary River as verified by the chief executive administering the *Nature Conservation Act 1992*

(ii) both banks of the Mary River from one kilometre downstream of the Project dam wall to the Amamoor Creek confluence

(iii) priority Mary River Cod recovery areas[46] (which may also be relevant to Queensland Lungfish recovery) selected from the following: Six Mile Creek from Lake McDonald to Mary River Junction, Tinana Creek from the mouth of Goomboorian Creek (Anderleigh Road) to Teddington Weir, Coondoo Creek from Windsors Road to the junction with Tinana Creek, Obi Obi Gorge from Lake Baroon to Skene's Creek (or Baxter Creek), Amamoor Creek from McGills Creek to Amamoor.

(iv) areas within the Mary River Catchment occupied by the Giant Barred Frog as verified by the chief executive administering the *Nature Conservation Act 1992*

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[45] The CEP Steering Committee may seek the advice of the Chief Executive administering the *Land Protection (Pest and Stock Route Management) Act 2002*.

[46] As set out in Table 4.5, Mary River Catchment Coordinating Committee "*Mary River and Tributaries Rehabilitation Plan Implementation Edition*" 19 July 2001

(h) Within the Protected Riparian Habitat Areas outside of the Project Area, the Proponent must ensure that habitat is created by:

(i) providing protected riparian habitat along bank stretches individually of not less than 100m in length to establish areas of protected riparian habitat with a minimum width of 30m (and desirably 60m where achievable) from the waterway edge and

(ii) protecting existing remnant native vegetation and

(iii) restoring native vegetation and

(iv) controlling and, where possible, eradicating weeds and pest animals and

(v) where required to exclude stock, installing perimeter fauna friendly fencing and

(vi) where Protected Riparian Habitat Areas include Mary River Turtle nesting areas, the Mary River Turtle nesting areas may remain uncovered by vegetation, and must be surrounded by suitable protective measures including native vegetation and predator and stock exclusion fencing on the non-riparian boundaries

(vii) introducing in-stream snags in locations that would benefit Mary River Turtles, Lungfish and/or Mary River Cod

(i) The CEP must:

(i) identify all actions necessary to achieve the required outcomes in condition 5(h), including verification

(ii) demonstrate that the actions in the CEP are adequately funded to achieve the required outcomes

(iii) include benchmarks similar to those in condition 4(i)(ii)

(iv) identify who will undertake the actions in 5(i)(i) (some may be delivered by, for example, local community groups, landholders, or government agencies).

6. **Visual impacts**

In conjunction with the Land Use Master Plan required in condition 2, the proponent must submit a report explaining how the following design and management measures relating to visual Project impacts on the landscape within the Approved Inundation Area Buffer have or will be addressed:

(a) protecting and enhancing the landscape and visual amenity of the visual catchment during construction and operation of the Project by integrating landscape design and the management of visual impacts into the detailed design, construction and operation of the Project

(b) undertaking and documenting landscape planning activities relating to the visual, social and recreational elements of the Project

(c) the objectives, performance criteria and mitigation measures contained within section 30.4.19, 30.5.13 and table 30-5 of the SREIS

(d) detail of consultation that has occurred in the regards to the landscape design of the Project with directly affected communities and individuals, particularly adjoining land owners

(e) as part of the consultation, how drainage and visual screening arrangements with adjacent land owners and other stakeholders (e.g. GRC) has been addressed

(f) preparing landscape design plans for all Project infrastructure and structures including road upgrades, new roads and local access arrangements, any accommodation or recreational areas identifying specific visual impact issues and related proposed landscape treatments

(g) documenting how the design and construction of the dam wall, associated embankments, spillway and visually exposed infrastructure incorporated consideration of visual impacts, including through the implementation of architectural or sculptural design elements and measures relating to the form and colour of the exposed downstream face of the dam wall

(h) using spoil placement adjacent to the downstream face of the wall to reduce the apparent height of the wall and provide a suitable foundation for screening plants and other uses, subject to safety requirements. Spoil is to be placed in a form consistent with local topography and landscape to avoid simply enlarging the engineering bulk of the storage structures

(i) treating the cut rock face on the eastern side of the dam wall to reduce visual impacts within landscape design of the dam spillway

(j) designing night lighting to focus emitted light on the targeted areas, to limit extraneous light and avoid light spill onto adjoining premises

(k) offering tree grants and planting advice to local residents who wish to plant screening vegetation consistent with integrated landscape designs

(l) rehabilitating decommissioned sections of existing roads in accordance with condition 20(c)

7. **Management measures for the Inundation Area**

(a) The proponent must, in the Inundation Area from FSL to 1.5m below FSL

(i) retain native trees subject to land use requirements in accordance with the Land Use Master Plan in condition 2

(ii) encourage the recruitment of endemic tree and shrub vegetation tolerant of wet conditions such as blue gum (Eucalyptus tereticornis), tea tree (Melaleuca spp.) and bottle brush (Callistemon viminalis) and river oak (Casuarina cunninghamiana)

(iii) place partly buried logs and tree stumps adjacent to Protected Riparian Habitat Areas, in erosion prone areas and consistent with Condition 21(j)(i) and 21(j)(ii), to break up wave action and to also provide habitat for aquatic species.

(b) Subject to the requirements of condition 7(a) and 16(h)(ii), remove as much vegetation as practicable from the inundation area prior to filling to minimise subsequent water quality impacts, especially adverse impacts on dissolved oxygen levels

(c) Subject to required approvals being obtained, and except where inconsistent with the conditions in Appendix 1, any other statutory approval or Project construction requirements, the proponent must provide access for reasonable proposals to extract surplus soil, sand and gravel resources from the future inundation area.

8. **Flow Requirements**

(a) The Project must be designed and operated to meet the outcomes and objectives of the *Water Resource (Mary Basin) Plan 2006* at all times

(b) In addition to the outcomes and objectives of the *Water Resource (Mary Basin) Plan 2006*, the Project must be designed and operated to comply with the Flow Performance Indicators in Table 18 below, after the water stored in the Inundation Area first reaches the level of the Project spillway (at approximately 67m AHD or 60,700ML, subject to detailed design). The operating rules to achieve the Flow Performance Indicators are to be determined for the Dagun Pocket flow node, using the Mary River IQQM model[47] as defined in the *Water Resource (Mary Basin) Plan 2006*.

- **Table 18 Required Flow Performance Indicators (FPI) at Dagun Pocket flow node**

Indicator	Season	IQQM Range
Low Flows (10cm)		
% of time >10cm	All year	97-99%
% of time >10cm	June - July	97-99%
% of time >10cm	Sep - Nov	96-99%
Low Flow Spells (10cm)		
Longest spell <10cm	Not to exceed 103 days, and the extent to which the spell is greater than 40 days to be minimised	
Low Flows (30cm)		
% of time >30cm	All year	55-75%
% of time >30cm	Aug - Dec	40-60%
Low Flow Spells (30cm)		
Longest spell <30cm	Not to exceed 300 days, and the extent to which the spell is greater than 180 days to be minimised	
Medium to High Flows (2m)		
% of time >2m	Aug - Dec	<1.1%
% of time >2m	Sep - Nov	<1%
% of time >2m	Oct - Feb	<7%
Seasonality of Flows		
Seasonal Flow Regime	Late Summer	

(c) From completion of construction until the water stored in the inundation area first reaches the level of the Project's spillway (at approximately 67m AHD or 60,700ML, subject to detailed design), the Project must be designed and operated to comply with the transition rules in Table 19 below

[47] The IQQM Model as defined in the *Water Resource (Mary Basin) Plan 2006*, currently incorporates data over the simulation period from 1 July 1890 to 30 June 1999, which may be updated from time to time

- **Table 19 Transition Rules**

Water stored in inundation area	Requirement
Between 20,700ML and 60,700ML	• Meet all Flow Performance Indicators and all WRP requirements (EFOs and WASOs) • Downstream allocations released from Borumba Dam must be maintained • Subject to first meeting the above requirements, up to 25% of the 70,000ML/annum yield may be taken
Above Dead Storage Volume to 20,700ML	• Meet longest period <10cm FPI moderated to be no more than 40 days, measured at the Dagun Pocket flow node • Meet longest period <30cm FPI • Meet medium to high flows (2m) FPI • Downstream allocations released from Borumba Dam must be maintained • No Project Yield may be extracted
Below Dead Storage Volume	• Meet longest period <10cm FPI • Meet medium to high flows (2m) FPI • Downstream allocations released from Borumba Dam must be maintained • Flows may require a pump or other interim measure to be achieved • No Project Yield may be extracted

Note: FPIs in this table are generally in accordance with Condition 8(a) as modified by this condition

(d) Alternatives to the Flow Performance Indicators in Table 18 and the Transition Rules in Table 19 may be permitted only if it can be demonstrated to the satisfaction of the Coordinator-General, in consultation with the chief executive administering the *Water Act 2000*, that the alternatives will achieve enhanced outcomes, having regard to riparian habitat, the flow conditions and broader aquatic community that support the Mary River Cod, Queensland Lungfish and Mary River Turtle.

(e) Prior to the Commencement of Principal Construction Works, the proponent must obtain the Coordinator-General's approval for the relevant components of Operating Rules (and if necessary design requirements), to manage flood impacts upstream and downstream of the Project. The Operating Rules must be consistent with the requirements of the conditions in Schedule A: Operational work that is the construction of a referable dam as defined under the *Water Supply (Safety and Reliability) Act 2008*. The submitted relevant components of the Operating Rules must be accompanied by a report explaining the flood control and mitigation strategy, including the outcomes of consultation undertaken in accordance with condition 8(f).

(f) The Operating Rules in 8(e) must be developed in consultation with the Sunshine Coast Regional Council, Gympie Regional Council, the Dam Safety Regulator, and the Department of Community Safety, with opportunities provided for directly affected individuals and businesses to express their views and to comment on the components relevant to flood impacts of the Operating Rules in 8(e).

(g) Prior to the Commencement of Extraction of the Project Yield, the proponent must obtain approval from the Chief Executive administering the *Water Act 2000* of Operating Rules demonstrated to be consistent with the requirements of conditions 8(a) to 8(e).

(h) Prior to commencement of Extraction of the Project Yield, the proponent must provide to the Coordinator-General confirmation that the Chief Executive has approved the Operating Rules as being demonstrated to be in accordance with condition 8(a) to 8(e)

(i) As part of the application for any Interim Resource Operations Licence or Resource Operations Licence, the proponent must provide to the chief executive administering the *Water Act 2000* the constraints imposed on the operation of the infrastructure by these conditions, including:

  (i) the rules and procedures governing dam and fishway operations, consistent with condition 8(a) to 8(e)

  (ii) a report demonstrating that the proposed operating rules and flow performance indicators governing dam operations achieve compliance with the:

    A. *Water Act 2000*

    B. *Water Resource (Mary Basin) Plan 2006*

    C. Mary Basin Resource Operations Plan (when finalised)

    D. Operating Rules in accordance with Appendix 1, Schedule C, Condition 8 of the Coordinator-General's Evaluation Report and

    E. Flow Performance Indicators specified in Appendix 1, Schedule C, Condition 8 of the Coordinator-General's Evaluation Report.

(j) The Project must be designed to include a multi-level offtake which allows water to be selectively extracted during stratification events and outlet works which increase the oxygen content of water released through the outlet works in order to assist flows to meet the water quality objectives in condition 9(c).

9. **Water Quality Program**

(a) The proponent must produce a Project Water Quality Program (PWQP) for the approval of the Coordinator-General, prior to the Completion of Construction.

(b) The Program must be directed at achieving the Water Quality Objectives (as per condition 9(c)). The PWQP must identify:

  (i) monitoring locations

  (ii) sampling frequency and timing

  (iii) sample handling procedures and if necessary analysis procedures

  (iv) monitoring result reporting process and

  (v) investigations, mitigation actions, reporting, and/or other response actions in the event that monitoring results exceed the Water Quality Objectives in condition 9(c).

(c) The Water Quality Objectives are:

(i) for the Mary River and other tributaries outside of the reservoir (but within the project area) - the Mary River Environmental Values and Water Quality Objectives (EPA March 2007 or any later edition) specifically for Lowland Freshwater in a Slightly to Moderately Disturbed (level 2) Aquatic Ecosystem

(ii) for water impounded within the Traveston Crossing Dam - Mary River Environmental Values and Water Quality Objectives (EPA March 2007 or any later edition) specifically for Freshwater Lakes/Reservoirs in a Slightly to Moderately Disturbed (level 2) Aquatic Ecosystem

(iii) for water where primary contact recreation is likely within the reservoir, - Mary River Environmental Values and Water Quality Objectives (EPA March 2007 or any later edition) specifically for Suitability for Primary Contact Recreation in Coastal, Estuarine and Freshwaters

(iv) for water in the vicinity of off-takes (Level 1 or Level 2) - Mary River Environmental Values and Water Quality Objectives (EPA March 2007 or any later edition) specifically for Drinking Water EV: Priority WQOs for Drinking Water Supply in the Vicinity of Off-Takes, Including Groundwater, Before Treatment

(v) for all surface waters – the requirements for Aquatic Ecosystem Toxicant Guidelines for Metals, Metalloids, Pesticides, and Fungicides & Herbicides in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, 2000, or any later edition).

(d) The PWQP must be directed towards achieving the Water Quality Objectives in Condition 9(c), after the Completion of Construction and identify management procedures to respond to non-compliance caused by natural events (e.g. floods). Those management procedures should document how actions will be implemented in a timely manner to minimise environmental impacts on aquatic species.

(e) The Proponent may submit an application to remove an individual Water Quality Objective parameter from those mentioned in Condition 9(c) from further monitoring for the Coordinator-General's approval. To gain approval, the Proponent must demonstrate, through previous water monitoring results and risk assessment methodology, which in the context of this Project, its catchment and surrounding land uses, and considering existing controls that continued monitoring of the parameter will not provide any significant additional protection for human health and/or ecological values. An application to remove a Water Quality Objective parameter, must include a verifiable explanation of the opinions of the chief executives for the *Environmental Protection Act 1994*, *Nature Conservation Act 1992* and the *Water Supply (Safety and Reliability) Act 2008*.

(f) The PWQP's monitoring methodology must not be inconsistent with the methods prescribed in the latest edition of the EPA's Water Quality Sampling Manual and the Australian and New Zealand Environment and Conservation Council's Australian Guidelines for Water Quality Monitoring and Reporting

2000 or documents that supersede these in accordance with regulator requirements.

(g) The PWQP's sampling locations must cover the Mary River and tributaries above the inundation area, within the inundation area, and the Mary River below the dam wall (including a sample point within 200 metres of outlet). The number and locations (including depths) of the monitoring sites must be selected to provide a reasonable understanding of the water quality conditions and water quality processes, relevant to the Water Quality Objectives in Condition 9(c). The proponent must justify the proposed number and locations of sampling sites.

(h) The PWQP must include a real time monitoring functionality within the inundation area (in addition to the manually collected samples). Parameters to be subject to real time monitoring must include temperature. Real time monitoring is to be situated at locations and depth intervals to allow an understanding of the inundation area's stratification characteristics.

(i) The PWQP must stipulate routine sampling to cover all the Water Quality Objectives, as mentioned in Condition 9(c), with the following minimum frequencies for the routine monitoring once filling commences:

(i) Algae (blue green and diatoms if appropriate), dissolved oxygen, pH, turbidity at depth to occur weekly

(ii) All other parameters listed in Condition 9(c) to occur monthly

(iii) Sampling within the inundation area for nutrient, physio-chemical, and metals to monitor water quality against Priority Water Quality Objectives for Drinking Water Supply is to occur at a variety of depths.

(j) The PWQP must outline a process and identify triggers (including significant inflows and/or environmental incidents) for event-based monitoring.

(k) From the Completion of Construction until the Project first reaches FSL, the PWQP must include additional sampling sites and increased sampling frequency of turbidity, pH, and dissolved oxygen. The additional sampling sites must be downstream of the wall, within the impounded waters, and in the tributaries that will be inundated.

(l) The PWQP must require that a health risk assessment be undertaken in relation to expected water quality outcomes, and necessary controls implemented, before recreational water usage is permitted within the reservoir.

(m) The PWQP must require that the data available from the weather station required in 17(a)(i) be considered when analysing of water quality results. Water quality performance and trends (particularly when explaining exceedance events) are to be presented, when relevant, with weather and flow records. Relevant records must include local ambient air temperatures, wind speed, wind direction, rainfall events, pan evaporation, humidity; as well as reservoir inflows and releases.

(n) The PWQP must require that water quality findings and trends are summarised as part of the report required in Condition 12(j). The Proponent will utilise the report to demonstrate any significant trends in regard to water quality within the Project Area. The report must also discuss actions taken and future options for the proponent to manage water quality exceedances of the water quality objectives in Condition 9(c).

10. **Groundwater management plan**

(a) Prior to the commencement of Principal Construction Works, the proponent must prepare and implement a Groundwater Monitoring Network Plan that:

(i) details the design and location of a groundwater monitoring network in areas of the alluvium downstream from the dam wall

(ii) details the design and location of a groundwater monitoring network in areas close to the edge of the FSL as informed by a survey of existing users who may be impacted by the inundation area

(iii) describes how the groundwater monitoring system, will be used to assess potential impacts on existing groundwater users including monitoring programs, predictive modelling if required and the development of further mitigation measures if required

(iv) includes a requirement for collection and assessment of the monitoring data obtained from the Groundwater Monitoring Network, and if impacts are identified, prepare a mitigation plan for the Coordinator-General's approval and implementation by the proponent

(v) include collection of point source water level and water quality data from existing bores, including private and established piezometers. Water quality samples will include analysis of electrical conductivity (EC), pH, dissolved oxygen (DO), and major cations and anions

(vi) identification of presence of springs and obtain water samples (same analytes as described above)

(vii) information from landholders regarding the behaviour of any springs present

(viii) correlating proposed dam levels with local groundwater levels

(ix) correlating groundwater levels with hydrographic data from the Mary River and its affected tributaries

(x) correlating groundwater quality results with surface water quality data to define potential interactions

(xi) identifying any water quality variations along length of alluvium upstream and downstream of the proposed dam

(xii) identifying any areas of potential salinisation due to elevated water levels and mobilised salts

(b) If it is demonstrated that adjacent landholders are experiencing adverse groundwater impacts (rising water table, or poor water quality from wells etc) due to the Project, the proponent must implement mitigations to make good those impacts.

11. **Applied Research relating to the Mary River**

(a) Within 12 months of the date of this Coordinator-General's Evaluation Report, or such time agreed in writing by the Coordinator-General, the Proponent must have approved by the Coordinator-General a Research Delivery Plan (RDP) (the Approved RDP).

(b) During development of the RDP, the Proponent must consult with and obtain the written views of the chief executives administering:

(i) the *Fisheries Act 1994*

(ii) the *Nature Conservation Act 1992*

(c) The written views of the chief executives under 11(b) must be provided to the Coordinator-General with the RDP.

(d) The RDP must include:

(i) specific research outcome targets for each of the priority research activities identified in Schedule E, (unless agreed otherwise by the Coordinator-General in consultation with DERM and DEEDI)

(ii) a summary of key tasks that will be implemented to enable the specific research outcome targets for the priority research activities, including permit requirements and animal ethics approvals

(iii) a program for monitoring, auditing and reporting on progress with the key tasks summarised in (ii) and demonstration as to how the key tasks have achieved the specific research outcomes

(iv) expected dates for the initiation and completion of key tasks (i.e. milestones), demonstrating that the majority of the specific research outcomes will be achieved within a 10 year timeframe

(v) identification of specific research outcomes that will not be achieved within 10 years, and an anticipated timeframe for achievement of those outcomes

(vi) identification of how intellectual property in data collected is to be managed and made available to assist ongoing nature conservation research and management activities

(vii) summaries of methodologies that will be used for the key tasks

(viii) a description of financial and human resource requirements for each key task relating to each priority research activity and specific research outcome targets

(ix) established procedures for the provision of raw and field data collected through implementation of the RDP to any appropriate public institution (e.g. government department or agency) for subsequent use for research and management purposes

(e) The proponent must implement the approved RDP, and provide at least $35 million funding for its implementation.

(f) The proponent must prepare and make publicly available, for the life of the RDP, an annual report that includes:

(i) a summary of all research undertaken

(ii) an assessment of research outcomes and how these will be applied to informing the adaptive management and improvement in the implementation of the mitigation measures, offset requirements and rectification requirements, as relevant, addressing but not limited to those in Conditions 3, 4, 5, 7, 8, 9, 21, 22 and 23.

(iii) progress for each of the priority research activities

(iv) significant findings in relation to the specific research outcomes

(v) a summary of all published data and reports and how these can be accessed

(vi) an audit of research activities against the RDP

(vii) the forward program for the balance of the RDP, including any recommendations for change to the RDP.

(g) Where changes are recommended to the Approved RDP by the proponent, the written approval of the Coordinator-General must be obtained. The Coordinator-General's approval is deemed to be an amendment the Approved RDP.

12. **Project EMP**

(a) An Environmental Management Plan for design, construction and operation phases of the Project (Project EMP) must be submitted for the approval of the Coordinator-General within 6 months of the date of this Coordinator-General's Evaluation Report or an alternative timeframe agreed in writing by the Coordinator-General.

(b) The Project EMP must set out the overarching framework and requirements that will be implemented through task-specific EMPs.

(c) The proponent must ensure that any EMPs prepared for the Project to address specific tasks or work undertaken by specific organisations (e.g. contractors procured by the proponent or works undertaken by voluntary or non-profit organisations) adhere to the approved Project EMP.

(d) The Project must be designed, constructed and operated in accordance with the Project EMP.

(e) The Project EMP must:

(i) be developed to incorporate the objectives and performance criteria contained within the Draft EMP (Construction and Operation) in Chapter 30 of the SREIS

(ii) incorporate the mitigation measures within the Draft EMP (Construction and Operation) in Chapter 30 of the SREIS, or alternative mitigation measures where those mitigation measures achieve the objectives and performance criteria

(iii) incorporate all of the conditions within this Appendix 1, Schedule C of the Coordinator-General's Evaluation Report

(iv) demonstrate how each condition within Appendix 1, Schedule C of this Coordinator-General's Evaluation Report has been incorporated in the Project EMP and identify the record and reporting mechanisms that will demonstrate compliance with each condition

(v) describe the components of the Project that each Project EMP element is relevant to, including as necessary descriptions of locations and relevant Project phases

(vi) include processes for dealing with circumstances where thresholds are exceeded during construction activities. These processes must establish mechanisms for reporting, taking corrective action where required, and indicating responsibilities and timing for such action

(vii) include mechanisms for reporting on compliance that also include the requirements of reporting in Table 20 below

(viii) incorporate the consultation procedures in accordance with condition 13 below.

(f) From the date of this Coordinator-General's Evaluation Report until the Completion of Construction, the proponent must submit pre-construction and construction Project EMP reports to the Coordinator-General, signed by the chief executive officer of the proponent, in accordance with Table 20 below.

- **Table 20 Preconstruction and Construction – Reporting on Compliance and Performance**

Report	Frequency and Scope
Compliance Report	Six-monthly: • undertaken by an independent and appropriately qualified person • set out the current status of Project activities, any approvals yet to be obtained and emerging issues relevant to the Coordinator-General's conditions • compliance with Coordinator-General's conditions and details of any non-compliances • compliance with the Project EMP • response to incidents of non-compliance, including corrective actions, revised construction practices, responsibility and timing and • all other matters pertaining to environmental performance during construction
Incidents and Exceedance Report	Interim Report: • within 2 days of incident or an exceedance or non-compliance with a condition, goal or requirement being identified and • details of incident and initial response. Full Report: • within 14 days of incident or an exceedance or non-compliance with a condition, goal or requirement being identified • how the matter is to be dealt with under the Project EMP and • details of incident, response, corrective action, responsibility and timing.
All reporting must be to the Coordinator-General in both written and portable document format (for distribution at the discretion of the Coordinator-General), and must be available to relevant agencies on request. Publication of complaints and information on the resolution of complaints is at the Coordinator-General's discretion.	

(g) A major update to the Project EMP (Operation Update) must be prepared and submitted to the Coordinator-General for approval at least 30 business days prior to the Completion of Construction.

(h) Commencement of Extraction of Project Yield must not occur until the Coordinator-General has, by written notice, approved the Operation Update

(i) The Project must be operated in accordance with the approved Project EMP as updated by the Operation Update

(j) From the Completion of Construction, the proponent must submit operations Project EMP reports to the Coordinator-General, signed by the chief executive officer of the proponent, in accordance with Table 21 below.

- **Table 21 Operations – Reporting on Compliance and Performance**

Report	Frequency and Scope
Operations Phase Compliance Report	6-monthly for the first 2 years from the Completion of Construction, and then annually thereafter: • undertaken by an independent and appropriately qualified person • compliance with the conditions in Appendix 1, Schedule 3 of the Coordinator-General's Evaluation Report • satisfaction of environmental objectives and EMP requirements • response to incidents of non-conformance, including where necessary corrective actions, revised operations practices, responsibility and timing and • all other matters pertaining to environmental performance during operations.
All reporting must be to the Coordinator-General in both written and portable document format (for distribution at the discretion of the Coordinator-General), and must be available to relevant agencies on request. Reporting is required for the life of the Project or as otherwise confirmed in writing by the Coordinator-General. Where reporting requirements are incorporated in another Project Approval or statutory instrument (e.g. ROP, ROL in relation to flow), those requirements may replace the relevant requirements contained in these conditions upon notification to the Coordinator-General with a copy of the relevant Project Approval.	

13. **Consultation and community engagement**

The proponent must:

(a) for the life of the Project, establish and maintain a toll-free telephone service with 24 hour-7 day servicing and a Project website or other similar means of communication to provide information to the community and to receive complaints

(b) conduct of consultation with property owners and occupants in the Project area and/or potentially affected people identified through investigative or predictive studies, (e.g. consultation with the wider community if indicated to be necessary or areas along construction vehicle routes), for the duration of relevant construction and pre-construction activities

(c) conduct consultation with affected property owners and occupants with confidentiality where requested by the owners or occupiers of premises and at a level of detail sufficient to address specific construction impacts and mitigation requirements

(d) prior to the Completion of Construction, actively engage with affected landholders to minimise disruption and to facilitate, where practicable, the continuation of current land use in the vicinity of the Project (particularly in regard to the creation of viable lot sizes with 100 ha where practicable)

(e) prior to both the commencement of any construction works within 1 km of the sensitive receptor located at lot 2 on registered plan 172026 and prior to the commencement of Principal Construction Works, submit to the Coordinator-General additional reporting about mitigation measures relating to any occupants of the dwelling at the sensitive receptor located at lot 2 on registered plan 172026. This report must address impacts associated with construction traffic, dust, blasting and noise. The report must also identify mitigation measures to be implemented to achieve acceptable environmental outcomes for the occupants of the sensitive receptor

(f) for the life of the Project, implement procedures for receiving and dealing quickly and effectively with complaints. The complaints procedures must be activated before the Commencement of Construction

(g) develop and implement procedures to ensure effective communication with the local community regarding the development of the Project. The procedures must include a range of methods, including, but not limited to:

    (i) face to face meetings

    (ii) printed material in local newspapers, magazines, community notice boards or meeting points

    (iii) notification of key community groups, such as Friends of Kandanga and local schools

14. **Complaints management**

As a minimum, the complaints process mentioned in 13(f) above must achieve the following:

(a) a protocol establishing the responsibility for receiving and addressing complaints, and the means of notifying the community of this protocol (eg. publication of a complaints telephone service, website advice, and address for notices and other correspondence)

(b) a register must be maintained that includes the following information: identification of the complainant, the identity of the person who received the complaint, the manner in which the complaint was made, the time and date on which the complaint was made, and description of the complaint

(c) a process wherein, upon receipt of a complaint, an investigation commences forthwith into the cause of the complaint and any actions reasonably required to address the complaint. Feedback to the complainant must be provided as soon as practicable about the action to be taken, and subsequently, the results of any action taken. Relevant authorities, if any, must also be notified of such actions

(d) a database for tracking complaints, issues, the subject of complaints, responses and corrective actions taken. A means of reporting each complaint, such as a complaints register, must include identification of the entity responsible for addressing the complaint, the time and date on which the complaint was addressed and closed out, a brief summary of any action taken to address the complaint, and a notation as to the satisfaction or dissatisfaction of the complainant with the outcome and

(e) reporting of complaints and proponent's performance in management of complaints, is to be included in the report required by condition 12(f) and condition 12(j).

15. **Design for bank erosion and sediment management**

(a) Prior to the Commencement of Principal Construction Works, the proponent must submit to the Coordinator-General for approval a Bank Erosion and Sediment Management Plan, which must:

(i) include the results of sediment movement monitoring both upstream and downstream of the inundation area for at least four seasons and at least one of each different season (i.e. autumn, winter, summer and spring)

(ii) provide an estimate of sediment movements anticipated under the prevailing flow conditions informed by the outcomes of 15(a)(i) and bank condition surveys

(iii) include an assessment of the anticipated sediment flows into the inundation area, areas of high bank erosion risk, and potential sediment related impacts downstream, based on the sediment monitoring data, sediment movement estimates and bank condition surveys upstream of the dam, and downstream to Fisherman's Pocket

(iv) identify anticipated quantities of sediments that may need to be extracted (including useful soil, sand and gravel) from the inundation area during project operations

(v) explain how such material could be extracted, released, reused or disposed, and the subsequent impacts on dam capacity

(vi) identify any additional mitigation measures required to address the predicted impacts in 15(a)(iii), and when and how the mitigation measures will be implemented

(vii) document long term sediment and bank condition monitoring and mitigation measures which must be implemented during both construction and operations of the Project.

(viii) the mitigation measures in (vii) must be progressively implemented until bank erosion changes caused by the Project have been rehabilitated and stabilised as demonstrated by monitoring

(ix) in the event of uncertainty regarding the cause of bank erosion changes in (viii), the proponent must provide a report on investigations undertaken by an appropriately qualified person to the chief executive administering the *Water Act 2000* with sufficient information to allow the chief executive to determine the likely cause of the bank erosion changes and the required mitigations.

(b) The proponent must design the spillway outfall and outlets from bridges, culverts and drains to minimise erosive flows and downstream disruption and provide erosion protection.

16. **Construction sediment and erosion control**

The proponent must:

(a) implement management approaches in relation to construction sediment and erosion control and soil management, which include:

(i) documenting sediment and erosion control and soil management plans which comply with erosion and sediment control guidelines for Queensland Construction Sites (Witheridge and Walker, 1996)

(ii) documenting procedures based on erosion risk assessments to minimise erosion, and to control and trap sediment movement which may occur through designed drainage and sediment controls

(iii) identifying areas to be disturbed and the staging of works in those disturbed areas

(iv) documenting specific measures to be implemented in each disturbed location

(v) referring construction sediment and erosion control management measures to the Chief Executive administering the *Fisheries Act 1994*, if the measures will cause a barrier that limits fish stock access and movement along a waterway.

(b) implement runoff and erosion controls by:

(i) controlling and diverting uncontaminated run off water away from disturbed areas and erosion prone areas

(ii) controlling erosion on disturbed areas

(iii) using drainage controls to direct sediment-laden runoff to sediment traps

(iv) determining the spacing and form of sediment control measures using the guidelines in Witheridge and Walker, 1996 Pages A4.18 and A4.19

(v) installing sediment basins or portable sediment tanks guided by the areas to be disturbed and the erosion risk assessment. Sediment basins must be provided when the disturbed area is greater than one (1) hectare, the disturbed soils are dispersible, and/or when there is a need to control runoff turbidity

(vi) designing sediment basins for a 24 hour storm event of ten years annual exceedance probability (AEP) and specifying that they will be cleaned out following inflow events and managed to ensure the required storage capacity is maintained

(vii) re-using water detained in sediment basins, collected from drainage controls, and from foundation dewatering on the construction site where possible, or progressively released back into waterways under a water quality management plan

(viii) implementing measures to minimise sediment taken offsite by construction vehicles, via the use of wash down bays or other appropriate methods.

(c) control erosion from disturbed surfaces by:

(i) shaping landforms in disturbed areas to take account of the erodibility of soil materials used and to not concentrate flows

(ii) progressively reshaping disturbed areas and re-vegetating disturbed areas that will not be inundated with native species as work phases are completed

(iii) removing loose, surplus excavated sand, gravel and clays to control erosion

(iv) minimising areas of disturbance, particularly of dispersive material

(v) not leaving clay subsoil materials exposed where possible to avoid dispersion under rainfall

(vi) remediating bare areas as soon as practicable by backfilling, covering with topsoil and revegetating, hydroseeding or hydromulching.

(d) manage topsoil stockpiles by:

(i) stockpiling topsoil during site stripping or excavation where appropriate for later rehabilitation or landscaping works. Stockpiled materials should have appropriate sediment and erosion control measures in place including bunding and silt fences when on sloping ground. Stockpiled topsoil should be used as soon as practicable to limit the deterioration in biological activity and stockpile heights should not exceed two metres

(ii) stockpiling topsoil for the minimum practical time before it is used for rehabilitation to minimise loss of biota. Where topsoil has been stockpiled for more than eight weeks, a layer of material from a more recent stockpile about 0.05 m thick will be used at the immediate surface if available

(iii) if stockpiles must be left exposed, temporary erosion protection, sediment traps and sedimentation ponds must be provided

(iv) using quick-growing groundcover plant species to protect stockpiles and similar sites but not letting them seed unless they are native to the area

(v) constructing stockpiles so the surface is reasonably level, but with sufficient roughness to trap water and aid infiltration rather than large conical or elongated crested stockpiles where run-off will be rapid

(vi) testing topsoils before they are reused to determine whether fertiliser applications are required to aid the re-establishment of vegetation, and ensure that any fertiliser regime is compatible with native species used

(vii) only stripping and stockpiling topsoil for subsequent rehabilitation works down to the top of any clay subsoil or to an appreciable colour change including any bleached layer (pale grey or white when dry)

(viii) returning topsoil to the area from which it was stripped (if above FSL) when used for rehabilitation wherever practicable to maximise return of plant propagules to their area of origin

(e) manage erosion and sediment control timing by:

(i) implementing construction sequencing and timing to minimise exposure of disturbed areas to rain and stream flows

(ii) minimising the time that cleared/disturbed areas are left exposed

(iii) timing works requiring high levels of soil disturbance and high traffic on surface soils for April to September inclusive to minimise compaction of wet soils and erosion risk as mean rainfalls and numbers of rain days are lowest over this period. If this is not practical then ripping must be implemented

(iv) timing rehabilitation work to coincide with vegetation growth periods

(v) ensuring that rehabilitation works involving revegetation will have plantings in place, with adequate temporary erosion protection, so that spring / summer rainfall will aid establishment

(f) implement management approaches in relation to long-term erosion protection by:

(i) monitoring vegetation establishment and persistence and provide replacements, possibly with species found to be hardier in the situation, wherever required

(ii) using locally endemic plant species that are known to be well adapted to the area and soils, including threatened species or species indicative of impacted regional ecosystems

(iii) managing potential run-off so that flows are dispersed and flow concentration is avoided unless drainage structures have been provided

(iv) spreading flows at culvert or drain outlets and providing structures to reduce discharge velocity if necessary

(v) covering areas of dispersive sediment and soil material within the inundation area, along margins and on islands with non-dispersive fill

(vi) shaping grassed landforms to provide slopes similar to or lower than those of the surrounding landscape, and establish grass as quickly as possible where it will be the primary vegetation cover for erosion protection. The following slopes must not be exceeded unless additional erosion protection measures such as graded contour banks or terraces using rock walls have been provided

Table 22: Slope Goals

Soil type	Natural soils	Reconstructed soils
Deep well structured uniform-textured soils	slopes up to 20%	slopes up to 15%
Coarse and medium uniform textured soils, gradational textured soils and non-sodic texture contrast soils	slopes up to 15%	slopes up to 12%
Sodic texture contrast soils	slopes up to 8%	slopes up to 5%

(vii) using exposed rock, which is a natural feature of the local landscape, to provide protection where slopes greater than allowed by Table 22 cannot be avoided

(viii) shaping landforms for surfaces to be covered by trees and shrubs above FSL by providing slopes similar to or lower than those of the surrounding landscape, place anchored, biodegradable erosion protection and establish trees and shrubs so they, and their leaf litter, will provide ground cover for erosion protection

(ix) ensuring that fencing permanently excludes introduced livestock from areas where trees, shrubs and their leaf fall will provide long-term surface protection and to control grazing where grasses will provide long-term surface protection and

(x) ensuring that adequate soil material is available to support plant growth by placing a layer of material with appreciable water holding capacity to increase profile water storage and covering this with topsoil stockpiled during excavation.

(g) Implement an Erosion and Sediment Control Monitoring Program to measure compliance with, and the effectiveness of, the Erosion and Sediment Control Plans. A summary of monitoring must be reported in the report required in condition 12(f). The monitoring must be directed at managing:

(i) the effectiveness of sediment control measures in preventing sediments leaving worksites. Monitoring to be at least weekly, and after rainfall runoff events

(ii) the suspended solid content in sedimentation pond waters prior to release. Samples to occur before any releases to ensure suspended sediments in released waters are no higher than 40 NTU

(iii) the health and coverage of the vegetative groundcover to prevent erosion. To be surveyed at the completion of works in each disturbed location and then at least monthly throughout the construction period to ensure adequate surface protection has been established and maintained

(iv) the incidences and impact of failing sediment and erosion control measures. The resulting remedial action, must be identified in the

Construction Compliance Report required in accordance with Table 20

(v) the impacts of erosion, sediment movement, or turbidity on sensitive receiving environments (i.e. water ways and aquatic ecosystems)

(h) ensure the design and construction methodologies for the Project allow suitable measures to intercept, treat if required and dispose of groundwater, liquid wastes, such as fire retardants, wash-down water, and contaminated stormwater, to avoid contamination of surface waters.

(i) conduct an investigative and predictive study to identify the risk of disturbing acid sulfate soils (ASS) or potential acid sulfate soils (PASS), or causing the oxidation of such soils leading to impacts on the environment, and if impacts are predicted or occur the proponent must develop and implement an Acid Sulfate Soil Management Plan

(ii) prior to the commencement of filling the proponent must, as far as practicable, maintain groundcover below FSL to minimise the potential for erosion and sediment movement, subject to condition 7.

17. **Air Quality**

The proponent must:

(a) implement measures that will avoid, or mitigate and manage the potential adverse environmental impacts of diminished air quality arising from construction activities. These measures must include:

(i) the establishment of an ambient particulate and meteorological monitoring station to measure and record temperature, wind direction and rainfall, evaporation, air pressure and humidity at a location adjacent and upstream of the dam wall,[48] at least 12 months prior to the commencement of any road works associated with the Project and the Principal Construction Works, to assist with the detailed assessment of potential air quality impacts and the development of appropriate dust management measures

(ii) identification of all areas where off-site air quality impacts may potentially occur (and the conditions under which these impacts may occur), including road works, worksite activities, vegetation disposal, movement or queuing of construction vehicles with diesel-powered motors adjacent to sensitive receptors, and long-term operation of diesel-powered plant and equipment at worksites

(iii) documented management plans detailing approaches to be adopted and all reasonable and feasible mitigation measures to address environmental dust issues within the surrounding areas. Where specific exceedances of the air quality criteria in Table 23 are predicted to occur or occur as a result of the Project, implement specific proactive mitigation measures targeted to minimise potential impacts on sensitive receptors. These measures may include, but are not limited to:

A. wet suppression – regular watering of construction areas

B. consideration of chemical stabilisation

[48] The location should also be representative of conditions across the eventual inundation area

C. vehicle movements confined to defined roads & access tracks and speed limited

D. maintenance of established vegetation

E. rehabilitation of disturbed surfaces as soon as practicable

F. management of construction activities (e.g. location, scale, type and timing)

G. other mitigation measures as outlined in section 10.2.7 and table 10.12 of the EIS, and section 21.1.4 and 30.4.12 of the SREIS

(iv) communicating planned mitigation measures to potentially affected sensitive receptors

(v) documenting and implementing construction dust monitoring procedures, which address the frequency of monitoring and the locations for the establishment of monitoring stations. The procedures must include regular monitoring of air quality for deposited dust, total suspended particulates (TSP) and particles (PM_{10}) to determine whether environmental requirements set out in Table 23 and the requirements of the Project EMP are being met

(b) Ensure that the release of dust from the construction works does not exceed the Particle Deposition criteria set out in Table 23.

- **Table 23 Construction Air Quality Criteria**

Pollutant	Construction Air Quality Criteria
Particles as PM_{10}	50 µg/m^3 (24 hour average) (5 exceedances allowed per year)
Total Suspended Particles	90 µg/m^3 (Annual average)
Particle Deposition	120 mg/m^2/day

(c) summarise the construction dust monitoring results, and monitoring of any other air quality issues, in the Construction Compliance Report required in 12(f). Records of monitoring results are to be maintained by the proponent at all times during the construction period and must be available for inspection by the relevant agency at any time.

18. **Greenhouse offset plan and research**

(a) The proponent must produce a Greenhouse Offset Plan that at a minimum, provides an offset for the greenhouse gas emissions associated with the Project, for the Coordinator-General's approval, at least 3 months prior to the Commencement of Principal Construction Works. The Greenhouse Offset Plan must detail:

(i) the greenhouse gas emissions to be offset associated with the construction of the Project, supported by detailed greenhouse gas emission calculations, with a minimum offset requirement of 287,253 tonnes $CO_{2\text{-}e}$

(ii) the greenhouse gas emissions to be offset associated with the operation of the Project for a 100 year operational timeframe, supported by detailed greenhouse gas emission calculations

(iii) the proposed offsets to be acquired by the Project, including the methodologies for calculating those offsets

(iv) how any offsets acquired by the Project surplus to the requirements of 18(a)(i) and 18(a)(ii) are to be dealt with by the proponent

(v) the proposed actions and associated timeframes, to achieve the offset and an ongoing reporting regime relating to progress against subsequently approved timeframes , which must include achieving the offset within 25 years of commencement of operation of the dam, and greenhouse gas abatements or offsets must be retained for a minimum of 100 years in line with:

A. Kyoto based accounting methods and

B. the NSW Greenhouse Abatement Scheme or other scheme as approved by the Coordinator-General

(vi) the required number and type of trees that will be planted progressively prior to the Completion of Construction

(vii) how the planting will be actively maintained for a period of five years to ensure their viability and with adequate viable stock to ensure the equivalent, within 12 years, of a minimum of 200-300 trees/ha for commercial plantations, or a minimum of 300 trees/ha for environmental planting purposes

(viii) the location of the above planting activities plus access arrangements, tenure arrangements and lessee terms, supported by relevant mapping

(ix) an explanation of how any commercial enterprises would be established

(x) any carbon offset credits that will be claimed

(xi) an explanation of the suitability of soil conditions

(xii) primary use (e.g. commercial plantation use, vegetation loss offset, erosion control, and riparian rehabilitation)

(xiii) how any constraints will be addressed including any planning scheme requirements, state, regional and local government policies and infrastructure requirements

(xiv) monitoring and verification requirements to demonstrate the maintenance of the carbon offsets

(b) The proponent must implement the measures within the Greenhouse Offset Plan approved by the Coordinator-General.

(c) The proponent must prepare a research plan into the issue of greenhouse gas emissions and carbon sink capacity and options for dams for the Coordinator-General's approval, within 6 months of the date of this Coordinator-General's

Report (or an alternative date agreed in writing by the Coordinator-General). The research plan must identify:

(i) the objectives and scope of a proposed research project

(ii) the budget for completion of such research project, including the funding contribution from the Proponent which shall not be less than $250,000

(iii) the timeframe for the research project and

(iv) the personnel to undertake the research project.

(d) The research plan must make provision for a final report to be provided to the Coordinator-General on the outcomes of the research.

(e) Upon approval by the Coordinator-General, the research plan must be implemented by the Proponent.

19. **Noise and Vibration**

The proponent must:

(a) design, construct and operate the Project in accordance with the objectives, performance criteria, and mitigation measures contained within section 30.4.13 and 30.5 of the SREIS

(b) undertake a background noise survey to define background noise levels at all potentially affected sensitive receptors, and the establishment of specific noise criteria at these receptors in accordance with Table 24

(c) identify all sensitive receptors where elevated off-site noise and vibration impacts may potentially occur (and the conditions under which these impacts may take place), based on predictive modelling having regard to the proposed construction methods and the proximity of residences and other relevant receptors

(d) adopt all reasonable and feasible mitigation measures to address environmental noise and vibration issues. This must include specific measures for mitigation of predicted impacts on sensitive receptors where predictive modelling indicates exceedance of Project noise and vibration criteria as per Table 24, Table 25 and Table 26 below. Mitigation measures should include, but not be limited, to:

(i) programming of activities (e.g. hours of work) for particular circumstances

(ii) installation of acoustic screens

(iii) enclosure of worksites possibly with purpose-built sheds

(iv) operational techniques (e.g. use of particular construction techniques to suit circumstances)

(v) other mitigation measures as outlined in section 30.4.13 SREIS and 11.2.10 of the EIS

(e) documenting and implementing noise and vibration monitoring procedures, which address the frequency of monitoring, and the locations for both the establishment of monitoring stations and other locations adjacent to sensitive receptors where monitoring may be undertaken during construction works . The monitoring procedures must detail how monitoring locations will be determined during construction work adjacent to sensitive receptors, the frequency of monitoring and the locations of where ongoing monitoring stations are to be established, including:

(i) a monitoring station immediately adjacent to sensitive receptor located at lot 2 on registered plan 172026 and

(ii) monitoring located immediately adjacent to sensitive receptors at locations 1, 2 and 3 (as identified in figure 31-14 of the SREIS)

The monitoring procedures must confirm the extent of predicted impacts and should the results of monitoring indicate exceedance of the construction noise criteria in Table 24, then additional mitigation measures must be implemented to achieve the construction noise criteria

(f) undertake building condition surveys of buildings or structures identified in the predictive modelling as mentioned in Condition 19(g) and 19(h) as likely to be adversely affected by vibration and/or blasting. Surveys must be completed prior to the Commencement of Principal Construction Works

(g) where the predictive modelling predicts that noise criteria for the Project are likely to be exceeded by construction works, the Proponent must implement further consultation, reasonable and practicable mitigation and management measures, and adapt the abovementioned monitoring procedures to provide further guidance on mitigations. These measures must be developed in consultation with owners and occupants of potentially- sensitive receptors. The noise criteria are in Table 24 below.

- **Table 24 Construction Noise Criteria**

Noise level dB(A) measured as	Monday to Saturday			Sundays and public holidays		
	7am - 6pm	6pm - 10pm	10pm - 7am	9am - 6pm	6pm - 10pm	10pm - 9am
	Noise measured at a 'sensitive receptor'					
$L_{Aeq, 1hr}$	Bg* + 10	Bg + 5	Bg + 3	Bg + 5	Bg + 3	Bg + 0
$L_{A1, adj, 10 mins}$	Bg + 15	Bg + 10	Bg + 6	Bg + 10	Bg + 6	Bg + 0
	Noise measured at a 'Commercial place'					
$L_{Aeq, 1hr}$	Bg + 15	Bg + 10	Bg + 6	Bg + 10	Bg + 6	Bg + 0
	Sleep Disturbance Criteria					
The construction noise activities for the Project must not cause the indoor sound pressure level to exceed Lamax 45 dB(A) at a sensitive receptor from 10pm – 7am more than 10-15 times per night						
* Bg is the background sound pressure level, $L_{A90,15 min}$						

(h) all road realignments must be designed as to ensure compliance with the operational traffic noise criteria outlined in the Mains Roads' Road Traffic Noise Management – Code of Practice (COP), as appropriate.

(i) where predictive modelling predicts that vibration criteria for the Project are likely to be exceeded by construction works, the Proponent must implement further consultation, reasonable and practicable mitigation and management measures, and adapt its monitoring procedures to provide further guidance on mitigations. These measures must be developed in consultation with owners and occupants of potentially-affected premises. The vibration criteria are in Table 25 and Table 26 below.

- **Table 25 Vibration Criteria - Levels for Minimal Risk of Cosmetic Damage**

Vibration Type	Peak Particle Velocity (mm/s)		
	Heritage Listed	Residential	Commercial and Industrial
Transient Vibration	2	10	25

Note: Measured in the ground directly adjacent the building of concern

- **Table 26 Vibration Criteria (All Directions) - Levels for Human Comfort Within Buildings**

Location	Criteria
Critical Working Areas (i.e. premises utilising vibration sensitive equipment)	0.8 mm/s
Residential Dwellings	1.6 mm/s
Commercial Premises	3.2 mm/s

Note: Measured in the ground directly adjacent the building of concern

(j) where the predictive modelling predicts that blasting criteria for the Project are likely to be exceeded by construction works, the Proponent must implement further consultation, reasonable and practicable mitigation and management measures, and adapt its monitoring procedures to provide further guidance on mitigations. These measures must be developed in consultation with owners and occupants of potentially-affected premises . Where these measures agreed with owners and occupants permit levels that exceed the blasting criteria, the chief executive administering the *Environmental Protection Act 1994* must be provided with written evidence of such agreement. The blasting criteria, measured at a sensitive receptor, are:

(i) the airblast overpressure must not exceed 120 dB (linear) peak for any blast

(ii) the airblast overpressure must not be more than 115 dB Z peak for 4 out of any 5 consecutive blasts initiated regardless of the interval between blasts

(iii) or vibrations of more than 35Hz—more than 25mm a second ground vibration, peak particle velocity or

(iv) for vibrations of no more than 35Hz—more than 10mm a second ground vibration, peak particle velocity

(k) undertake monitoring of noise and vibration in accordance with AS1055 and AS2670. In circumstances where the criteria are not met, the reporting must describe the corrective actions taken to mitigate and manage the impacts. Monitoring results and management actions must be included in the reporting required in Condition 12(f).

20. **Traffic Management**

The proponent must:

(a) construct the Project consistent with the requirements of DTMR in relation to activities on State controlled roads, and the requirements of GRC and the SCRC in relation to activities on local government controlled roads

(b) prepare the traffic and transport elements of the Project EMP in consultation with the relevant road authority, and implement measures that avoid, where practicable, or minimise and mitigate, construction and traffic impacts associated with the Project

(c) undertake and/or implement project design, work methods and other mitigation measures to address the construction impacts of the Project (including materials haulage, the removal and movement of redundant pavement from the realigned and closed state and local roads) on traffic flows, public safety generally, school buses and school pick-up and set-down arrangements, particularly around the Federal School, pedestrian movements, livestock, cycling activities, property access, parking and public transport. Redundant pavement must be removed and the underlying areas rehabilitated (e.g. revegetated)

(d) undertake and/or implement the construction, traffic and related safety management measures for traffic and safety from section 30.4 of the SREIS and the proponent's commitments in section 30.7 of the SREIS

(e) undertake and/or implement design, construction methods and associated mitigation measures, developed at the proponent's cost, in consultation with the relevant authorities including GRC, SCRC and DTMR. The Project EMP must include or be accompanied by reports explaining how the relevant components of the DTMR documents entitled Guidelines of Assessment of Road Impacts from Development, Road Planning and Design Manual and Environmental Management Policy and Strategy 2002-2007 have been addressed. Other particular requirements include:

(i) in relation to the intersection of the Traveston Road and the dam access road, and the entry into the Meadvale Quarry off Woondum Road, a shielded right-turn lane of sufficient length to allow safe separation of trucks and vehicles from the through traffic lane, widened lanes and shoulders, specific turning lanes and tapers, signage, full width resealing and new line marking or other design arrangements that achieve safe separation for trucks and passing vehicles

(ii) provision of one or more stopping areas (e.g. for buses, police) on the Gympie – Brooloo Road and Kenilworth – Skyring Road

(iii) the resolution of land tenure arrangements including the re-establishment of suitable and acceptable access arrangements for private properties, both of a temporary nature during construction works and design and construction of permanent access arrangements

(iv) consideration of drainage and runoff designs during planning and construction phase of the roads

(v) the design and construction of the dam access road to a standard commensurate with its intended use (construction access, operational access and potentially public recreational access) and any applicable GRC standards and the specifications provided in section 31 of the EIS

(vi) the design of the new roads or realigned road upstream of the inundation area to adopt the existing flood immunity (frequency and extended time of inundation) and consider the issue of outage times (length of time a road is closed during inundation) when designing surface levels of roads so that longer outage times are avoided where possible

(vii) sufficient modifications to roads servicing the Kandanga Cemetery to maintain or enhance existing access standards, particularly from a flood immunity perspective.

(f) Undertake and/or implement the following measures in terms of Project material haulage:

(i) confining haulage to the nominated haulage routes, as shown in Figure-13-4 of the EIS, (i.e. heavy materials transport may only occur on arterial roads which are designated B-double routes, the dam access road, Traveston Road, Woondum Road, Tuchekoi Road, Brooloo – Gympie Road and Moy Pocket Road) or is otherwise agreed by the chief executive administering the *Transport Infrastructure Act 1994* or the relevant local authority

(ii) if the Meadvale Quarry is used as a source of quarry material, Woondum Road and the intersection of Woondum Road with the Bruce Highway must be upgraded as agreed with the Chief Executive administering the *Transport Infrastructure Act 1994*

(iii) if an alternative quarry source is used, the proponent must undertake a road safety, bridge and pavement impact study on the haulage road route, liaising with the relevant state agency and/or council to determine if the route is suitable, safe and if upgrades are required to pavements, intersections and signage before haulage can commence

(iv) not permitting haulage to commence/proceed until the necessary appropriate road and bridge design and construction works are completed or any alternative traffic management arrangements are in place to enable safe haulage on a pavement that can be demonstrated as being likely to withstand the increased load factors

(v) subjecting haulage to DTMR specified restrictions in terms of dimension and excess mass loads, unless there is prior nomination of any exceptional circumstances where such transportation would be required, the specific approval is obtained from DTMR, and/or GRC and/or SCRC depending on roads to be used, and measures to be taken to minimise impacts are specified

(vi) identifying and mitigating haulage movement impacts to the construction sites on the road network, at the proponent's cost, particularly on the pavement of the at risk Moy Pocket Road, Kenilworth – Brooloo Road, the Gympie – Brooloo Road between Kandanga and Tuchekoi Road and the haulage route along Woondum Road/Bruce Highway/Traveston Road

(vii) finalising methods for pre-construction inspection and monitoring of truck impacts on the road network in consultation with DTMR and GRC and SCRC

(viii) subject to condition 20(h), collection, haulage and unloading of materials to and from Project construction sites must only occur between 6.00 am to 6.00 pm Mondays to Fridays and 6.00 am to 4.00 pm Saturdays, unless the Project EMP approved by the Coordinator-General in accordance with condition 12(a) allows for defined events outside of these hours (for example in relation to oversize vehicles)

(ix) implementing measures to maintain safe and functional access to community facilities, and to ensure pedestrian, cyclist and livestock safety and movements on routes adjacent to construction traffic routes and worksites

(x) implementing methods of haulage vehicle management to:

A. avoid disruption to local traffic movements, particularly during school drop-off and pick-up times

B. avoid haulage vehicles queuing beyond the limit of the right turn lanes on the Woondum Road and Moy Pocket Road to turn into the respective quarry or turning into the dam access road travelling east on Traveston Road

C. minimise and mitigate the adverse environmental and community impacts of haulage vehicle operations

D. encourage ongoing awareness of haulage contractors regarding haulage route usage as a residential traffic and school bus route

E. address safety, including accident & incident reporting routine and preventative vehicle maintenance.

(g) Implement the following measures in relation to construction traffic along the public road network:

(i) project related truck movements must not exceed 25 truck movements (in one direction) per hour at any time during Project construction

(ii) regular site deliveries are to be coordinated to occur at the same time each day

(iii) additional signage, traffic control lights and cautionary 'road safety' marking is to be used during the construction phase particularly at road and driveway accesses where risks are increased

(iv) development and implementation of and ongoing construction driver education program including safe practices and an awareness regarding usage of local roads by residential traffic, school buses and tourist/recreational traffic

(h) identify and implement specific mitigation measures to suitably address school road safety risks. These measures must be implemented prior to the commencement of Principal Construction Works and in consultation with DTMR, DETA, and the relevant regional councils. The measures must include, as a minimum, an appropriate reduction in Project related truck movements through signed school zones during school drop-off and pick-up periods (e.g. 8.00am to 9.00am and 2.30pm to 3.30pm) on school days

(i) ensure the Project EMP addresses the consultation and community engagement procedures as required by condition 13 as well as the following matters:

(i) initial community engagement and consultation with residents, regional councils, Queensland Police Service, schools and community groups, local business, primary producers and industry groups regarding transport and traffic is to be completed prior to the commencement of haulage of materials for the Project

(ii) in conjunction with the SCRC and the GRC, consult with the directly affected landholders, local businesses, relevant industry groups, community groups and primary producers for their input into the future road network design specifically addressing connectivity for the district road network

(iii) provide the landholder with an explanation of the proposed arrangements for property access reinstatement designs for the district and local road works as design details are developed for relocation, raising and closure of roads

(iv) keep the broader community, the Queensland Police Service and the Department of Community Safety informed of temporary and permanent lane and road closures and other road works for the Project

(v) keep the broader community informed of increased construction trucks and light vehicles on the district road network during the construction phase of the dam access road, local roads, and the dam and associated infrastructure.

21. **Flora and Fauna**

The proponent must:

(a) construct and operate the Project in accordance the performance criteria and mitigation measures in sections 30.4.7, 30.4.8, 30.4.9, 30.4.10 and 30.4.11 of the SREIS.

(b) incorporate within the areas of protected and restored vegetation required in condition 4 and/or areas relating to the Vegetation Offset Proposal the requirements for vegetation under Policy 11 of the *Nature Conservation (Koala) Conservation Plan and Management Program 2006-2016* and maximise, as far as practicable, the use of species preferred by Koalas, for example Eucalyptus tereticornis.

(c) incorporate within the areas of protected and restored vegetation required in condition 4 and/or areas relating to the Vegetation Offset Proposal suitable habitat for Giant Barred Frog, tusked frog, painted snipe, lewin's rail, black-necked stork, Australian cotton pygmy-goose, red goshawk, plumed frogmouth, square tailed kite, grey goshawk, glossy black cockatoo, black chinned honeyeater, red browed treecreeper, sooty owl and white-rumped swiftlet and document how this requirement has been established and maintained through the reports required in condition 12(f) and condition 12(j). The proponent must achieve an overall net gain in habitat for each species of at least a 1:1.5 loss to offset ratio.[49]

(d) incorporate within the areas of protected and restored vegetation required in condition 4 and/or areas relating to the Vegetation Offset Proposal Richmond Birdwing vine at an appropriate density to provide potential habitat for Richmond Birdwing within the protected and/or restored vegetation in the vicinity of Belli Creek and document how this requirement has been established and maintained through the reports required in condition 12(f) and condition 12(j).

(e) monitor, record and report the Project-related net loss and net gain of native vegetation flora species, habitat for listed threatened fauna species under the *Environment Protection and Biodiversity Conservation Act 1999* or protected wildlife under the *Nature Conservation Act 1992*, and demonstrate, taking account of the positive and negative impacts of the project's construction and operation and the implementation of the offset actions, including those required by Conditions 4 and 5, that the likelihood of a long-term net gain being achieved is being maintained

(f) develop, document and implement plans to enable suitable translocation and /or propagation activities in relation to any EVR terrestrial flora species affected by the Project to ensure no net loss of the relevant species (e.g. Slender milkvine). This requirement applies to all EVR species in the affected area including those that may be found after the publication of this Coordinator-General's Evaluation Report. The propagation or translocation plans must:

  (i) be developed in consultation with the chief executive administering the Nature Conservation Act 1992, recognising that this agency has the discretion to direct that proposed translocation not occur where alternative measures are possible

  (ii) identify EVR flora species which will, or are likely, to require translocation and/or propagation

  (iii) include record keeping and report procedures in relation to the locations and condition (including survival rates) of all translocation and propagation sites

  (iv) identify multiple sites that are appropriate for each of the listed EVR flora species identified for translocation (selected sites should provide protection against threats of disease, pests, grazing, vandalism or other disturbance)

  (v) involve translocation procedures appropriate for each EVR listed species based on consultation with the chief executive administering the *Nature Conservation Act 1992*

  (vi) include management regimes that are most likely to provide protection and sustenance to translocated plants until they reach full maturity

(g) develop, document and implement a plan to offset the number of Giant Ironwood, Narrow-leaved ironbark, Forest red gum, Grey ironbark, Pink bloodwood, Weeping bottlebrush, River Sheoak, native figs (Ficus spp.) trees

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[49] For example, based on this requirement, there must be at least 174.89 ha of suitable protected riparian habitat for the Giant Barred Frog adjacent to existing areas that are recorded to contain the species or areas that contain the species but are not currently protected, and similarly for the other species in this condition.

greater than 2 metres tall that will be affected by inundation or clearing within the Project Area. This plan must include:

(i) estimates of the quantity of the relevant trees to be cleared by the Project. Estimates may be based on surveyed reference locations and extrapolations to relevant sub-areas throughout the area to be cleared or may be based on a pre-clearing audit or another alternative method to be agreed with the Coordinator-General

(ii) the offset of the estimated trees to be lost within the Vegetation Offset Proposal and/or within the areas required by condition 4.

(h) Develop, document and implement a plan to establish artificial and/or relocate nesting/hollow shelters to approximately offset the shelters that hollow dependent fauna species will lose through vegetation clearing. This plan must include:

(i) estimates of the quantity estimates of shelters to be lost. Estimates may be based on surveyed reference locations and extrapolations to relevant sub-areas throughout the area to be cleared or may be based on a pre-clearing audit

(ii) where practicable, the relocation of nests (particularly raptor nests) during non breeding seasons, that would otherwise be lost due to the Project

(iii) the establishment of a range of artificial hollows (boxes or similar), to cater to the variety of habitat needs for the native fauna that require hollows. The range in designs and sizes should include appropriate hollows suitable for EVR fauna such as glossy black cockatoos, powerful owl and little pied bat

(iv) installation of logs and piles within locations likely to provide suitable micro-habitat for small reptiles and mammals, including the EVR fauna of Elf Skink, Challenger Skink, Common Death Adder and Three-toed Snake-tooth Skink

(i) Develop, document and implement procedures to minimise the risk of impacts on terrestrial native flora or fauna species. These procedures must include:

(i) the provision of environmental awareness training, including the identification of relevant species, to all workers involved in Project construction activities, generally as part of site induction and with more comprehensive training provided to Project workers identified as likely to encounter relevant species

(ii) a stop work and notification procedure relating to the discovery of EVR species. These procedures must as a minimum involve the relevant plants or animals and the habitat surrounding them, not being subjected to clearing unless in accordance with a work plan approved by the chief executive administering the *Nature Conservation Act 1992*

(iii) with regards to the Grey-headed flying colony identified in Schedule G, no construction activity or stockpiling occurring within 1 km of during the breeding season (September - November) and otherwise 50 metres at all other times

(iv) continuous monitoring of Grey-headed Flying Fox colony mentioned in (iii) during the Gympie-Brooloo Road works to determine if works are having a negative impact on the colony, and if required, additional mitigations at the worksite must be developed, documented and implemented

(v) the conduct of checks, prior to and during clearing activities, by a DERM-QPWS accredited spotter/handler to locate and search vegetation (particularly within hollow bearing trees)

(vi) in the event that native terrestrial fauna is found as part of the checks mentioned in (v) above, the tree/ burrow is to be left to allow the fauna time to move on their own accord (generally overnight). Direct movement of the animal by the handler is to be avoided unless the handler believes it is in the animal's interest as the animal is unlikely to relocate out of the clearing area on its own or the animal is to be moved to a suitable location

(vii) In the event that native terrestrial fauna is found as part of the checks mentioned in (v) above, breeding fauna are to be left undisturbed (with an appropriate vegetation buffer) until the young have left the burrow / nest / hollow, where practical

(viii) the creation of written field notes regarding the times and locations of any identified EVR species to enable incorporation of the events in DERM's Wildnet database or similar

(ix) processes to manage any injuries to wildlife during clearing or construction activities, including reporting of these injuries to DERM

(j) prior to the commencement of the Principal Construction works develop, document and implement procedures to treat Project-related risks to native frog, fish and turtle species. These procedures must be developed and implemented in consultation with the chief executive administering the *Fisheries Act 1994* and the chief executive administering the *Nature Conservation Act 1992*.

These procedures must include:

(i) the widespread introduction of snags in waterways, adjacent to at least 50 km of banks containing Protected Riparian Habitat within the Approved Inundation Area Buffer, consistent with the standards and processes described within the Design Guidelines for Reintroduction of Wood to Australian Streams (Brooks, 2006).

(ii) the production of a design and associated explanatory report detailing how the system of snags (from (i) above) is to be spread throughout the waterways within the Approved Inundation Area Buffer and located at different levels within the inundation area to meet habitat needs (e.g. shelter, substratum for the growth of freshwater sponges, and above water basking habitat)

(iii) the planting of endemic fruiting tree species adjacent to the inundation area to provide fruit for aquatic species (particularly turtles).

(iv) the identification, creation, protection and maintenance of areas of uncompacted sand in shallow areas of the inundation area to encourage the growth of freshwater mussels

(v) procedures to address risks related to spread of Chytridiomycosis fungus (particularly in relation to Giant Barred Frog habitats)

(vi) control measures for Phytophthora cinnamomi which adhere to the "Management of phytophthora cinnamomi for Biodiversity Conservation in Australia Part 2 - National Best Practice Guidelines"

(vii) the provision of environmental awareness training generally as part of site induction and with more comprehensive training provided to Project workers identified as likely to encounter relevant species, including in relation to the identification and rescue of injured turtle, frog and large-bodied fish species and the avoidance of practices that may cause injury or death to these species

(viii) the preparation of specific Project design elements, and associated documented explanatory notes, that minimise the risk of injury or death to wildlife, particularly Lungfish, Mary River Cod, and Mary River Turtle, associated with interactions with inlet and outlet structures, fishway, turtle bypass, and spillway structures

(ix) establish, implement and maintain monitoring and data-logging procedures for fish, turtle and frog species for 20 years or such longer period determined by the Coordinator-General that will:

A. enable the documentation of baseline population statistics prior to the Completion of Construction

B. enable the ongoing measurement of post construction population changes in the Inundation Area Buffer and associated waterways and

C. measures species movements past the Project dam wall

D. include data collection that will enable third party review of trend statistics relating to population, age distribution, nesting/breeding in key locations, and the take-up of restored and protected habitat at selected representative sites

E. collect data in a form and using methodologies compatible with existing data for these species

F. store and archive this data

G. allow this data to be available for legitimate research and management planning

(x) monitoring-based-thresholds that will trigger a requirement for specific mitigation measures to address adverse population changes

(k) develop, document and implement procedures to control terrestrial and aquatic weeds and pests. These procedures must include:

(i) controls during construction and operation to prevent the spread of weeds, particularly through the movement of equipment, vehicles and landscaping materials including temporary washdown facilities for construction and permanent washdown facilities for operation (inclusive of any recreational uses)

(ii) specific preventative, early detection and eradication measures to mitigate potential adverse impacts of weeds and pests on EVR species

(iii) the identification of priority surveillance areas for aquatic weeds having regard to the current location of weed species, prevailing wind conditions, the topography, geomorphology and depth of the inundation area (particularly where less than 2m)

(iv) regular monitoring of the priority surveillance areas in (iii) to detect the presence of aquatic and terrestrial weeds and pests with monthly monitoring from September - March, inclusive, or more frequently as required by climatic conditions. Monitoring results (including maps showing location) must be provided to the chief executives administering the *Nature Conservation Act 1992*, the F*isheries Act 1994* and the *Land Protection (Pest and Stock Route Management) Act 2002* (as relevant).

(v) coordinate weed and pest control activities with the GRC or SCRC (as relevant), the chief executives administering the *Nature Conservation Act 1992*, the *Fisheries Act 1994* and the L*and Protection (Pest and Stock Route Management) Act 2002* (as relevant) and adjacent land owners

(vi) Mosquito control activities in accordance with the Code of Practice for Mosquito Management.

(l) develop, document and implement procedures to minimise the risk of aquatic fauna pest species, including but not limited to, common carp, gambusia and tilapia occupying the waterways within the Approved Inundation Area Buffer. The procedures must include:

(i) measures (e.g. signs, information on the Project website, distribution of written document) that inform employees and contractors of the Proponent, recreational users of land or waterways within the Approved Inundation Area Buffer of the requirements to restrict aquatic fauna pest species[50]

(ii) the identification and monitoring of high risk locations relating to the potential introduction of aquatic fauna pests into waterways within the Approved Inundation Area Buffer

(iii) the prohibition of the stocking in waterways within the Approved Inundation Area Buffer of any fish species for recreational fishing purposes unless specifically authorised by the agency responsible for the *Fisheries Act 1994* in accordance with a documented risk management strategy relating to threats to EVR species and any EVR recovery plans

(m) Develop, document and implement procedures for managing fire within the Inundation Area Buffer, including an explanation of how the procedures maximise benefits for EVR species

[50] Educational and/or signage materials must be developed in consultation with the Chief Executive administering the *Fisheries Act 1994*

22. **Turtle bypass system**

(a) Prior to the commencement of the Principal Construction Works, the proponent must develop, document, and submit to the Coordinator-General for approval, a design and specification for a Project dam wall bypass system for turtles.

(b) The design and specification for a Project dam wall bypass system for turtles must:

(i) be developed in consultation with the chief executive administering the *Nature Conservation Act 1992*

(ii) be developed in consultation with the chief executive administering the *Fisheries Act 1994*

(iii) be developed in consultation with the chief executive administering the *Water Act 2000*

(iv) be informed by a turtle bypass trial for cloacal breathing turtles

(v) be developed to complement the operation of the fishway for the Project dam wall having regard to the design and specification of the fishway in condition 23(a)

(vi) incorporate performance criteria for the safe movement of turtles around the dam wall in both directions

(vii) be developed to take into account the potential use of the bypass system by other native species

(viii) include a monitoring program to assess performance against the criteria in 22(b)(vi), with the results of the monitoring program informing the specific research outcome targets in Condition 11

(ix) make provision for continuous improvement of mitigation measures in response to research outcomes as per Condition 11 and the results of the monitoring program in 22(b)(vii)

(x) include an explanation as to how non-compliance with any performance criteria within the specification in 22(b)(vi) will be rectified, including triggers for rectification measures, including modification to the turtle bypass system and if required alternative forms of passage, to be implemented as approved by the chief executive administering the *Nature Conservation Act 1992*

(c) The Project dam wall bypass system for turtles must be constructed and ready for operation prior to the Completion of Construction.

(d) Prior to the Completion of Construction, an additional water barrier bypass system for turtles must be constructed over an existing waterway barrier within the Mary River Catchment

23. **Fish movement in the Mary River Catchment**

(a) The design and specification for fishways for the Project must be:

(i) developed in consultation with the chief executive administering the *Fisheries Act 1994*

(ii) developed in consultation with the chief executive administering the *Nature Conservation Act 1992*

(iii) developed in consultation with the chief executive administering the *Water Act 2000*

(iv) informed by a review of relevant studies assessing Lungfish movements

(v) informed by a trial fishway for Mary River Cod and Queensland Lungfish

(vi) developed to complement the operation of the turtle bypass system having regard to the design and specification of the turtle bypass system in condition 22(b)

(b) Prior to the Completion of Construction, an additional fishway must be constructed over an existing barrier that is outside of the Project Area but within the Mary River Catchment.

(c) The proponent must submit to the Coordinator-General for approval prior to the construction of the fishway in 23(b) a report detailing the location, design, construction and operation arrangements for the fishway, together with the written view of the chief executive administering the *Fisheries Act 1994* regarding the location and design.

24. **Estuarine Monitoring Program**

(a) The Proponent must develop an Estuarine Monitoring Program, prior to the Commencement of Extraction of Project Yield, for the approval of the Coordinator-General.

(b) The Estuarine Monitoring Program must be developed in consultation with the chief executives for the *Environmental Protection Act 1994*, the *Coastal Protection and Management Act 1995*, *Nature Conservation Act 1992* and the *Fisheries Act 1994*.

(c) The Proponent must develop, implement, and maintain the Estuarine Monitoring Program to detect if Project-related impacts are affecting the Ramsar wetlands.

(d) The Estuarine Monitoring Program must facilitate monitoring to identify relevant changes in the estuary and assess if they may reasonably be a causal link with the Project. When applicable, the Estuarine Monitoring Program may utilise monitoring data and assessment from existing and historic sources.

(e) The Estuarine Monitoring Program must include:

(i) flow rates

(ii) turbidity / suspended solids loads

(iii) salinity

(iv) nutrient loads

(v) bank erosion and sedimentation patterns

(vi) relative distribution and variety of saltmarsh, mangroves and other macrophytes

(vii) fishery productivity

(f) The Estuarine Monitoring Program must include threshold criteria and document how they relate to the estuarine environmental values, natural processes, and potential threats.

(g) Should the Estuarine Monitoring Program indicate threshold criteria are being exceeded, an analysis must be undertaken to determine whether adverse impacts may be fully, or partially, attributed to the Project.

(h) If the analysis in 24(g) determines that adverse impacts at the estuary are attributable to the Project, then the proponent must implement mitigation actions developed in consultation with the chief executives administering the *Fisheries Act 1994*, *Coastal Protection and Management Act 1995*, *Nature Conservation Act 1992* and *Environmental Protection Act 1994*.

(i) The Estuarine Monitoring Program monitoring activities must commence prior to the commencement of operations. The Estuarine Monitoring Program must be maintained for at least the first 5 years of operation, or such longer period as determined by the Coordinator-General.

(j) The Proponent must submit ongoing reports on the findings of Estuarine Monitoring Program, as part of the report required in Condition 12(j). The reports will assess the monitoring data against the thresholds identified in the Estuarine Monitoring Program.

25. **Aboriginal Cultural Heritage**

(a) No excavation, construction or other activity that may cause harm to Aboriginal cultural heritage may be undertaken unless in accordance with:

(i) the Cultural Heritage Investigation and Management Strategy (CHIMS) that forms part of the registered Indigenous Land Use Agreement (ILUA) or

(ii) for areas not covered by the registered ILUA, an approved Cultural Heritage Management Plan (CHMP) under Part 7 of the *Aboriginal Cultural Heritage Act 2003*.

(b) The Project EMP, must include provision for the proponent to undertake archival recording of cultural heritage significance, subject to the requirements of the ILUA and/or the CHMP.

26. **Non-indigenous Cultural Heritage**

The proponent must complete a detailed field assessment of non-indigenous cultural heritage within the Project area, at least 6 months prior to the commencement of Principal Construction Works. The recommendations and actions from the assessment are to be included in the Cultural Heritage Construction EMP Sub-Plan, with the purpose of:

(a) examining the entire inundation area including areas to be affected by Project-related infrastructure, the dam access road and road realignments, to identify and record any additional places or items of historic heritage in those areas

(b) determining the significance of any places or items identified during field investigations, and ascertain the nature of impact that the proposed development may have on such places or items – in determining significance, consideration is to be given to criteria stipulated in the *Queensland Heritage Act 1992* and

(c) developing management strategies for any places or items of historical significance. The management strategies should be discussed with the National Trust of Queensland, and any local historical society who express an interest in the matter. Further, management strategies should be agreed with the DERM and the Queensland Heritage Council.

27. **Waste**

The proponent must:

(a) Construct the Project in accordance with the performance criteria, mitigation measures and other matters contained in Table 30.4.14 of the SREIS and ensure that construction methods:

(i) adopt and reflect the principles of 'reduce, re-use, recycle, energy recovery from waste, and waste disposal' (i.e. the Waste Management Hierarchy)

(ii) involve the auditable identification of the type, source and estimated quantities of waste

(iii) include procedures and responsibilities for dealing with an incident in which waste material with the potential for causing environmental harm, is released to the environment and

(b) ensure that all inert soil, rock and concrete material from excavation and demolition is to be reused:

(i) In the dam embankments; or

(ii) in areas between islands that are planned to be joined through infilling; or

(iii) as fill in the former river channel below and downstream of the dam wall; or

(iv) in recreation areas where fill is required or where mounding will add to visual appeal.

(c) Ensure that, prior to the commencement of Principal Construction Works (including clearing), a weed assessment is undertaken for that locality and ensure that waste disposal actions do not contribute to the further spread of declared weeds' genetic material. In this regard, the weed assessment and follow-up actions must facilitate and ensure:

(i) reusable or valuable materials extracted from the site remain free of weed material

(ii) disposal options adopted, for contaminated weed material, prevent the spread of the existing weed mix (e.g. onsite mulching, burial, offsite transport, burning etc)

(iii) procedures are implemented to ensure the disposal process does not lead to the escape of viable genetic material (e.g. appropriate training, equipment, hygiene, secure transport etc)

(d) require that burning of vegetative waste may only be implemented as a least preferred option having regard to factors such as cost, potential beneficial reuses and vegetation types. Burning of vegetative waste may only occur in favourable weather conditions. Vegetative Waste Instructions must be issued to construction contractors and workers undertaking activities relating to vegetation within the Project Area to ensure that construction method documentation (e.g. via a construction EMP) includes transparent, auditable and enforceable decision making procedures for disposal of vegetative waste. These Vegetative Waste Instructions must:

(i) be developed in consultation with the DERM and GRC

(ii) address specific types and/or locations of vegetative waste

(iii) be consistent with the Waste Management Hierarchy (see Condition 27(a)). In this regard, offsite burning may only occur for purposes of energy recovery and where energy recovered is greater than energy expended in transporting the waste.

(e) in circumstances where waste material is released to the environment, ensure the release incident is reported immediately to the relevant authorities, including as required in condition 12(f) and such corrective or remedial action as required to render the area safe and to avoid environmental harm must be taken forthwith

(f) ensure that wastewater from any construction activities (e.g. the vehicle wash-down activities) are treated and/or reused on site.

The proponent must:

(g) operate the Project in accordance with the objectives, performance criteria, mitigation measures and other matters set out in Table 6-20 of the SREIS.

(h) Develop, document and implement procedures which:

(i) adopt and reflect the principles of 'reduce, re-use, recycle'; energy recovery from waste, and waste disposal' (i.e. the Waste Management Hierarchy)

(ii) identify the type, source and estimated quantities of waste and

(iii) identify the procedures and responsibilities for dealing with an incident in which waste material with the potential for causing environmental harm, is released to the environment. Incidents are to be reported as required in Condition 12(f)

28. **Contaminated land**

The proponent must:

(a) construct the Project in accordance with the contamination-management-related performance criteria, mitigation measures and other matters contained in Tables 30.3, 30.4.3 and 30.5.9 of the SREIS.

(b) implement the following actions, to investigate, evaluate, and where necessary take actions to remove or remediate within the Project Area:

(i) all identified sites will be inspected to determine whether the identified potentially contaminating activity took place at the site, and if so, a Preliminary Site Investigation (PSI) will be undertaken.

(ii) all high-risk sites will be subject to a more detailed PSI, and if contamination is found or suspected of being present a Detailed Site Investigation (DSI) will also be undertaken. These further investigations will also include the gathering of additional site histories including interviews with landholders, local residents and historians, and the updated mapping of potential contaminated sites.

(iii) all contaminated land investigations and remediation will be undertaken in accordance with the National Environmental Protection Measure (NEPM) and the DERM guidelines including the requirements of the Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland (DEH) 1998). This will include sampling and analysis, detailed soil and groundwater investigations if contamination is found, assessment of human health and environmental impacts on the reservoir in consultation with the relevant authorities, and if necessary the development and implementation of a remediation plan in consultation with DERM prior to the Completion of Construction.

(iv) sites will be assessed as necessary (depending on contaminant concentrations encountered and evaluation of the source-pathway-receptor linkage post inundation) and remediation and management options evaluated and implemented where required, prior to the Completion of Construction.

(v) the processes required by the DERM will be followed to ensure that appropriate remediation strategies are implemented to ensure that for any land parcel with identified and delineated soil contamination, the soil will not have a detrimental impact on the surrounding community and environment, including the water quality for the Project.

(vi) all contaminated land investigations and management measures will be undertaken by suitably qualified and experienced practitioners. All studies and proposed management measures will be reviewed and approved by Third Party Reviewer (TPR) as defined by the DERM.

(vii) investigation of all potential contaminated sites will be undertaken whether or not subject to a Notifiable Activity as defined by the EP Act.

(viii) as a precautionary measure, procedures will also be implemented to monitor sites during the construction phase of the Project, in the event that unidentified or unexpected contamination is encountered

(ix) soil transfer will be managed during construction to avoid cross–contamination of soil, deposition of contamination in uncontaminated areas and importation of contaminated soil into the construction site and/or inundation area

(x) investigate dips and fixed spray reservoirs below the 1 in 100 AEP flood level to determine appropriate remediation actions, which may include the pumping out of reservoirs and appropriate disposal

(xi) investigate any portable spray reservoirs below the 1 in 100 AEP flood level to determine appropriate remediation actions, which may include the removal or reservoirs and appropriate disposal

(xii) investigate all sheds and yards below the 1 in 100 AEP flood level to determine appropriate remediation actions, which may include removal of and disposal of chemicals and containers

(xiii) investigate other potential sources of contamination below the 1 in 100 AEP flood level to determine appropriate remediation actions.

(c) implement the following actions, to be implemented as soon as practicable, to prevent land contamination:

(i) chemicals, fuels, oils and any other substances that, if spilled would cause contamination of the land or water, must be stored appropriately to minimise the risk of environmental impact.

(ii) smaller quantities of chemicals, fuels and oils will be stored in self bunded pallets, within a bunded area in the workshop, or in a bunded container on the site. Bulk quantities of fuel should be stored in double skinned tanks (self bunding).

(iii) waste products (e.g. oil/water separator waste, sludge and residues), should be contained within weatherproofed, sealed and bunded areas to ensure stability of the waste containment receptacles and prevent any leakages or spills causing environmental harm to soils, surface water or groundwater. Regular inspections will be carried out of the tanks, bunds and storage areas to ensure integrity.

(iv) standard procedures for the storage, handling, disposal and spill response for potentially hazardous waste materials will follow the Emergency Management Plan. In the event of a large spill, sites will be investigated, managed and remediate in accordance with the requirements of the contaminated land provisions of the EP Act and the QLD DERM Draft Guidelines. Following remediation of these spills, validation sampling will be conducted to verify that remediation is successful.

29. **Hazard and Risk**

The proponent must:

(a) construct the Project in accordance with the AS 4360:2004 Risk Management methodology and the objectives, performance criteria, mitigation measures and other matters contained within Table 30.4.15 and Table 30.5.11 of the SREIS

(b) implement mitigation measures relating to the potential Project risks associated with dam and road construction and powerline relocation including, among other things, flood during construction, explosive blasting, fire hazard, biological hazard, chemical hazard, electrical faults, high voltage exposure, construction traffic hazards, accessibility for emergency services vehicles, maintenance of essential services (e.g. water, power), the transport, use and storage of dangerous goods and failed communications during incidents

(c) implement specific emergency response actions and a safety management system developed and operated in compliance with AS4801 and AS4804

(d) prepare and implement risk and hazard elements of the Project EMP in consultation, at the dam and road network design stage, with the relevant emergency services organisations (QFRS, QAS and Emergency Management Queensland) incorporating, at least, the development of an Emergency Action Plan, Emergency Response Procedure and Bushfire Management Plans for risk minimisation and incident management during construction of the dam, associated infrastructure and roadworks

(e) develop Material Safety Data Sheets and provide these Sheets to all site personnel involved in the storage, handling, use and disposal of dangerous and hazardous substances and materials. The storage, handling and use of these materials/substances must be in accordance with current Australian Standards, industry codes of practice and best environmental management practices. Appropriate controls for these materials must be implemented avoid risks to employees, adjacent land users, general public and the environment

(f) maintain documented counter disaster and other emergency response plans and procedures which:

(i) are sufficient to enable specific emergency response actions to address foreseeable emergencies and disasters that may occur within the Inundation Area Buffer

(ii) incorporate controls to minimise the probability of a dam failure and measures to mitigate the consequences of a failure were to occur.

(iii) are developed in conjunction with the Queensland Police Service, Emergency Management Queensland, QFRS and QAS

(iv) are based on simulation exercises

(v) involve routine testing of emergency response systems

(vi) designate responsibilities in the event of an incident such as an uncontrolled water release in the event of a power failure

(g) include in the Project EMP:

(i) simulation exercises prior to the commencement of filling

(ii) provision for routine testing of emergency response systems

(iii) designation of responsibilities in the event of an incident such as an uncontrolled water release in the event of a power failure

(h) maintain adequate public liability insurance

(i) establish a seismograph station consistent with the requirements of the ANCOLD Guidelines for large dams inclusive of connection to the State's seismic network.

30. **Workforce Management**

(a) The proponent must construct the Project in accordance with the objectives, performance criteria and mitigation measures contained in Sections 30.4.18 and 30.5.12 of the SREIS.

(b) Prior to the commencement of the Principal Construction Works, the proponent must submit to the Coordinator-General for approval a Workforce Management Proposal that has regard to the estimated proportion of the Project workforce that do not reside within proximity to the Project Area.

(c) The Proposal must:

(i) include analysis and related measures designed to deliver suitable worker and community safety and amenity outcomes

(ii) provide for a construction camp able to accommodate at least 200 workers, including optimisation of potential future use for the local community, for example for affordable housing, recreational and tourism use

(iii) demonstrate that the proposed measures are unlikely to cause significant adverse housing availability or affordability outcomes in the GRC or SCRC local government areas and where necessary the development of any temporary or permanent residences to house Project workers and

(iv) provide for the establishment of infrastructure to support workforce facilities

(v) include documented workforce commuting arrangements (possibly involving buses), including consistency with the Transport and Traffic requirements in Condition 20 of this Schedule C

(vi) include arrangements to advise Queensland Health, the Department of Community Safety, Queensland Police Service, local health care and education providers of increases in workforce numbers that may result in any increased demand for their services

(vii) include details regarding procedures to be implemented to govern the conduct of the project workforce (including contractors), to ensure respect for the local community and manage any impact of the camp and construction workforce on the local communities

(viii) include details on the management of alcohol provision within the construction camp

(d) The approved Workforce Management Proposal must be implemented.

31. **Community and Economic Development Program**

(a) Prior to the Commencement of Principal Construction Works, the proponent must submit to the Coordinator-General for approval a Community and Economic Development Program (CEDP).

(b) The CEDP must be developed in consultation with at least the following entities: GRC, SCRC, the chief executive of DEEDI, Gympie Chamber of Commerce (subject to its agreement to be involved), Sport & Recreation and Tourism Queensland.

(c) The CEDP must be funded by the Proponent to a total of at least $20 million as provided for in conditions 31(d) and 31(e).

(d) The CEDP must include descriptions and design specifications, timing details, cost estimates and implementation plans for:

(i) the extension of DEEDI's existing Food & Fibre Strategy (targeted at the Mary Valley as a whole) for an additional 4 years commencing 2009/10 at a cost of $2.75 million

(ii) the development of individual Property Management Systems (targeting up to 200 properties) in the Mary River Valley as a whole for a four year period at a cost of at least $2 million

(iii) funding of at least $4 million for beneficial capital investments (e.g. fencing, off-stream watering points, planting etc) identified as part of the development of Property Management Systems in (ii) to optimise catchment water quality and riparian vegetation outcomes

(iv) funding of $3.45 million for the provision of an Innovation and Incentive fund to accelerate the establishment of new agribusinesses in the Mary Valley, subject to assessment of all potential constraints (e.g. availability of water)

(e) The CEDP must also incorporate the development and implementation of a Recreation and Tourism Program (RTP) funded by the proponent to a minimum of $7.8 million.

(f) The RTP must be consistent with the conditions in this Schedule C, in particular conditions 4 to 7 and be incorporated within the Land Use Master Plan required in condition 2.

(g) The RTP must include descriptions and design specifications, timing details, cost estimates and implementation plans for:

(i) the provision and promotion of Project recreational facilities, for example multi-use trails, picnic areas

(ii) the promotion of visitor attraction events

(iii) the provision of infrastructure to support tourism or visitor attraction

(iv) support for tourist attraction activities by local operators

(v) information interpretive centre relating to local, environmental, cultural heritage, historical or other features

(vi) other recreational and tourism promotion initiatives designed to stimulate the local economy developed during the consultative process in 31(b).

(h) As part of the reporting required in condition 12(f) and 12(j), for the life of the CEDP the proponent must report on the implementation and an audit of expenditure under the CEDP. On completion of all actions in the CEDP, the proponent must provide a final report to the Coordinator-General that demonstrates how the CEDP has been implemented, the outcomes achieved and an audit of expenditure under the CEDP.

(i) The proponent must ensure compliance with the following policies for construction:

(i) Local Industry Policy: A fair go for local industry dated January 2008

(ii) the State Government's Building and Construction Contracts - Structured Training Policy.

32. **Kandanga Urban Development Master Plan and Kandanga Cemetery**

(a) The proponent must implement an independently facilitated consultation process with the people of Kandanga and the GRC to establish an Urban Development Masterplan for Kandanga's redevelopment within 12 months of the date of this Coordinator-General's Evaluation Report (or an alternative date agreed in writing by the Coordinator-General). The proponent must also consult with the Department of Infrastructure and Planning (Local Government and Planning) during the preparation of the Masterplan.

(b) The independent facilitator must be appropriately qualified and approved by the Coordinator-General.

(c) The consultation process in 32(a) must consider the following measures for inclusion in the Kandanga Urban Development Masterplan:

(i) a replacement swimming pool

(ii) development of sports fields

(iii) public hall facilities

(iv) relocation and/or upgrade of the Kandanga rural fire brigade headquarters and training facilities

(v) other measures selected from options identified through the independently facilitated consultation process

(d) The Kandanga Urban Development Masterplan must include descriptions and design specifications, timing details, cost estimates and implementation plans for the measures.

(e) Subject to the consultation requirements of Condition 32(a), some measures may be delivered prior to finalisation of the Kandanga Urban Development Masterplan.

(f) The proponent must contribute at least $3.5 million to the cost of implementation of the Kandanga Urban Development Masterplan.

(g) The Kandanga Urban Development Masterplan must be implemented prior to the Completion of Construction, or an alternative date as agreed in writing by the Coordinator-General.

(h) The proponent must identify measures to mitigate potential flood impacts at Kandanga Cemetery as a result of the Project.

(i) The measure for mitigating potential flood impacts at Kandanga Cemetery must be:

(i) developed through a consultation process facilitated by an appropriately qualified and independent facilitator approved by the Coordinator-General

(ii) developed in consultation with members of the Kandanga community and those with a direct connection to the cemetery identified by the independent facilitator

(iii) directed at achieving consensus of the preferred approaches to mitigating potential flood impacts

(j) In the absence of a consensus decision in condition 32(i)(iii), based on the advice of the independent facilitator, the Coordinator-General may require the proponent to implement the grass verge as a mitigation measure as described in at page 15-105 of the EIS

(k) The preferred approach to mitigating potential flood impacts in accordance with 32(h) to 32(j) must be implemented prior to the Completion of Construction.

(l) The proponent must contribute at least $2.5 million towards the relocation of the Kandanga Bowls Club.

(m) The proponent must contribute at least $4 million for the upgrade of sewerage and water supply for Kandanga and ensure the upgrade of those facilities prior to the Completion of Construction.

Schedule D: Fishway Design Documentation

FISHWAY DESIGN PROCESS AND CRITERIA

DESIGN PROCESS

Background

Under the *Fisheries Act 1994* all dam and weir proposals will require approval to undertake waterway barrier works as part of the development permit, and approval will only be given if fish passage is satisfactorily addressed. In most cases for dams and weirs the incorporation of fishways is the likely method for providing for fish passage.

The process set out below details the steps QPIF consider necessary for a successful design process. This summarises the process used for the design of major fishways in Queensland. It is QPIF'S experience that the best fishways come out of a highly consultative process. Maximum use should be made of existing expertise among external (overseas and Australian) fishway designers and biologists as this only adds to the quality of the outcome. The requirements of other aquatic fauna such as turtles and platypus should also be considered during the process, to ensure that there are no adverse effects on these animals and that any facilities are complimentary and not detrimental to non-target fauna.

It is also important that the operations of the dam or weir in terms of water releases, spillway gates, environmental flow provisions, offtake works and fishways are integrated so that no single component compromises the operation of the others.

The timing of the design process will to a degree depend on the availability of critical data however the first meeting must be initiated as soon as possible once the data is available or the project is confirmed.

Design steps

1. Collate as much as possible of the following data:

- fish assemblages at the site, up and downstream of the site and any relevant behavioural data for those species
- fish habitat at the site, up and downstream of the site
- (as above for turtles, platypus etc.)
- existing hydrological data (e.g. flow duration curves, annual exceedance probabilities, flow event curves)
- projected headwater/tailwater levels at a range of flows
- rate of tailwater rise over a range of flows
- modelled storage levels at full entitlements scenario over the simulation period
- periods of no flows
- relevant water management impacting on the site (e.g. environmental flow release requirements, ROP requirements)

- likely dam/weir operation (including gate operation, flow releases, water offtake, inflow outflow mimicry etc.). Also proposed on-site personnel or remote operation
- proposed dam/weir design including spillway design; all outlet and offtake works; dissipater designs; location and design of associated upstream and downstream gauging structures.

As far as possible this data should be provided for review prior to the first design meeting.

2. First meeting (once data is collated)

- Discuss existing data; identify data gaps.
- Initiate steps to fill data gaps where practicable.
- Identify a date by which additional data will be collected, and disseminated (before first site inspection).
- Discuss possible design types.
- Agree on how the preferred design type will be arrived at.
- Agree on date for site inspection.

3. Site inspection

- Inspect site of waterway barrier and any associated works (e.g. gauging structures).
- Inspect catchment below site to identify further impediments to fish passage that may be affected by changes in flow regimes.
- Inspect catchment above site where additional instream works may be required e.g. raising road crossings above full supply level (FSL).
- Determine how access to fishways will be provided for monitoring and maintenance purposes.
- Relate hydrological data to site.
- Agree on date for workshop.

4. Development of design specifications

The development of the design specifications could be done during a discussion meeting and through collating submissions from QPIF and any other players (e.g. DERM).

5. Design workshop

The design workshop allows fishway design issues to be identified and discussed with input from all the relevant players and experts. It is critical that the proceedings and outcomes of the workshop are captured and adequately recorded by someone with sufficient technical understanding. These minutes will constitute an important part of the whole design documentation.

Fish passage issues to be discussed are:

- fishways providing upstream passage across the dam/weir
- fishways providing downstream passage across the dam/weir
- fishways providing passage across temporary structures associated with the construction of the dam/weir (e.g. haul roads, bunds etc.)
- provision of fish passage during stream diversion
- fishway passage provision at other sites within, up or downstream of the dam/weir where passage opportunities are further limited by the presence/operation of the dam/weir.
- interactions between fishways and other dam/weir components (e.g. intake works, environmental release works etc.)
- operation of the dam/weir and fishway design implications
- fish passage over the spillway and spillway and dissipater design that maximises fish survival.

Concept designs agreed upon and disseminated prior to next meeting.

6. Post workshop meetings (regular)

- Discuss concept designs.
- Agree consultative process and contacts for input into the development of the design.
- Discuss post-construction monitoring requirements, including design elements related to monitoring.
- Establish processes for developing post-construction monitoring, budgets for monitoring, monitoring outcomes, contingencies for post-construction adjustments etc.
- Establish processes for developing fishway management plan including operation and maintenance manual, maintenance program, contingency plans for fishway failure, continuous improvement program etc.

7. Modelling (once QPIF agrees to concept designs)

A scale model will need to be constructed and run under various flow scenarios to evaluate entrance and exit conditions and flow patterns at the dam/weir wall. QPIF must be present at this modelling exercise. Outcomes of the modelling exercise are then incorporated into the concept designs and these are disseminated for approval by QPIF.

8. Ongoing input

When any change is made to the fishway designs (including during construction) that could affect their capacity to pass fish, its operation or monitoring, QPIF must be consulted.

Once a close-to-final design is available, this should be disseminated and a meeting date agreed upon.

9. Final design meeting(s)

- Discuss final designs and agree on any further modifications.

- Final plans must be provided to QPIF for inspection prior to commencement of fishway(s) construction.
- Agree on the process for consultation and close communication between the construction contractor and QPIF and regular (fortnightly) site visits by QPIF during the construction of the fishways to avoid unilateral decisions on the fishways by the construction contractors that could affect their capacity to pass fish, their operation or monitoring).
- Agree on the fishways inspection program during and close to completion of construction.
- Outline contents of the fishway management plan.
- Set up ongoing management committee/process for the fishways to deal with issues arising such as:
  - monitoring outcomes
  - associated modifications to the operation or structure of the fishways
  - implementation of continuous improvement obligations
  - operating contingencies
  - long-term outcomes.
- Agree on commissioning process and key players.
- Look at community education programs relating to the completed fishways and biopasses to increase public acceptance of the technologies and to improve public ownership of the structures.

<u>Key players</u>

1. **Biological**

- Input required from QPIF fishway biologists.
- Input required from DERM aquatic fauna biologists.
- Input required from DERM ROP managers.
- There is an expectation that the design engineers would have access to a fishway biologist with some experience in major fishway projects.
- Proponent may be required to fund additional fishway biological or fishway engineering expertise as required, as identified by QPIF, to assist in the assessment of and input into the design.
- Where deemed necessary by QPIF (e.g. for major structures, innovative technology etc.), an independent (possibly overseas) fishway biologist with experience in providing fish passage at similar structures and preferably with comparable biota will peer review the design.

2. **Engineering**

- Engineers should have fishway design experience.

- Construction managers who have already had experience in constructing and commissioning fishways are preferred.

- Where necessary, independent fishway engineer(s) with experience in providing fish passage at similar structures and preferably with comparable biota will peer review the design.

3. **Operational**

- Input is sought from dam/weir operators with experience of similar dams/weirs (and possibly fishways) to uncover any operational issues that may have been missed by the design engineers or fishway biologists.

- The future operator must be involved at every step of the design process from the beginning.

4. **Proponent**

The presence of the proponent at all elements of the design process ensures that decisions can be made on the fishway design made more readily (e.g. in terms of expenditure implications) without constantly having to refer back to the developer for agreement, outside the process.

DESIGN PRINCIPLES FOR FISHWAYS (NON-EXHAUSTIVE)

General

- QPIF advice on fishway design (including capacity and downstream passage) and operation will necessarily be conservative given the current knowledge available, the longevity of water infrastructure and potential changes to the fish communities and fish behaviour over time.

- The quality of the materials and componentry used in the construction of the fishway

- should be commensurate with its intended service life and operation (i.e. to the same standard as the outlet works).

- The fishways must cater for the whole fish community at each site in terms of size classes, swimming abilities and biomass. This includes all life stages of the fish species at each site.

- Fishways must provide both upstream and downstream passage all year round for the whole fish community.

- The fishways must be designed to be operational all year round when there is an inflow into the impoundment or a release from the impoundment.

- The fishways will be required to operate when there are inflows to the dam/weir, above dead storage level. An inflow/outflow operational model will need to be developed for the fishways.

- The fishways must be constructed to operate down to 0.5 m below minimum tailwater (to allow for changes in tailwater levels and modelling errors) and 0.5 m below minimum headwater drawdown levels (dead storage level or minimum offtake level, whichever is lower and up to a one in 50 year flood or drownout (whichever is lower). (*QPIF experience is that tailwaters at sites after weir or dam construction are generally lower than the modelled tailwater and the 0.5 m below tailwater rule addresses this anomaly.*)

- Other seasonal fish migration requirements must be identified and included in the operating requirements for the fishways, irrespective of flows.

- All releases from the impoundments must be directed first through the fishway as a priority over the outlet works (design to take account of this operational requirement if necessary), with the fishway being operated whenever a release is made through it, regardless of whether the release volume is less than the optimal minimum release for fishway operation.

- Spillway flows should be transferred to fishway releases as soon as possible during a flow recession.

- Allocated water volume to the fishway must be at design levels for the fishways as opposed to minimum possible water usage.

- Adjacent outlet works should be screened or otherwise designed and placed to prevent fish passing through or becoming trapped in these works.

- Spillway design, aprons, stilling basins and dissipater design must be demonstrated to minimise fish injury, mortality and entrapment.

- Fishway entrances must be sited where fish can access them over the full operational range of the fishway.

- Outlet works must be positioned so as not to interfere with fish access to the fishway entrance.

- Spillway overtopping flows must initiate and terminate adjacent to the fishway or be directed parallel to the fishway entrance.

- There must be a continuous attraction flow at all times at the fishway entrance when the fishway is operating.

- Appropriate light levels must be maintained at fishway entrances.

UPSTREAM PASSAGE

Entrance

- The fishway entrance must be accessible under all flow conditions within its operating range.

- Fish attracted to the spillway must be able to access the fishway without having to swim back downstream.

- Attraction flow velocities must be sufficient and variable to attract fish but not too high for smaller fish to navigate.

- Water supply for the fishways and attraction flows must be sourced from surface quality water.

- There must be adequate holding chamber dimensions (for lock, lift, trap and transfer type fishways).

- There must be adequate hydraulic conditions for all fish within the fishways.

- Attraction flow diffuser must be vertical and fixed on the back wall of the holding chamber (for lock, lift, trap and transfer type fishways).
- Turbulence and velocities need to be balanced to ensure attraction without precluding smaller fish.
- The entrance slot must be adjustable.

Exit

- Fish exit so as to avoid entrainment in any outlet work screens and avoid being washed back over the spillway during overtopping.
- Cover is provided for fish moving from the exit.
- Fish exit at water level.
- Weeds are controlled at the fishway exits and entrances to ensure that fish swim into water free of weed mats.
- Trash is excluded from the upstream fishway exit and downstream fishway entrance to ensure that fish can access the exits and entrances and that the fishways are not blocked or damaged by trash.

Outlet works

- Outlet works should be adjacent to the fishway.
- The orientation of the outlet works water jet is angled so that it does not mask or isolate the entrance to the fishway or impinge on fish moving up the adjacent riverbank.
- High flow (slug release) should not cause confusing flows at the fishway entrance.

Screens

- Intake screens dimensions must be such that small fish are not drawn through the outlet works and velocities should be low enough that fish are not impinged on the screens.

Tailwater control and crossing structures

- Any tailwater control structures such as a gauging weir (proposed and existing), rock bar or stream crossings are fitted with fish passage facilities or designed to allow fish passage.
- Any existing instream structure downstream of the proposed dam/weir, whose barrier effect to fish passage is increased by changes in flow characteristics due to the proposed dam/weir, must be fitted with fish passage facilities.

DOWNSTREAM PASSAGE

- Downstream passage must be provided whenever the upstream fishway is operating.
- Fish must be delivered into the tailwaters at or below water level over the full range of tailwater levels including with no flow over the spillway.

- Appropriately screened to prevent blockage by debris but allow fish passage.
- Spillway design and associated dissipation structures must be shown to minimise the potential for fish injury and mortality during passage over the spillway in overtopping flows.

PROVISION OF FISH PASSAGE DURING CONSTRUCTION

- Temporary fish passage must be provided during all phases of construction and during the period prior to the filling of the impoundment and operation of the fishway.
- Stream crossings for construction traffic must be provided for by full channel bridges.
- Where culvert type crossings are necessary, the culverts must be of suitable dimensions to pass all flows up to drownout without constriction of the river channel.
- Flow velocities within any culvert crossings must be controlled so as to permit fish passage over the full range of flows.

For design principles relating to other aquatic fauna (e.g. turtles) refer to DERM for advice.

CONSTRUCTION PRINCIPLES

- In the experience of QPIF, construction managers and teams that have worked on fishways previously (e.g. the installation of vertical slots, fishlocks etc.) have been far more successful when building subsequent fishways than those who have never built a fishway. Continuity of experience in fishway construction is preferred.
- Fish passage must be maintained during the construction of the weir or dam. Provision will need to be made for fish passage through any coffer dams and access causeways and also through diversion conduits.
- Impacts to water quality must be minimised during the construction process. Poor water quality can impact both on downstream habitat and also on fish movement, as fish may be unwilling to move into poor quality (e.g. turbid, deoxygenated or different temperature) water.
- QPIF fishway biologists will be required on site during construction at the following times:
    - where a rock ramp fishway is being built, at the commencement of construction of the rock ramp and also close to completion of the rock ramp
    - for other fishways, in the latter half of the fishway construction so that the general form of the fishway can be checked for visible errors
    - at the dry and wet commissioning of any fishway.
- Monitoring access and equipment, such as traps, lifting equipment etc. will need to be installed and tested as part of the construction phase.

It is important to note that structural adjustments are likely to be required to fishways in almost every case. Generally, these adjustments are not all identified until after the fishway and weir has been completed, and commissioned and operated for a sufficient period to allow a full performance monitoring program of the fishway to be undertaken. This may go beyond the handover period between developer and owner and allowance will need to be made to pay for and undertake the required adjustments.

FISHWAY OPERATION PRINCIPLES

The optimal operating regime for the fishways will be an outcome of the results of monitoring as well as a degree of trial and error. It is not expected that the fishway will be optimally operated from day one. However, there are some minimum operating requirements that the designers need to be mindful of:

- The fishways must be operated as per the design levels until monitoring results suggest otherwise and QPIF stipulate changes.
- The fishways should be designed to operate to 0.5 m below minimum tailwater and 0.5 m below minimum headwater drawdown levels (dead storage level or minimum offtake level, whichever is lower) and up to a one in 50 year flood or drownout (whichever is lower).
- The fishways will be required to operate when there are inflows to the dam above dead storage level. An inflow/outflow operational model will need to be developed for the fishways and fishways may need to be operated in the absence of other (allocated) releases from the dam/weir.
- Other seasonal fish migration requirements must be identified and included in the operating requirements for the fishways, irrespective of flows.
- The fishways should be operated when there is any release from the impoundment

PROJECT INFORMATION

Information availability at the commencement of the design process will vary from site to site and depend on how comprehensive and/or close to completion the impact assessment process is. Information about a dam or weir project relevant to the fishway design process includes:

- identity of the operator
- proposed operation of the dam/weir
- regulatory processes relating to the dam/weir operation, releases etc. (e.g. resource operating licences, resource operations planning etc.)
- final dam/weir design
- spillway and dissipation designs
- gate operation
- weed control/exclusion
- downstream release regime and offtake volumes and timing
- diversion works
- outlet works capacities
- downstream barriers and impact of the dam/weir on fish passage at these.

As the design process proceeds, further information requirements may be identified.

Schedule E: Priority research activities (Condition 11)

1. Priority research activities relating to Mary River Turtles (and the proponent's research commitments about “Determine key habitat requirements” and “develop a sound model of population dynamics and recruitment”), must, as a minimum, include:

   (a) mark-recapture studies to provide sound estimates of population size, survivorship and recruitment and provide insights into dispersal and migration.

   (b) Determinations of the sex and maturity of captured turtles via at least 2 complementary methods including measurement, papation, X-ray, and gonad examination using laparoscopy and/or ultrasound

   (c) determining migration and dispersal through either radio telemetry, sonic tracking, automated PIT tag scanning or conventional tagging-recapture surveys.

   (d) identifying and quantifying essential habitat characteristics including the relationship to diet and age class classifications.

   (e) identifying differences between diurnal and nocturnal habitat uses

   (f) identifying specific habitat and diet requirements of turtles by different age classes

   (g) diving physiology/dive profile studies, using temperature and depth data logging devices

   (h) Identifying the relationship of water quality (particularly dissolved oxygen and temperature) with the distribution and abundance of juvenile turtles (ideally through the use of data logging devices)

   (i) Quantifying the nesting distribution and incubation success throughout the catchment

   (j) Quantifying the mortality factors impacting this species throughout the catchment

2. Priority research activities relating to Mary River Cod must, as a minimum, include:

   (a) Undertaking an annual survey program in the Mary River Catchment covering sampling sites located within the footprint of the Project (at least 2 sites), at least 3 sites within the Mary River outside the footprint of the Project and at least 3 sites in tributaries known to currently or previously support remnant cod populations

   (b) Determining growth, movements, population size and mortality rate through mark/recapture studies and by PIT tagging

   (c) Undertaking genetic analysis through collection of appropriate material

   (d) Determining morphological characteristics, including length, weight, head width and body depth

(e) Developing techniques to describe demographic parameters including age (possibly by use of fin spines or scales), sex and maturity status (by non-lethal internal examination), fecundity (possibly by study of hatchery spawning rates or post mortem examination of accidental deaths)

(f) Developing a life history model using historical data and data collected during the annual monitoring program (Data and population models for other freshwater cod species should also be examined)

(g) Identifying and describing breeding locations, including areas within the impoundment

(h) Determining retention rate and health impacts associated with surgical implant of radio telemetry devices. This study should use captive bred stock only (i.e. sourced from catchments outside of the Mary catchment)

(i) Comparing genetic material from stocked fish and known wild populations (e.g. Tinana Creek) to inform recovery actions and subsequent restocking

(j) Developing a strategic conservation stocking plan that includes consideration of brood stock collection on wild cod populations, genetic management protocols and hatchery quality assurance protocols

(k) Developing a best practice manual for hatchery production of Mary River cod

(l) Improving techniques for captive rearing and husbandry of Mary River Cod

(m) Developing field test techniques to batch mark cod fingerlings for the restocking program

(n) Undertaking post-stocking monitoring activities to determine the contribution of stocked fingerlings to the overall population and determine movements and growth of stocked fish.

3. Priority research activities relating to Lungfish must, as a minimum, include:

(a) Establishing methods for determining age

(b) Undertaking annual surveying program in the Mary River Catchment, including at least two sampling locations within the footprint of the inundation area, at least three locations outside of the inundation area and at least two tributary streams inhabited by Lungfish

(c) Developing a Lungfish population model relating to likely responses to a multiple key management interventions and strategies

(d) Developing and testing methods for maximising the potential for spawning in or near impoundments

(e) Determining the impacts of poor water quality and aquatic weed proliferation on spawning, egg development and recruitment

(f) Evaluating genetic consequences of population fragmentation, by collection and analysis of appropriate genetic material

(g) Determining habitat requirements, dispersal patterns and mortality causes for juveniles

(h) Establishing impacts of introduced fish on Lungfish populations

(i) Determining the extent of any recreational and/or traditional harvest of Lungfish, including impacts of bait collection on developing larvae

(j) Estimating injury and mortality rates associated with marine stranding and movements over infrastructure

(k) Establishing the underlying triggers for aquatic weed proliferation in impoundments

(l) Estimating extent and effects of livestock trampling during the spawning season

(m) Estimating the frequency and extent of boat strike and its effects

(n) Determining effects of algal toxins and chemical run off

(o) Investigating the feasibility of captive rearing and batch marking juvenile Lungfish

4. Priority research activities relating to the Giant Barred Frog, must, as a minimum include:

(a) Investigating amphibian chytrid fungus (*Batrachochytrium dendrobatidis*) distribution and prevalence of *chytridiomycosis* throughout the Mary River region.

(b) identifying spatial movement characteristics (including how individuals survive and respond to inundation)

(c) describing the current distribution and concentration throughout Mary River Catchment

(d) developing captive husbandry techniques

(e) identifying macro- and micro-habitat preferences, including breeding, non-breeding and juvenile habitat use

(f) uptake and utilisation of newly created or restored riparian habitat

(g) undertaking genetic analyses of isolated populations (both inside and outside the Project area) to identify genetic mixing at the stream and catchment levels and to determine metapopulation genetics

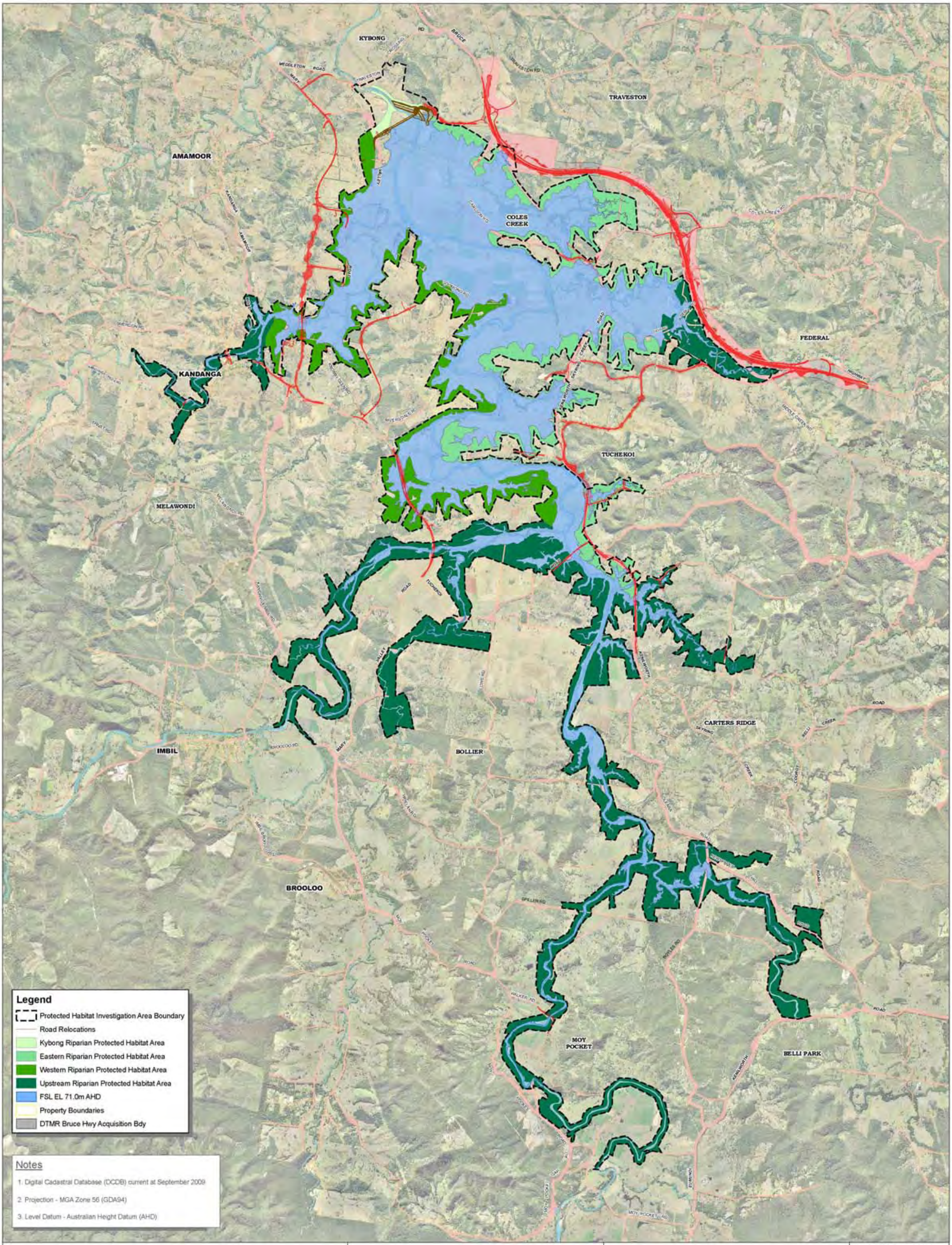
(h) Investigating larval ecology to see how tadpole period and predatory fish density influence the distribution of the Frog.

(i) Evaluating impacts of invasive species removal techniques.

(j) Investigating Impact of pesticides.

(k) Identifying weed control measures for new and existing weed infestations.

Schedule F: Habitat Areas



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Kilometres

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QUEENSLAND WATER INFRASTRUCTURE PTY LTD

MARY RIVER AMTD 207.6KM

TRAVESTON CROSSING DAM

PROTECTED HABITAT AREAS

DRAWING NUMBER

101173

DATE: SEPTEMBER 2009

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Schedule G: Grey headed flying fox colony

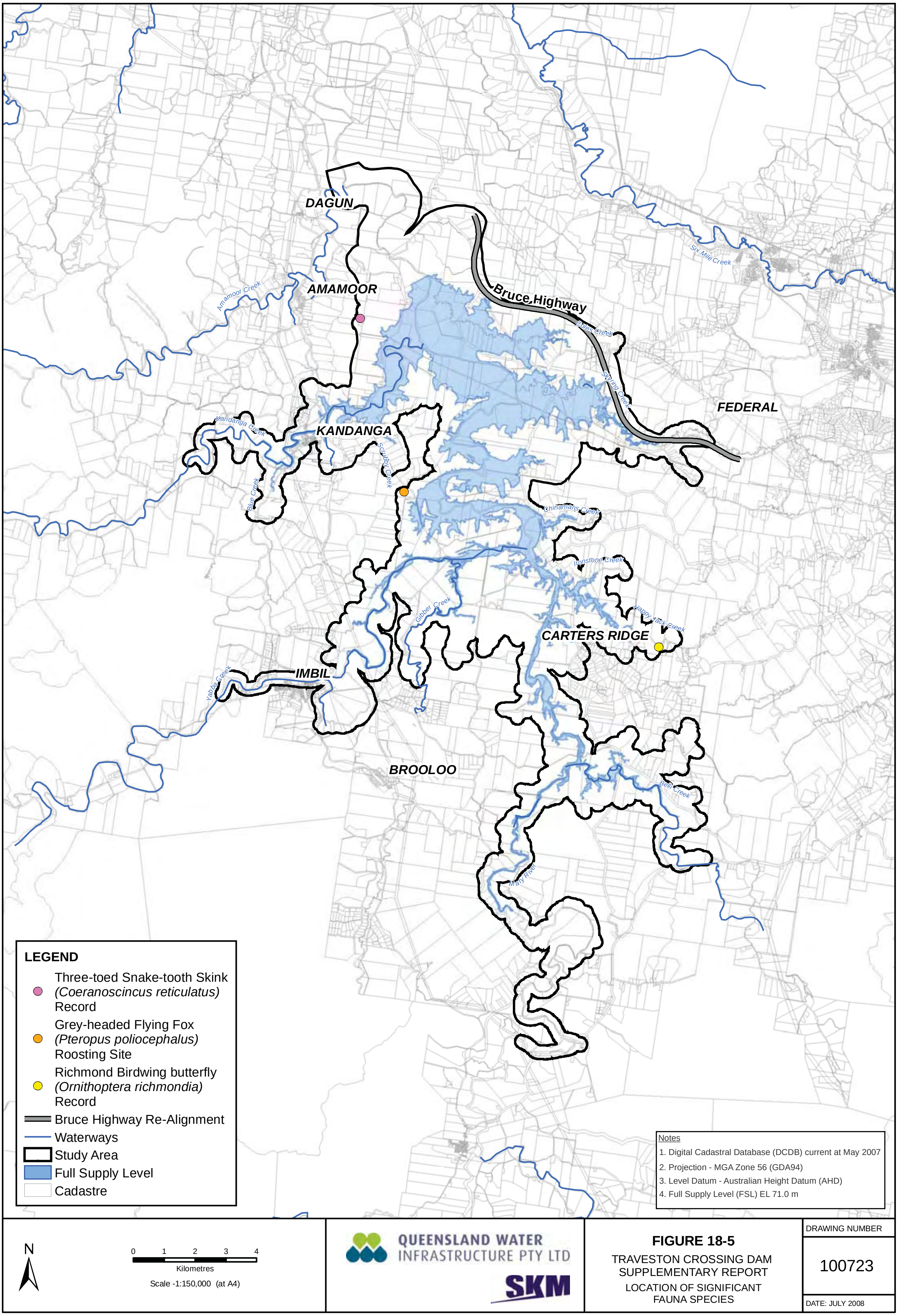

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FIGURE 18-5

TRAVESTON CROSSING DAM SUPPLEMENTARY REPORT

LOCATION OF SIGNIFICANT FAUNA SPECIES

DRAWING NUMBER

100723

DATE: JULY 2008

I:\QENV\Projects\QE06430\Spatial\Arc_MXD\Supplement\Report_Figures\Figure_18-5_Location_of_Significant_Fauna_Species.mxd Produced: 8/4/2008 This figure should be read in conjunction with the data disclaimer at the front of this report.

Schedule H: Definitions for Appendix 1

$	Means 2009 dollars
Approved Inundation Area Buffer	Means the Inundation Area Buffer approved by the Coordinator-General in accordance with Schedule C, Condition 3
Commencement of Extraction of Project Yield	The extraction of any of the Project's water yield of up to 70,000 ML per annum for the purpose of human consumption following treatment
Commonwealth Environment Minister	The Commonwealth Minister administering the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).
Completion of Construction	Means the date which is the earliest of: • the proponent providing notification to the Coordinator-General that construction of the dam wall is complete and operations have commenced • certification by a Registered Professional Engineer of Queensland (RPEQ) that the dam wall has been constructed in compliance with the final design drawings • the commencement of operation of the dam following the removal or closure of temporary diversion works
Dead Storage Volume	The volume of water stored by the dam at the water level below which releases are not able to be made. The preliminary design provides for a Dead Storage Volume of 3,440ML or 56m AHD, equivalent to about 2% capacity
Inundation Area	The area of land that will be inundated by the Project, when reservoir reaches full supply level.
Legally Secured	Means land that is secured by a legally binding mechanism, including: • freehold or leasehold tenure; • a registered easement • dedication as a protected area under the *Nature Conservation Act 1992* • by a covenant under the *Land Act 1994*, *Land Title Act 1994*
Principal Construction Works	Means the works for the Project, including clearing, excavation and building activities but does not include: • pre-construction-work-assessment investigations and surveys (e.g. Geotechnical studies) • excavation and removal of soil to create test pits for foundation design and material selection purposes that do not collectively exceed a total area of 2 hectares, with no single test pit to exceed 1 hectare in area • catchment management works (e.g. erosion control, remediation works) • habitat restoration works (e.g. planting, rehabilitation, placement of snags) • vegetation and habitat offsets • community infrastructure and transport infrastructure (including roads, pathways etc)

	• local utilities and services (e.g. stormwater, water, wastewater, communication, power) • building works for the purpose of the proposed Freshwater Species Research Centre • works associated with trialling, developing and construction of mitigation infrastructure (e.g. turtle bypass systems or fishways)
Project	The design, construction and operation of the Traveston Crossing Dam Stage 1, as described in the EIS and Supplementary Report to the EIS and described in section 1.2 of the Coordinator-General's Evaluation Report.
Project Approval	A license, permit, development approval or other instrument in relation to the Project
Project Area	Means the Project Area as shown in Appendix 2, Figure 2
Sensitive receptor	Includes • a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or • a motel, hotel or hostel; or • a kindergarten, school, university or other educational institution; or • a medical centre or hospital; or • a protected area under the *Nature Conservation Act 1992, the Marine Parks Act 2004* or a World Heritage Area; or • a public thoroughfare, park or gardens.
Use	Includes any use incidental to and necessarily associated with the Project
Vegetation Offset Proposal	The vegetation offset proposal required in Appendix 1, Schedule A: Operational work for clearing of native vegetation

Schedule I: Jurisdiction for conditions

Condition Reference	Description of Condition	Entity with Jurisdiction
Schedule A		
Making a material change of use of premises for an environmentally relevant activity		Chief Executive administering the *Environmental Protection Act 1994*
Operational works for clearing native vegetation		Chief Executive administering the *Vegetation Management Act 1999*
Operational work that is the construction of a referable dam		Chief Executive administering the *Water Supply (Safety and Reliability) Act 2008*
Operational work that is taking or interfering with water from a watercourse, lake or spring under the Water Act		Chief Executive administering the *Water Act 2000*
Operational work that is constructing or raising a waterway barrier works		Chief Executive administering the *Fisheries Act 1994*
Material change of use for land on the EMR or premises used for a notifiable activity		Chief Executive administering the *Environmental Protection Act 1994*
Schedule B		
Riverine protection permit		Chief Executive administering the *Water Act 2000*

Condition Reference	Description of Condition	Entity with Jurisdiction
Interim Resource Operations Licence/ Resource Operations Licence		Chief Executive administering the *Water Act 2000*
Works on a State-controlled road		Chief Executive administering the *Transport Infrastructure Act 1994*
Schedule C		
Condition 1	**Lapsing of Coordinator-General's evaluation report**	Coordinator-General
Condition 2	**Land Use Master Plan**	Coordinator-General
Condition 3	**Inundation Area Buffer**	Coordinator-General
Condition 4	**Protected Habitat within the Project Area**	Coordinator-General
Condition 5	**Protected Riparian Habitat Areas outside of the Project Area**	Coordinator-General
Condition 6	**Visual impacts**	Coordinator-General
Condition 7	**Management measures for the Inundation Area**	Coordinator-General
Condition 8	**Flow Requirements**	Coordinator-General
Condition 9	**Water Quality Program**	Coordinator-General
Condition 10	**Groundwater management plan**	Coordinator-General
Condition 11	**Applied Research relating to the Mary River**	Coordinator-General
Condition 12	**Project EMP**	Coordinator-General

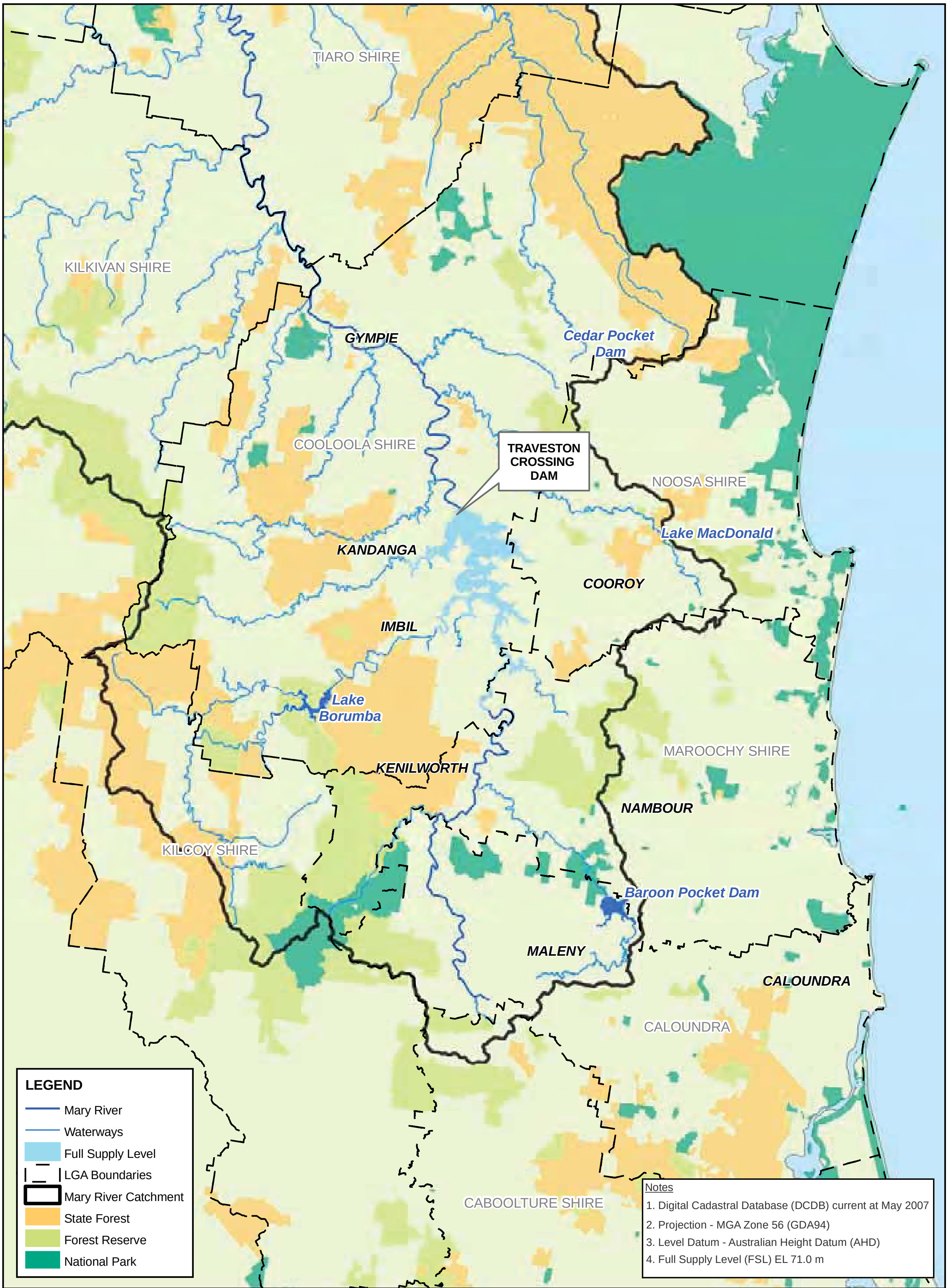
Condition Reference	Description of Condition	Entity with Jurisdiction
Condition 13	**Consultation and community engagement**	Coordinator-General
Condition 14	**Complaints management**	Chief Executive administering the *Environmental Protection Act 1994*
Condition 15	**Design for bank erosion and sediment management**	Coordinator-General
Condition 16	**Construction sediment and erosion control**	Chief Executive administering the *Environmental Protection Act 1994*
Condition 17	**Air Quality**	Chief Executive administering the *Environmental Protection Act 1994*
Condition 18	**Greenhouse offset plan and research**	Coordinator-General
Condition 19	**Noise and Vibration**	Chief Executive administering the *Environmental Protection Act 1994*
Condition 20	**Traffic Management**	Chief Executive administering the *Transport Infrastructure Act 1994*; Relevant Local Government
Condition 21	**Flora and Fauna**	Chief Executive administering the *Nature Conservation Act 1992*
Condition 22	**Turtle bypass system**	Coordinator-General
Condition 23	**Fish movement in the Mary River Catchment**	Coordinator-General
Condition 24	**Estuarine Monitoring Program**	Coordinator-General
Condition 25	**Aboriginal Cultural Heritage**	Chief Executive administering the *Aboriginal Cultural Heritage Act 2003*
Condition 26	**Non-indigenous Cultural Heritage**	Chief Executive administering the *Queensland Heritage Act 1992*
Condition 27	**Waste**	Chief Executive administering the *Environmental Protection Act 1994*
Condition 28	**Contaminated land**	Chief Executive administering the *Environmental Protection Act 1994*

Condition Reference	Description of Condition	Entity with Jurisdiction
Condition 29	**Hazard and Risk**	Coordinator-General
Condition 30	**Workforce Management**	Coordinator-General
Condition 31	**Community and Economic Development Program**	Coordinator-General
Condition 32	**Kandanga Urban Development Master Plan and Kandanga Cemetery**	Coordinator-General

Appendix 2: Project location and Project Area

Figure 1: Location of the Project

Figure 2: Project Area



QUEENSLAND WATER INFRASTRUCTURE PTY LTD

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FIGURE 4-1

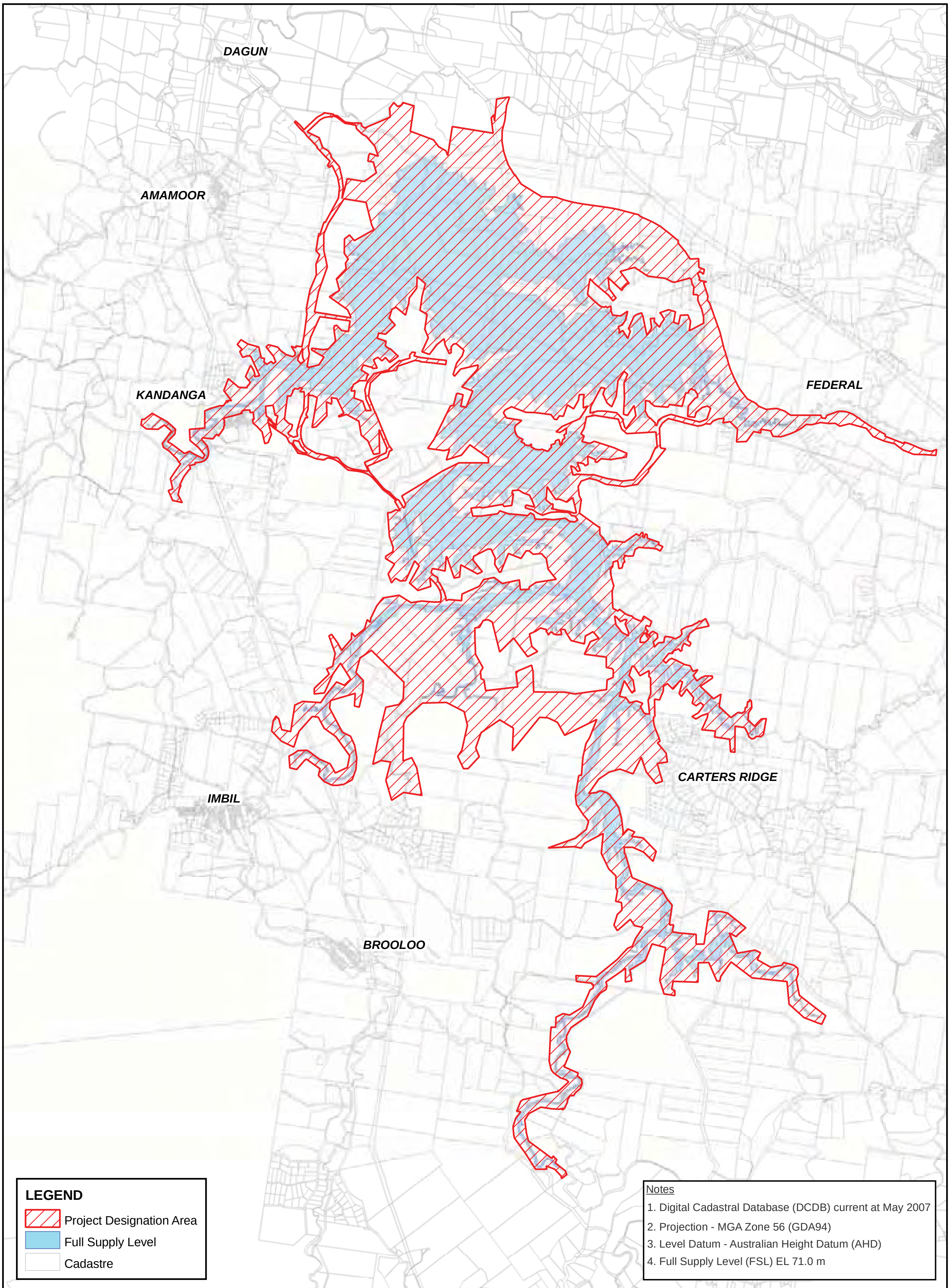
TRAVESTON CROSSING DAM EIS

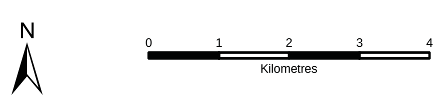
REGIONAL LOCATION

DRAWING NUMBER

100401

DATE: SEPTEMBER 2007





QUEENSLAND WATER INFRASTRUCTURE PTY LTD

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FIGURE 4-2

TRAVESTON CROSSING DAM EIS

PROJECT DESIGNATION BOUNDARY

DRAWING NUMBER

100402

DATE: SEPTEMBER 2007

I:\QENV\Projects\QE06430\Spatial\Arc_MXD\Figures\Final\Final_Print\Figure_4-2_Project_Designation_Boundary.mxd Produced: 18/9/2007. This figure should be read in conjunction with the data disclaimer at the front of this report.

Appendix 3: Correspondence from 3D Environmental

Correspondence from 3D Environmental to the Proponent dated 5 December 2008 regarding remnant vegetation in the Project Area

3D ENVIRONMENTAL

Vegetation Assessment & Mapping Specialists

PO Box 959
Kenmore, Qld
4069

Lauren Barnaby
General Manager - Environment
Queensland Water Infrastructure P/L
Level 8- 119 Charlotte Street
City East Brisbane, Qld. 4000

December 5, 2008

Dear Lauren,

I have presented the data demonstrating the discrepancies between the EPA mapping and 3d Environmental as comprehensively possible in Table 1 and Table 2 on following pages. Table 1 demonstrates discrepancies in VMO requirements across the entire inundation area and Table 2 demonstrates the discrepancies on a site by site basis. It is not possible to provide precise quantifiable information on how these discrepancies will affect VMO planning for the Traveston project. The nature of areas acquired for offset must also be considered as eucalypt dominant RE's (eg. RE12.3.2) will often regenerate much more rapidly than vine forest communities and hence VMO requirements and ratio's may vary considerably. An area of advanced Eucalyptus grandis regrowth for example may progress to remnant status extremely rapidly and be subject to a different offset policy option. The establishment of VMO's for eucalypt communities is likely to be considerably less expensive and labour intensive than for vine forest communities. For this reason, it is necessary to provide ecosystem mapping in the study area as accurately as possible to allow these issues to be strategically planned for. In any case, development of VMO's with a mix of representative ecosystems including vine forest and sclerophyll communities (casuarina and eucalypt) will likely be more readily secured than an extensive area of a monotypic ecosystem.

It should also be considered that whilst this process is being driven by the requirements for VMO's, the nature of the vegetation that will be preserved within the broader Traveston land purchase area must be considered. It is this conserved vegetation that will require intensive management prior to and post dam construction. Hence, the distinction between vegetation within the immediate impact area and the surrounding land purchase area has been noted in the Table 2.
One of the greatest difficulties experienced during this process is that some fairly significant information voids were created when the herbarium revised its own mapping following the 3d field survey. This revision was completed prior to submission of the 3d Environmental map amendment request and resulted in considerable change to the original EPA mapping. The design of our original field survey, being based on the original EPA data (Version 5.0, 2005) did not test the integrity of the EPA mapping as effectively as had been originally planned.

Yours Sincerely,

David Stanton

Director - 3d Environmental

Ph: 0447822119 Email: davidstanton@3denvironmental.com.au

Table 1. Total VMO requirement comparisons between amended EPA and 3d Environmental mapping data.

Regional Ecosystem	Status (VMA, 1999)	Area Stage 1 Inundation Zone – EPA Amended Area 2008	Area (ha) within Stage 1 Inundation Zone – 3D Environmental 2007	Total Offset Required- EPA (ha)	Total Offset Required- 3d Environmental
12.3.1	Endangered	184	59.9	552**	179.7**
12.3.2*	Of Concern	14	42*	42*	126*
12.3.11	Of Concern	15	14.6	45*	44*
12.11.14	Of Concern	7.6	14.7	23*	44ha
12.3.7 (Riparian)	Not of Concern	23	100.5	46***	201***
Total Area of Required Offset (ha)				**708**	**594.7**

* = Policy Option 3.3; ** = Policy Option 2.3; *** = Policy Option 6

Table 2. Comparisons of EPA and 3d Environmental mapping per individual vegetation survey site.

3d Env. Site Number/Numbers	**3d Env Proposed RE**	**EPA RE Version 5.0 (2005)**	**EPA amendment RE**	**Area 3d RE – Dam Impact Area**	**Area EPA RE – Dam Impact Area**	**Offset Requirement 3d Environmental**	**Offset Requirement EPA**	**Comments**
TT31, TQ4, TS8, TS28	12.3.2	12.3.1	12.3.1	6.54 ha (RE12.3.2)	8.1 ha (RE12.3.1)	19.5 ha (RE12.3.2)*	24.3 ha (RE12.3.1)**	Large areas of this RE12.3.2 have been mapped by 3d Env. within the Traveston Dam land purchase area marginal to the dam inundation area.
TT14, TS15	12.3.2	12.3.11	12.3.1	8.05 ha (RE12.3.2) 3.03 ha (RE12.3.1)	11.69 ha (RE12.3.1)	24 ha (RE12.3.2)* 9 ha (RE12.3.1)**	34 ha (RE12.3.1)**	
TT63, TQ98	12.3.2	12.3.11	12.3.1 12.3.11	16 ha (RE12.3.2)	8.3 ha (RE12.3.1)** 2 ha (RE12.3.11)*	48 ha (RE12.3.2)*	25 ha (RE12.3.1)** 6 ha (RE12.3.11)*	
TS11, TQ11b, TQ10a, TQ147	12.3.7	12.3.1	12.3.1	35.2 ha RE12.3.7)*** 2.6 ha (RE12.3.1)**	45 ha (RE12.3.1)***	70.4 ha (RE12.3.7)*** 7.8 ha (RE12.3.1)*	135 ha (RE12.3.1)**	Relatively extensive area on Kandanga Creek Extending to the Mary River. Four sites by 3d Environmental demonstrating RE12.3.7 on this reach have not been considered
TS6a, TQ7a	12.3.7	12.3.1	12.3.1	6.3 ha (RE12.3.7)***	6 ha (RE12.3.1)**	12.6 ha (RE12.3.7)***	18 ha (RE12.3.1)*	

3d Env. Site Number/Numbers	3d Env Proposed RE	EPA RE Version 5.0 (2005)	EPA amendment RE	Area 3d RE – Dam Impact Area	Area EPA RE – Dam Impact Area	Offset Requirement 3d Environmental	Offset Requirement EPA	Comments
TS48	Non-remnant	12.3.1/12.3.2	12.3.1/12.3.2	0 (non-remnant)	1 ha (RE12.3.1)** .7 ha (RE12.3.2)*	0 (non-remnant)	3ha (RE12.3.1)** 2.1ha (RE12.3.2)*	Demonstrated non-remnant status has not been addressed during the EPA amendment process.
TS49	12.3.2	12.3.1/12.3.2	12.3.1/12.3.2	0.00 ha (RE12.3.2)	0.5ha (RE12.3.1) 0.25 ha (RE12.3.2)	0.0	1.5 ha (RE12.3.1) 0.75 ha (RE12.3.2)	Site TS49 is marginal to the inundation area.
TS22 & TS26	12.3.7	12.3.1	12.3.7					Correctly identified and represented by EPA as RE12.3.7 as requested by 3d Environmental

* = Policy Option 3.3.
** = Policy Option 2.3
*** = Policy Option 6

Appendix 4: Acronyms

ACHA	*Aboriginal Cultural Heritage Act 2003*
AEP	Annual exceedence probability
AHD	Australian Height Datum
ANCOLD	Australian National Committee On Large Dams
CFT	Community Futures Taskforce
CHIMS	Cultural Heritage Investigation and Management Strategy
CHMP	Cultural heritage management plan
DEEDI	Department of Employment, Economic Development and Innovation
DERM	Department of Environment and Resource Management
DIP	Department of Infrastructure and Planning
DNRW	Department of Natural Resources and Water (former)
DO	Dissolved Oxygen
DSV	Dead Storage Volume
EC	Electrical Conductivity
EFOs	Environmental Flow Objectives
EIS	Environmental Impact Statement
EP Act	*Environmental Protection Act 1994*
EPA	Environmental Protection Agency (former)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ERAs	Environmentally Relevant Activities as defined in the *Environmental Protection Regulation 2008*
EVR	Species that are listed under either State or Commonwealth legislation as Endangered Vulnerable or Rare species
EVs	Environmental values
FPI	Flow performance indicators
FSL	Full supply level
GQAL	Good quality agricultural land
GRC	Gympie Regional Council
ILUA	Indigenous Land Use Agreement
IP Act	*Integrated Planning Act 1997*
IROL	Interim resource operations licence under the *Water Act 2000*
KRA	Key resource area
LGA	Local government area
LOS	Level of service
Mary Basin WRP	*Water Resource (Mary Basin) Plan 2006*
ML	Megalitres
MNES	Matters of national environmental significance under the EPBC Act
NC Act	*Nature Conservation Act 1992*

NC Reg	*Nature Conservation (Wildlife) Regulation 2006*
NES	National environmental significance
NNTT	National Native Title Tribunal
QWI	Queensland Water Infrastructure Pty Ltd
RCC	Roller compacted concrete
REs	Regional ecosystems under the *Vegetation Management Act 1999*
ROP	Resource operations plan under the *Water Act 2000*
SCRC	Sunshine Coast Regional Council
SDPWO Act	*State Development and Public Works Organisation Act 1971*
SDPWO Regulation	*State Development and Public Works Organisation Regulation 1999*
SEQ	South-East Queensland
SIA	Social impact assessment
SREIS	Supplementary Report to the Environmental Impact Statement
TAP	Technical advisory panel
TSP	Total suspended particles
TSS	Total suspended solids
VM Act	*Vegetation Management Act 1999*
VMO	Vegetation management offset
vpd	Vehicles per day
WASOs	Water allocation security objectives
WQOs	Water quality objectives
WRP	Water Resource Plan
WSI	Water sharing index
WSS	Water Supply Strategy