NSW GOVERNMENT
Department of Planning

MAJOR PROJECT ASSESSMENT
Keepit Dam Upgrade

Director-General's
Environmental Assessment Report
Section 75I of the
Environmental Planning and Assessment Act 1979

March 2009

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EXECUTIVE SUMMARY

State Water Corporation (the Proponent) proposes to upgrade Keepit Dam to ensure it meets modern day dam safety requirements for extreme flood and earthquake events. Dam safety considerations are requirements under *the Dams Safety Act 1978*. The project is subject to Part 3A of the *Environmental Planning and Assessment Act 1979* (the Act), by virtue of the Minister for Planning's Order under Section 75B(1) of the Act, Gazetted 29 July 2005. The Proponent has sought the Minister's approval to submit a Concept Plan, as three upgrade options, Options B1, D2, and D3, were identified which would achieve the project's dam safety objectives, but with varying impacts and capital costs. All options would require the main and subsidiary dam wall raising, new spillways and saddle dams. On 25 January 2006, the Minister for Planning authorised the submission of a concept plan for the proposal.

On 23 September 2008, the Proponent submitted its Preferred Project Report (as part of the Submissions Report) for the proposal, including responses to issues raised in public submissions and selecting one preferred option for implementation, i.e. Option B1. The Proponent stated that the Environmental Assessment outlined that Option B1 was considered to best meet the objectives of the project. Following its review of the submissions received, the additional information and investigations undertaken and consultation with stakeholders, it has reaffirmed its preference for Option B1. The Proponent has therefore argued that the Minister should use the discretion provided by the *Environmental Planning and Assessment Act 1979* to not require any further environmental assessment and to issue full project approval accordingly. The Proponent, in support of its position, notes that the Director-General's requirements were issued based on the Concept Plan, in light of the uncertainty surrounding specific components of the project. However, over the course of preparing the Environmental Assessment, it has been able to resolve these issues and provide sufficient details of the project in the Submissions Report, to allow a detailed assessment of environmental impacts and residual risks to be undertaken.

During the exhibition period of the Environmental Assessment, the Department received a total of sixteen submissions. These comprised of five responses from State Government agencies, three local Councils, four landholders, two community groups and one private organisation. The landholders were concerned that the operation of the preferred Option B1 would result in irreversible damage to their properties and raised the issue of compensation from the Proponent. The community group that would be most affected by changes to the State Park supported the preferred option primarily because it minimised impacts on the facilities and the overall functionality and amenity of the State Park, during both construction and operation. The other community group argued that the Environmental Assessment did not include a detailed account of its reasons for supporting Option D3. The private organisation objected to the preferred option primarily because it includes a design loss of storage should a very large to extreme flood occur. It also suggested that the transfer of floodwaters by the preferred option from one river valley into another during a very large to extreme flood event and the scale of the subsequent erosion and sedimentation would be environmentally unacceptable. Of the three council submissions, one objected to the preferred option and two were either neutral or silent on the Proponent's preferred Option B1. The submissions from the State government focused on the technical studies contained in the Environmental Assessment, and either outlined support for the information or requested further information to be provided on the proposed biodiversity offset package and air, noise and vibration impacts.

The Department has undertaken a comprehensive assessment of the technical merits of the proposed Option B1 upgrade, with invaluable technical input from the Department of Environment and Climate Change, Department of Water and Energy and Gunnedah Shire Council. Based on the Department's assessment, as detailed in this report, the Department recommends that the Minister grant project approval to Option B1 for the dam upgrade, as sufficient detail has been provided following the public exhibition of the Environmental Assessment.

Through its assessment, the Department has determined that the key assessment issues for the proposal relate to construction impacts (direct impacts to terrestrial ecology and indirect impacts to aquatic ecology from potential degradation of water quality) and potential operational impacts of the dam upgrade (significant erosion from the diversion of water from the Namoi into the Peel River). Other issues considered in this assessment report relate to heritage impacts, noise impacts, air quality impacts and water security.

The construction footprint of Option B1 on the threatened White Box Yellow Box Blakely's Red Gum Woodland ecological community is less than that for Options D2 and D3, however this community is still be impacted. The

Department has therefore recommended that the Proponent be required to prepare and implement an appropriate biodiversity offset package, which includes offsetting impacts to this ecological community, native grasslands and habitat for threatened fauna species. The Department has also recommended that the Proponent develop an ecological monitoring program prior to construction, for threatened species in and adjacent to the construction footprint.

The main construction impacts on aquatic habitat and biota are associated with the potential mobilisation of sediment from earthworks into the main water body of Lake Keepit or into the Peel and Namoi Rivers downstream of Keepit Dam. This will mainly cause a reduction in water quality and therefore potentially affect the ability of aquatic fauna to dwell in the impacted areas. The Proponent has proposed management and mitigation measures for these potential impacts, which will include the prevention of sediments from entering the watercourses through the use of sediment fences and bunding between earthworks. It also proposes to revegetate disturbed areas such as the access roads and stockpile sites following completion of construction of each component, to prevent ongoing erosion and resultant runoff into the relevant water body.

To ensure the protection of the aquatic ecology, the Department has recommended that the Construction Environmental Management Plan (CEMP) detail the measures described in the Environmental Assessment to minimise the impacts to water quality, by way of a Water Management Sub Plan. The Proponent is also required to detail in the CEMP, the measures to monitor and minimise soil erosion and the discharge of sediment and other pollutants into local waterways or land during construction. The Department also recommends that the Proponent employs soil and water management controls to minimise soil erosion and the discharge of sediment and other pollutants to lands and/or waters, in accordance with Landcom's *Managing Urban Stormwater: Soils and Conservation* document.

Option B1 would require the diversion of water from the Namoi into the Peel River. During very large to extreme floods of 1:10,000 AEP or less frequent, this would result in downstream damage between the subsidiary dam wall spillway and the Peel River, which would not otherwise have occurred but for the subsidiary dam wall spillway required for Option B1. The Proponent has committed to rectify, where liable, any property or building damage caused directly or indirectly by the operation of the project, at no cost to the property owner(s). The Proponent also states that, at its complete discretion, it may elect to compensate landholders on a case by case basis for insurance-related loss.

The Department considers that given the Proponent is unable to articulate the actual criteria or process it may use to judge whether compensation should be granted at this time, a Compensation Liaison Group must be formed prior to the commencement of construction. The findings and conclusions drawn would then be required to be presented in the Operational Environmental Management Plan. This Group is required to include the Proponent, representatives from DWE, Council and affected landholders. The Department believes that the use of this Group would assist the Proponent in quantifying the possible extent of damage to property from the operation of the upgraded dam and forming criteria that would assist in determining compensation, more specifically payments of an ex gratia nature.

The Department has also recommended specific conditions to be imposed on the Proponent to address the other issues raised in the assessment process:

- noise impacts – specific conditions to limit hours of construction to acceptable times unless a noise agreement has been formed between the receptor and Proponent, to limit noise generated during construction to mitigate amenity noise impacts;
- air impacts – specific conditions to mitigate dust and monitor air quality during construction; and
- Aboriginal heritage – specific requirement to ensure no disturbance to the Aboriginal site 20-5-0021 (stone procurement source) occurs during construction.

The Department believes that provided the Proponent implements all nominated environmental commitments, its recommended impact minimisation measures contained in the Environmental Assessment, and the Department's recommended conditions of approval, the impacts associated with the construction and operation of the proposal can be minimised and adequately managed.

CONTENTS

1. BACKGROUND

1.1 Location

State Water Corporation (the Proponent) proposes to upgrade the existing Keepit Dam, situated between the townships of Gunnedah and Tamworth in the north-east of New South Wales, and located on the Namoi River, 13 kilometres upstream of its confluence with the Peel River. Figure 1 below illustrates the regional location of Keepit Dam and Figure 2 displays the existing site and key features.

1.2 Existing Site

The key existing features of Keepit Dam are a main dam wall and a subsidiary dam wall. The main dam wall has one gated spillway, consisting of six radial gates, each 14.9 metres wide and 11.3 metres high. Floodwaters discharged through the spillway flow directly into the Namoi River downstream from the dam. The gantry crane sits atop the wall, a valve house and the hydroelectric power generating station are the other infrastructure located at the main dam wall. The subsidiary dam wall was modified in 2003 to function as an auxiliary spillway. This was an interim measure by the Proponent to temporarily reduce the likelihood of failure of the main dam wall, while a long term solution to the dam safety concerns was being sought. This proposed upgrade is the long term solution to achieve the current dam safety requirements. The key features of Keepit Dam are outlined in Table 1.

Table 1 - Key Features of Keepit Dam

Feature	Specification
Age	48 years (in 2008)
Storage capacity	425,000 megalitres
Length of main dam wall	533 metres
Maximum height of main dam wall	43 metres
Upstream catchment area	570,000 hectares
Length of subsidiary dam wall	914 metres
Maximum height of subsidiary dam wall	11 metres (prior to interim works)
Storage full supply level	329.6 metres AHD
Storage design flood level	333.5 metres AHD
Maximum spillway discharge	10,475 cubic metres per second
Flood handling capability (prior to/after interim safety works being implemented)	1:2,800/1:12,000 AEP
Upstream area inundated at full supply level	4,370 hectares

1.3 Surrounding Land Use

Keepit Dam is situated approximately 60 kilometres west of Tamworth and 40 kilometres northeast of Gunnedah on the Namoi River. The Proponent's study site (includes the construction areas and the potential areas to be impacted from construction and operation) is situated in Central Northern NSW and is part of the Namoi Catchment. This catchment has an area of 41,350 square kilometres, and extends from Woolbrook in the east to Walgett in the west of New South Wales. Industry in the catchment is dominated by agricultural activities such as cotton cultivation, cereal crops and cattle and sheep grazing. Keepit Dam regulates flows to downstream regions to provide a reliable water source for downstream irrigators, industry and towns.

Key land uses around the southern end of Lake Keepit include:

- Proponent's administration office, workshop depot and employee housing;
- Lake Keepit State Park, which includes a caravan park, golf course, two boat ramps, sailing and fishing clubs, camping ground, kiosk, sewage treatment plant and other facilities. These facilities are generally located on the western side of Lake Keepit between the main and subsidiary dam walls, with the exception of the gliding club, camping ground and one of the boat ramps, which are located on the eastern side of the subsidiary dam wall;

Figure 1 – Regional Context of Project

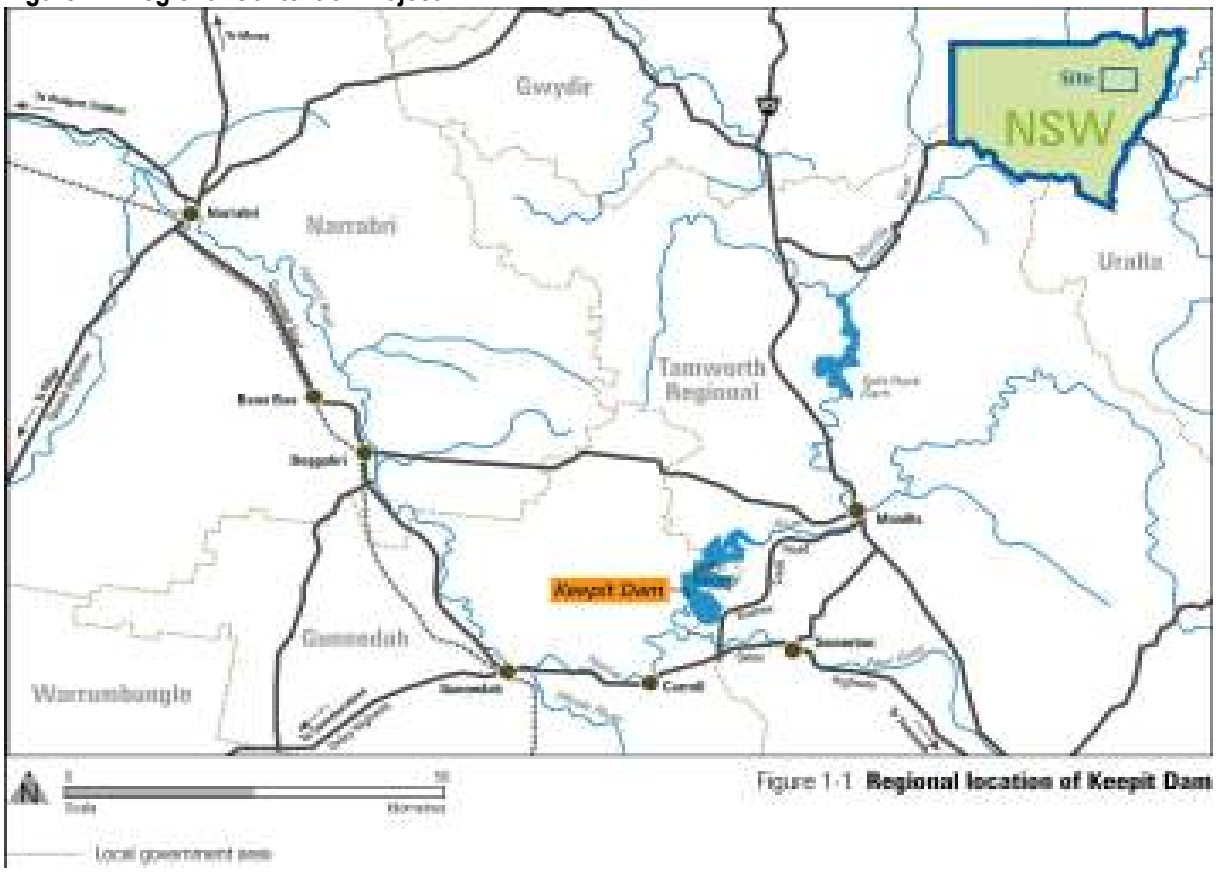
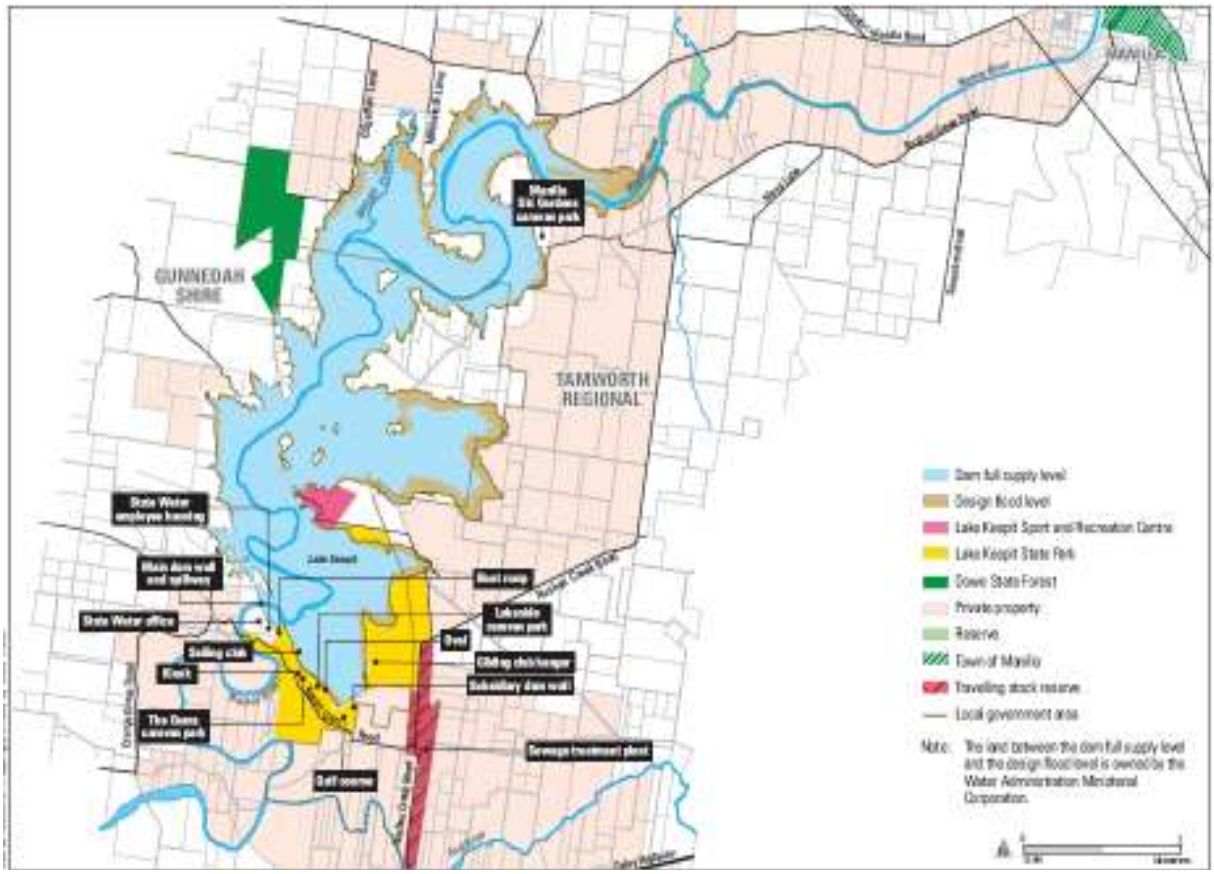


Figure 2 – Project Site Context



- Lake Keepit Sport and Recreation Centre, which is located on the foreshore approximately 7 kilometres north-east of the main dam wall and includes cabins, a conference centre, a swimming pool and other recreational facilities; and
- a further caravan park, the Manilla Ski Gardens, which is located at the north-eastern end of Lake Keepit.

A large proportion of the foreshore area around Keepit Dam has been designated as a State Park (the Lake Keepit State Park). It is owned by the Water Administration Ministerial Corporation which is a statutory body enacted under the *Water Management Act 2000*. The Water Administration Ministerial Corporation has delegated management of these areas to the Department of Lands, which has subsequently established the Lake Keepit State Park Trust to manage the park on its behalf.

2. PROPOSED DEVELOPMENT

2.1 Project Description

The Proponent initially sought approval for the upgrade of Keepit Dam by one of three options (B1, D2 or D3), where one of these dam safety concept options would be selected for implementation by the Proponent. Based on the outcomes of its assessment, the Proponent stated in the Environmental Assessment that its preferred dam safety upgrade option is Option B1. However, it had also indicated that a final decision would be made following the public exhibition of the Environmental Assessment and additional liaison with project stakeholders. Subsequent from the Environmental Assessment exhibition, the Proponent has now reaffirmed its decision for this preferred option. However as the Proponent submitted a Concept Plan Application for all three options, this report, for comparison, also considers Options D2 and D3. Table 2 summarises the key components of each option, while Figure 3, Figure 4 and Figure 5 illustrate the three options.

Table 2 - Key Project Components

Option	Key Features of the Option	Estimated Cost (March 2007) $ million	Estimated Cost (June 2008)* $ million
B1	• Raising the main and subsidiary dam walls by 3.4 metres, including post-tensioning of the main dam wall. • Constructing a 220 metre release-plugged spillway at the right-hand abutment of the main dam wall. • Constructing a 380 metre release-plugged spillway at the subsidiary dam wall. • Constructing three saddle dams (one each at the boat ramp, sailing club and caravan park) to match the raised height of the main and subsidiary dam walls.	75.0	116.2
D2	• Raising the main and subsidiary dam walls by 4.6 metres, including post-tensioning of the main dam wall. • Constructing a 220 metre release-plugged spillway at the right-hand abutment of the main dam wall. • Constructing 380 metres of release plugged spillways at the boat ramp and sailing club or only at the sailing club location. • Constructing a saddle dam at the caravan park to match the height of the raised dam wall if the full 380 metres of spillway is implemented at the sailing club location.	87.0	140.6
D3	• Rasing the main and subsidiary dam walls by 5.5 metres, including post-tensioning of the main dam wall. • Constructing a 220 metre release-plugged spillway at the right-hand abutment of the main dam wall. • Constructing 380 metres of release plugged spillways at the boat ramp and sailing club or only at the sailing club location. • Constructing a saddle dam at the caravan park to match the height of the raised height of the main and subsidiary dam walls. • Constructing a saddle dam at the boat ramp to match the height of the raised dam wall if the full 380 metres of spillway is implemented at the sailing club location.	89.0	144.9

Note. Shaded green = Preferred Option

*The revised cost estimate equate to an overall scheme budget – it takes into account recent geotechnical results and probability based estimating which considers potential variations to quantities and unit rates as well as providing contingent items.

Figure 3 - Key Components of Option B1

Note: The two proposed spillways would have a total width of 600 metres and would comprise seven release plugs, with sill levels 3.0 metres below the full supply level of the dam.

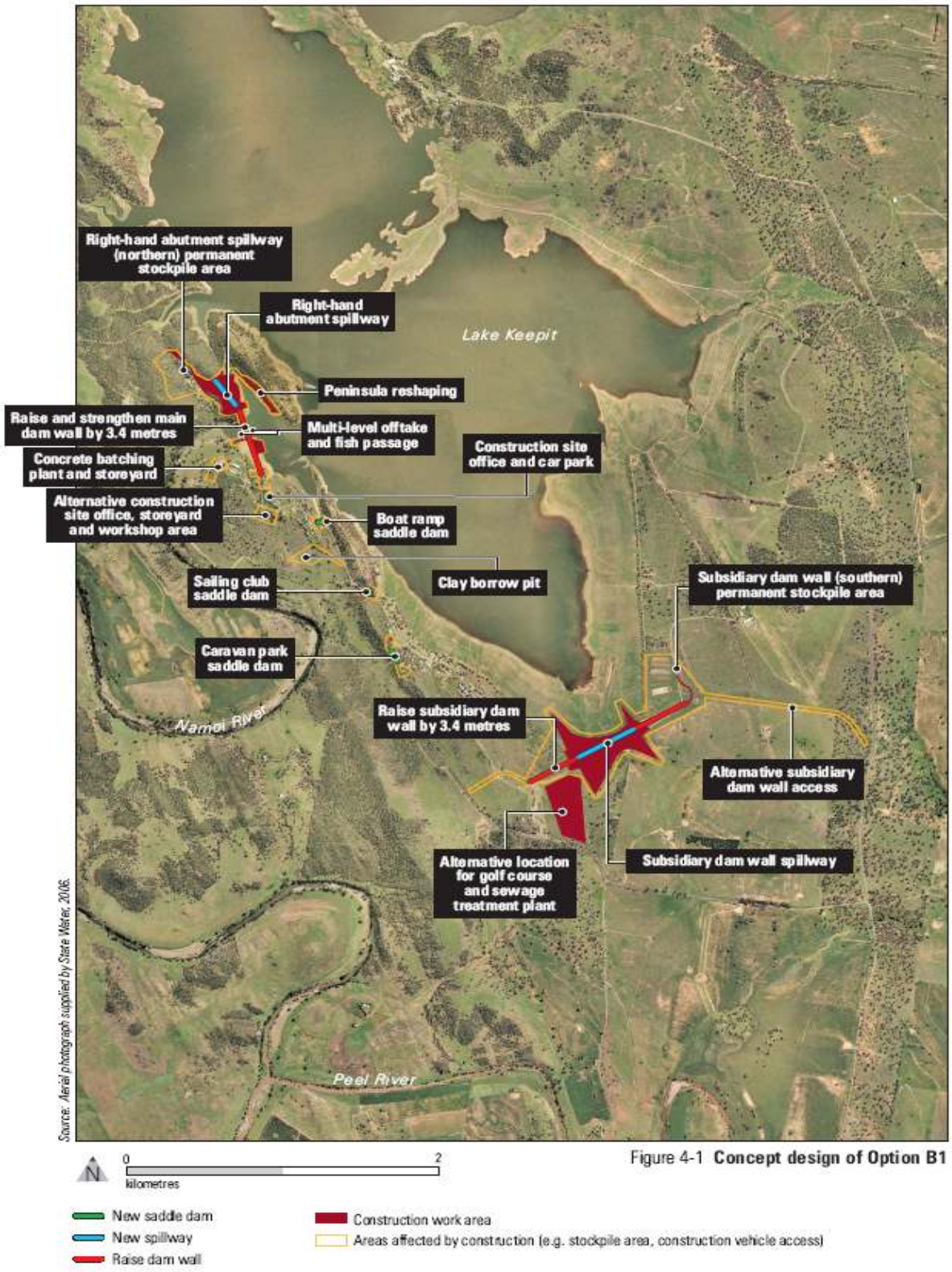


Figure 4-1 **Concept design of Option B1**

Figure 4 - Key Components of Option D2

Note: The three proposed spillways would have a total width of 600 metres and would comprise seven release plugs, with sill levels 1.3 metres below the full supply level of the dam.

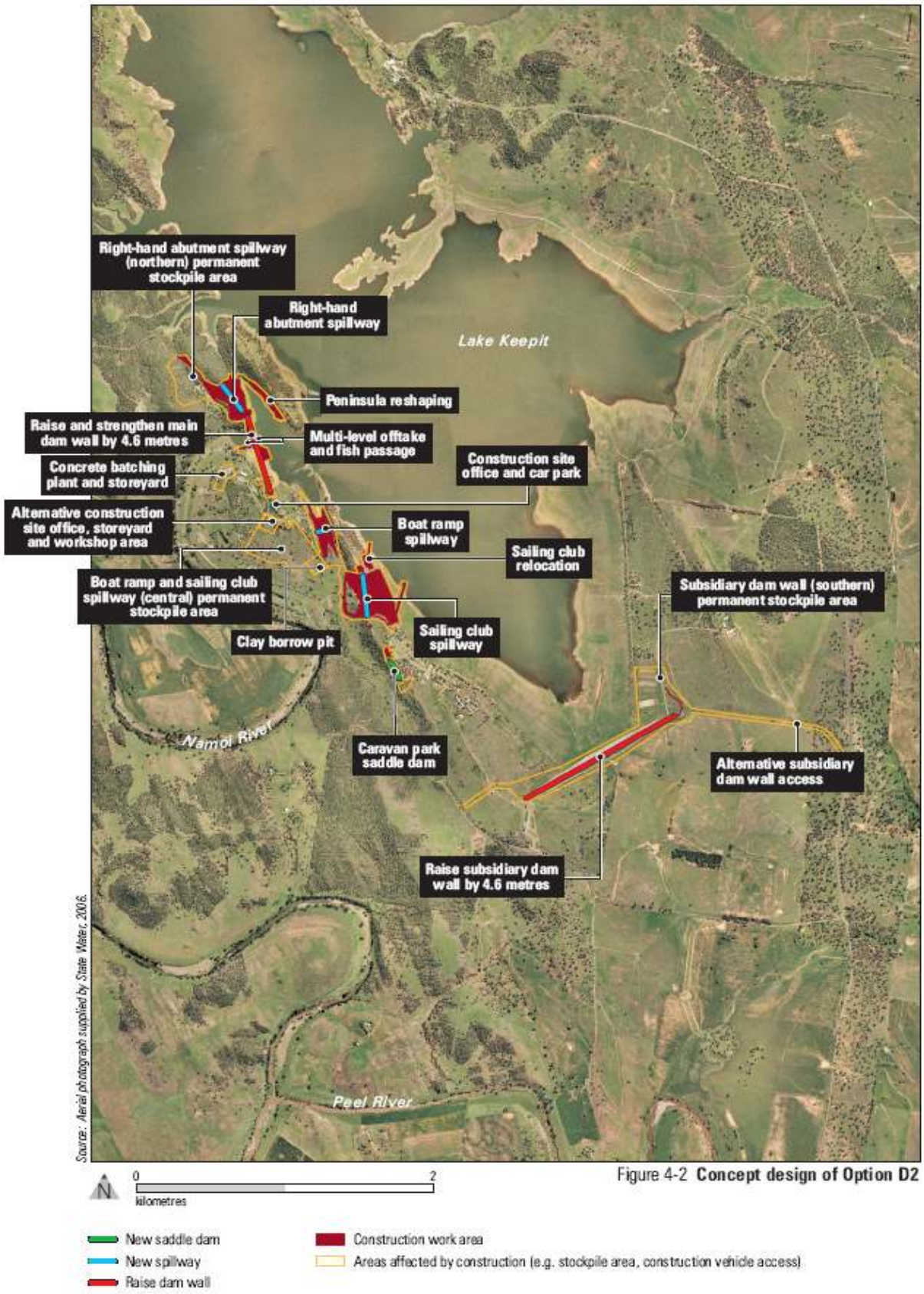


Figure 4-2 **Concept design of Option D2**

Figure 5 - Key Components of Option D3

Note: The three proposed spillways would have a total width of 600 metres and would comprise seven release plugs, with sill levels 0.3 metres below the full supply level of the dam.

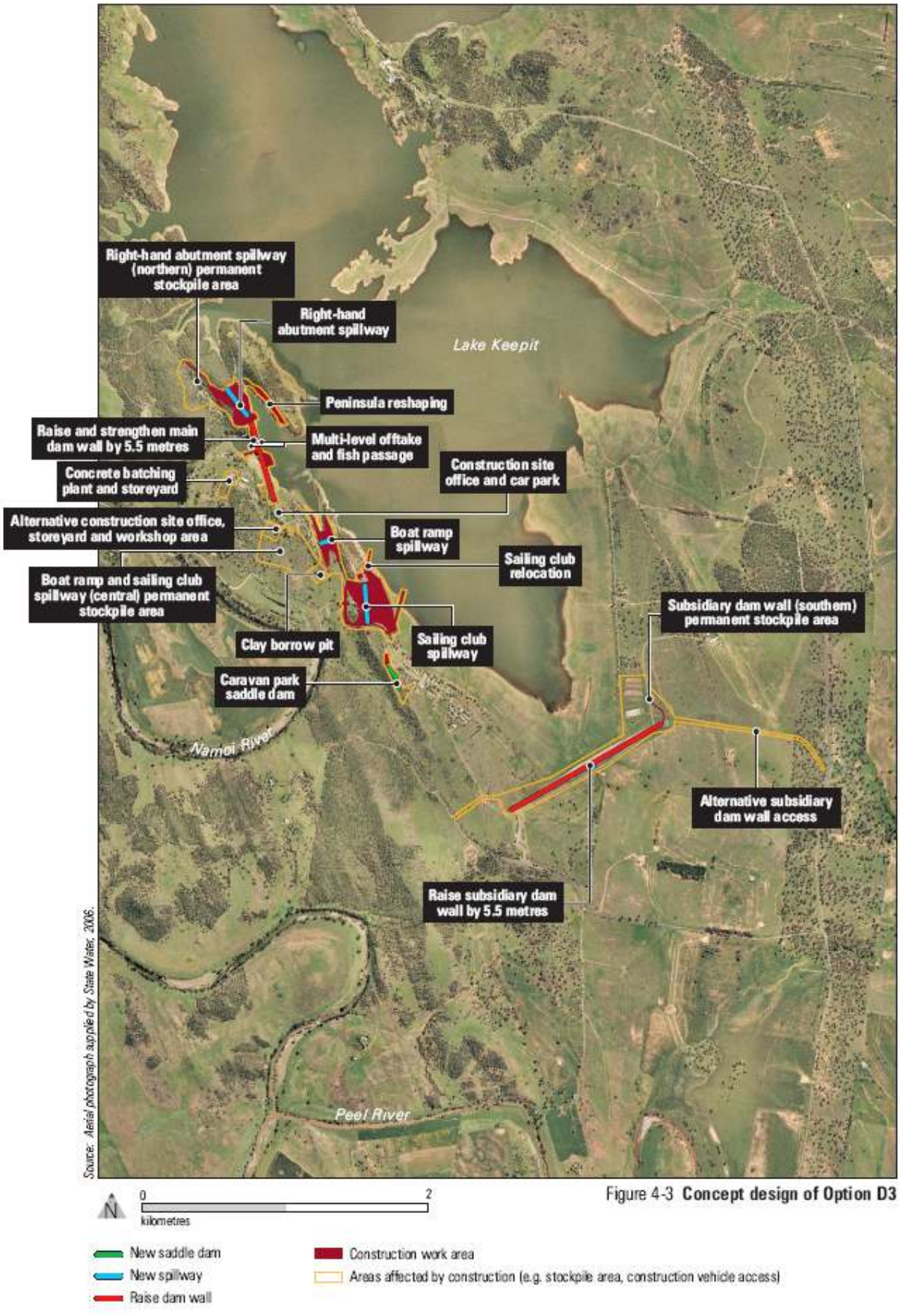


Figure 4-3 **Concept design of Option D3**

2.2 Operational Details

Upstream Impacts - Probable Maximum Flood (PMF)

- The maximum temporary upstream inundation would occur during a PMF when the level of the storage rises to the design flood level for each option. Option B1 would result in the least increase in temporary inundation (approximately 1,085 hectares), whereas Option D3 would result in the greatest increase in temporary upstream inundation (approximately 1,795 hectares), as it has the highest design flood level. The duration of inundation of land will also increase, where land at the full supply level would be inundated for durations of 60, 75 and 90 hours in a PMF for Options B1, D2 and D3 respectively. These durations equate to a marginal increase of 10, 25 and 40 hours respectively, relative to the existing situation. This upstream inundation caused by Options D2 and D3 would affect facilities including the Lake Keepit Sport and Recreation Centre, the Manilla Ski Gardens Caravan Park and a number of rural properties.

Downstream Impacts

- *Floods smaller than 1:2,400 AEP (Annual Exceedance Probability)* – Under Option B1 (and Options D2 and D3), there would be no change to downstream inundation, relative to the existing situation.
- *Flood larger than 1:2,400 AEP, but smaller than 1:10,000 AEP* – the right hand abutment spillway would operate and the release of water would be staged to reduce downstream impacts. Under the existing situation, the dam would release water only through the spillway gates up until approximately 1:2,800 AEP, following which dam failure would occur. This proposal would result in more frequent downstream inundation for a limited range of floods between 1:2,400 AEP and 1:2,800 AEP, although the Proponent states that the trade-off would be that the dam would be safe, i.e. would not fail and would be capable of safely passing storms up to the PMF without failure. All three options showed similar performance for flood events within this frequency range.
- *Flood larger than 1:10,000 AEP* – For Option B1, operation of the subsidiary dam wall spillway is predicted to occur at approximately 1:10,000 AEP, which would result in additional inundation (when compared to the dam failure scenario), over a distance of approximately 1 kilometre between the subsidiary dam wall and along the Peel River, down to the confluence of the Namoi River. Floodwater would also flow across Lake Keepit State Park, including an access road to the camping area, the golf course and sewage treatment plant and Keepit Dam Road (the main entry road into Keepit Dam). The sewage treatment plant would be destroyed, as would more than half of the gold course. The operation of the spillway would also affect privately owned land several hundred metres wide, along a distance of approximately 2.5 kilometres between the spillway and the Peel River. The affected land is currently used for grazing. Floodwaters would also be discharged into the Peel River, which is not the natural course of water from the Keepit Dam catchment. The existing subsidiary dam wall would be converted into an auxiliary spillway and flooding related damage to up to sixteen properties could be worsened as a result of high velocity flood flows along the Peel River. This downstream inundation between the subsidiary dam wall and the Peel River would not otherwise have occurred but for the subsidiary dam wall spillway required for Option B1.
- *Flood larger than 1:10,000 AEP* – For Options D2 and D3, operation of the sailing club spillway is predicted to occur, followed by operation of the boat ramp spillway at approximately 1:100,000 AEP. The operation of these spillways have the potential to damage sections of Lake Keepit State Park between the spillways and the Namoi River as well as a section of Keepit Dam Road (which is located in Lake Keepit State Park).

The Proponent states that the effect of the discharges in the Peel River from the subsidiary dam wall spillway can be considered by the following. Following dam failure, the release of the Keepit Dam storage into the Namoi River would result in a backup of flows in the Peel River for several kilometres upstream of the subsidiary dam wall. This would occur without any dam safety measures. Also, the Peel River would be expected to be flood simultaneously with floods larger than 1:10,000 AEP in the Namoi River. The relative frequency estimates for a 1:10,000 AEP and 1:500,000 AEP flood in the Namoi River, are 1:300 and 1:1,400 AEP floods in the Peel River, respectively. Thus the additional inundation caused by Option B1 would be limited to the overland flow path between the subsidiary dam wall and the edge of the Peel River inundated area, a distance of approximately 1 kilometre.

The Proponent's analysis of the discharge volumes for storms larger than 1 in 2,400 AEP found that discharges associated with Option B1 would initially be approximately 15% greater than Option D3 and to a lesser extent greater than Option D2. Additionally, as a result of the release plug depth, the duration of flows associated with

Option B1 would be approximately three days longer than Options D2 and D3. When a storm of approximately 1:10,000 AEP is reached, there would be only marginal differences between the volumes of water released from the three dam safety upgrade options and the duration of flows – of the order of three percent.

2.3 Environmental Improvements

The concept Environmental Assessment included works to improve the environmental performance of the dam, which comprised of a multi-level offtake and a fishway. The Environmental Assessment stated that these improvements were subject to further investigations to confirm their cost effectiveness and the availability of funding and would be able to be developed irrespective of which dam safety upgrade option is implemented.

2.4 Multi-level offtake

A multi-level offtake is proposed as part of the project. The multi-level offtake will be constructed within the dam, and will function to take water from various depths, i.e. allows for water to be released from different heights which subsequently provides better water quality.

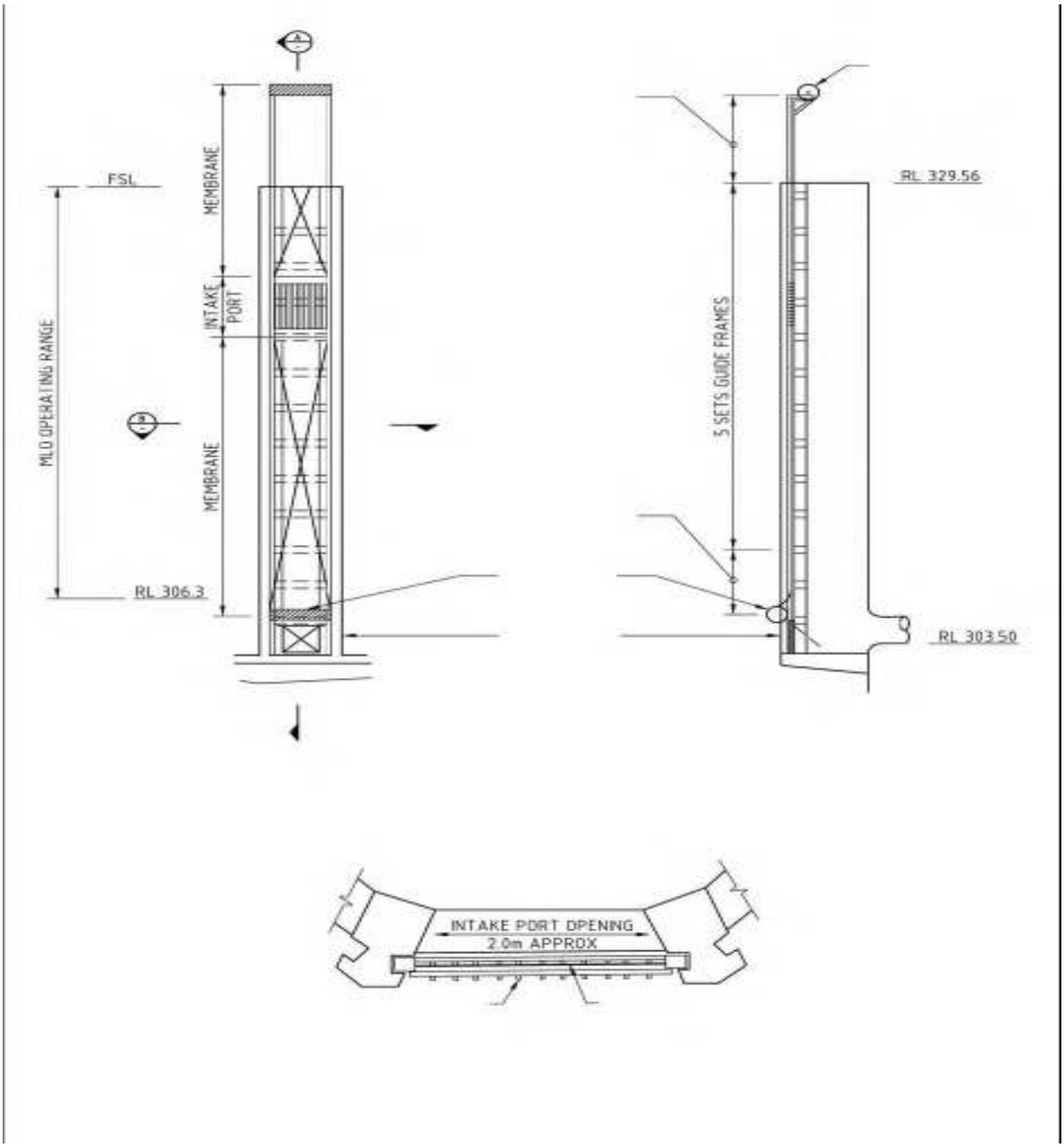
In consultation with the Community Reference Panel, the Proponent identified ten options to address the issue of cold water pollution resulting from the Keepit Dam and related downstream impacts. From these, three selective withdrawal options involving a multi-level offtake attached to the existing outlet were identified for further investigation, which were sliding plates, roller doors and automatic shutters. Based on the Proponent's evaluation criteria (temperature improvement ability, operating flexibility, ease of installation and reliability, maintenance frequency and occupational health and safety issues), it has adopted the roller-shutter concept for the multi-level offtake. A conceptual design of the multi-level offtake structure is illustrated in Figure 6.

2.5 Fishway

The Proponent was advised by the Department of Primary Industries (DPI), that the costs of construction of the proposed high level fishway at Keepit Dam are likely to exceed the potential benefit to the migratory fish community at the Namoi River. However DPI supports the construction of fishways on three downstream weirs (Mollee, Gunidgera and Weeta) as a suitable alternative to the proposed fishway on Keepit Dam. DPI noted that this alternative would be more suitable to the proposed fishway at Keepit, as it would provide significant conservation benefits. This is due to the species assemblage, length of river opened to fish passage and the amelioration of cold water release impacts planned for as part of the proposal modifications.

The DPI states that these works would satisfy any requirements in relation to the modification of Keepit Dam under Section 218 of the *Fisheries Management Act (1994)*. DPI has further noted that the three downstream weirs would also serve as an offset for the proposed dam safety upgrade works at Spilt Rock Dam. State Water has conveyed to the Department that the provision of fishways at these three downstream locations will be managed as separate projects and as part of State Water's Downstream Dam Upgrade Program. Therefore the Proponent has removed this element from the proposal.

Figure 6 - Concept Design of Multi-level Offtake



2.6 Project Need

The Proponent owns and operates Keepit Dam. It is responsible for ensuring that the dam meets the current safety requirements of the NSW Dams Safety Committee, which is a government statutory authority, formed under the *Dams Safety Act 1978*. The Committee requires all dams to be functionally safe under all weather conditions for the welfare of the public.

The construction of Keepit Dam was completed in 1961 and complied with the engineering and safety standards of that period. However advancement in technology has allowed for the prediction of rainfall and the understanding of extreme natural events, including flooding and earthquakes. As such, the NSW Dams Safety Committee has now set new safety requirements. Keepit Dam can safely handle the worst floods on records however it does not meet the current modern dam safety requirements for extreme floods and earthquakes.

The NSW Dams Safety Committee's flood capacity requirement for extreme consequence dams, such as Keepit Dam, is the estimated PMF (Probable Maximum Flood) for that dam. The Committee also requires that all extreme consequence dams can withstand a maximum design earthquake of less than 1:10,000 AEP, without an uncontrolled loss of storage due to partial or complete dam failure. Seismic date enables determination of historical maximum events and, to some extent, estimation of the magnitude of future events. Since the construction of Keepit Dam, earthquake and rainfall estimation methods have advanced and dam practice has changed. The NSW Dams Safety Committee has stated that several earthquakes of magnitude 7 on the Richter Scale have occurred in Australia since European settlement, however major earthquakes up to magnitude 7.5 can be expected to occur.

Prior to improvements undertaken on the dam in 2003 by the Proponent, it was predicted that there was a 1:2,800 AEP that floodwaters could overtop the dam causing it to collapse. The interim measures implemented have reduced this risk to approximately 1:12,000 AEP (or less frequent). The aim for this proposal is to reduce the impacts for floods with a frequency of occurrence of between 1:2,400 and 1:10,000 AEP, i.e. very large to extreme flood events. The PMF is the largest flood that could theoretically occur in a catchment. The estimated frequency of the Keepit Dam PMF is expected to be 1:500,000 AEP or lower, i.e. 1 chance in 500,000 years.

For this reason, the NSW Dams Safety Committee requires the Proponent to undertake an upgrade of the dam safety, to comply with current requirements.

3. STATUTORY CONTEXT

3.1 Major Project

The proposal is a project to which Part 3A of the *Environmental Planning and Assessment Act 1979* (the Act) applies by virtue of an Order made by the Minister for Planning under section 75B of the Act on 29 July 2005.

3.2 Concept Plan Authorisation

On 25 January 2006, the Minister for Planning authorised the submission of a concept plan for the proposal.

3.3 Permissibility

The proposed project is permissible without development consent as it is a project identified within Part 2 of the *State Environmental Planning Policy No. 4 - Development Without Consent and Miscellaneous Exempt and Complying Development* (SEPP 4), i.e. it is subject to Part 5 of the Act.

On 21 December 2007, *State Environmental Planning Policy (Infrastructure) 2007* was gazetted, which commenced on 1 January 2008 and clause 11 of SEPP 4 repealed. SEPP (Infrastructure) does not apply to this project by virtue of the savings provision under clause 11(b) of that policy. However, it is noted that this policy would not have altered the permissibility of this project.

This project would have been formerly assessed under Part 5 of the Act. Under Part 5 of the Act, the Proponent is also the determining authority. The Proponent was of the opinion that the proposal may result in a significant impact on the environment and, would therefore require the preparation of an environmental impact statement. However pursuant to the standing Order dated 29 July 2005, which declared that where the Proponent is a public authority (other than a local council) and an Environmental Impact Assessment is required (ie likely to significantly affect the environment), then Part 3A of the Act would apply.

The project has also been declared to be a 'Controlled Action' under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC reference no. 2006/3186), i.e. the project will need approval from the Department of the Environment, Water, Heritage and the Arts. The EPBC Act Part 3, Division 1 controlling provisions are: sections 18 and 18A (listed threatened species and communities). The proposal will impact on the Murray Cod (*Maccullochella peelii peelii*), Namoi River Turtle (*Elseya belli*), White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland, and other species potentially present and listed under sections 18 and 18A of the EPBC Act. Under the provisions of the Bilateral Agreement between the New South Wales and Commonwealth governments, the environmental impacts of the controlled action will be assessed under Part 3A of the Act. To enable the assessment of controlling actions under the EPBC Act, the Director-General's requirements issued for the project on 26 June 2006 were supplemented with additional requirements under section 75F(3) of the Act.

3.4 Environmental Planning Instruments

The are no applicable environmental planning instruments that substantially govern the carrying out of the project.

3.5 Director General's Requirements and Adequacy of Environmental Assessment

The Director-General's requirements for the preparation of an Environmental Assessment for this proposal were issued on 26 June 2006. However, to ensure that the Environmental Assessment addressed matters of National Environmental Significance, the Director-General's requirements were supplemented with additional assessment requirements identified, focused on the controlling actions for the project.

The draft Environmental Assessment submitted to the Department on 5 October 2007 was found to be inadequate by the Department on 29 October 2007. The reasons for the inadequacy were:

1. did not include a detailed assessment of the mitigation measures and offset strategies;
2. did not include sufficient information for the threatened species assessment; and
3. did not include unambiguous photomontages of the type of visual impacts associated with the project.

The Environmental Assessment with the inclusion of the revised sections was found to be adequate pursuant to section 75H of the Act. The Proponent was notified of its compliance on 26 November 2007.

3.6 Exhibition of the Environmental Assessment

The Environmental Assessment was placed on public exhibition from 4 December 2007 to 8 February 2008 and submissions were invited in accordance with Section 75H of the Act. The exhibition locations were:

- Department of Planning's head office in Sydney;
- Nature Conservation Council;
- Gunnedah Shire Council;
- Tamworth Regional Council (Tamworth and Manilla offices); and
- Lake Keepit State Park (Lake Keepit State Park office and Keepit Kiosk).

The Environmental Assessment was also provided for download on the Department's internet site. Notification of the exhibition period was made through three separate advertisements in the *North-West Magazine* (4 December 2007 and 17 January 2008), the *Northern Daily Leader* newspaper (5 December 2007 and 17 January 2008) and *The Australian* newspaper (5 December 2007 and 17 January 2008). The Department has met all its legal obligations so that the Minister can make a determination on the project.

3.7 Nature of Application and Approval

The Proponent has lodged an application for concept approval for the upgrade of Keepit Dam, accompanied by an Environmental Assessment framed to support assessment of the 'concept' of the development. The Director-General's environmental assessment requirements were framed in the context of an application for concept approval, and the Environmental Assessment deemed adequate against those requirements for the purpose of assessing and forming a view as to the environmental acceptability of the development in concept. Subsequent to the exhibition of the Environmental Assessment, the Proponent has conducted detailed studies for air, noise and vibration for Option B1 and provided updated information on revised capital costs, geotechnical investigations, traffic movement and approach to the proposed biodiversity offset package.

In determining the concept plan application, the Minister has the power to specify subsequent assessment and approval steps for the detailed project application stage under the concept plan. Further, the Minister has the ability to specify that no further assessment is required if the Minister considers the level of detail in the concept plan is sufficient to also support project approval at this time. Although the Minister is considering a concept plan application, the Proponent argues that sufficient information has been provided for Option B1 to also grant project approval. The Department concurs that sufficient information has been provided to support project level assessment for Option B1.

In summary, the Department concurs with the Proponent that sufficient information has been provided at this time to support a Ministerial view that no further assessment of the upgrade of Keepit Dam by way of Option B1, is necessary. The Department recommends that the Minister form this view and, concurrent with the grant of concept approval for Option B1, also grant project approval for Option B1.

4. CONSULTATION AND ISSUES RAISED

The Department received a total number of sixteen submissions on the project from Government agencies, private landowners and organisations. Issues raised in these submissions are summarised below.

4.1 Submissions from Government Agencies

Submissions were received from five State government agencies and three councils:

Department of Environment and Climate Change (DECC)

- states that it is able to support concept approval subject to its recommendations however requires further detailed assessment of construction impacts prior to supporting project approval;
- states that the Proponent should include in its SoCs, that prior to the commencement of construction, an application for an environment protection licence (EPL) for any scheduled works and activities is submitted and that no works will commence until the EPL is issued to the occupier of the premises where the scheduled activity will occur;
- supports the biodiversity offset strategy being developed in conjunction with the DECC and using the Bio-Banking Tool as a guide. Has requested the SoC be amended to explicitly address this process.
- states it cannot undertake an adequate assessment or provide meaningful comments on the noise and vibration assessment and the proposed SoC as the Proponent has not undertaken any noise impact assessment to determine whether the construction impacts would affect sensitive receptors; and
- recommends that in addition to the development of stormwater management plans, a rehabilitation plan for the soil/extracted material permanent emplacement areas be developed.

Department of Water and Energy (DWE)

- supports the surface water management principles outlined in the SoC and the proposal to prepare and implement a Soil and Water Quality Management Sub Plan as part of the proposed Construction Environmental Management Plan;
- advises that because there is no proposed change to the water availability in the dam below a 1 in 2400 year event, it is not considered necessary to modify the Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Sources or licensing under the *Water Act 1912* and the *Water Management Act 2000*; and
- advises that the proposed increase in the design flood level associated with each of the upgrade options has the potential to impact on existing pump sites operated by water users within the area of increased upstream inundation. As such, it would be necessary for the Proponent to ensure that these users are identified in further detailed studies and considered in terms of potential impact by the design flood level. Mitigating measures would need to be developed where impacts are identified.

Department of Primary Industries (DPI)

- advises that the environmental benefit stated in the Environmental Assessment understates the potential benefits by limiting the beneficial outcomes to downstream environments. The capacity of thermal mitigation through a mutli-level offtake and reinstatement of fish migration through the incorporation of a fishway presents potential benefits to migratory aquatic organisms that exist within the Namoi Catchment beyond the downstream environment of the site; and
- comments that the determination made in the Environmental Assessment that there will be no environmental benefit from providing a fishway without a multi-level offtake requires validation and requires further investigation. It also states that it is pursuing this with the Proponent.
  Note. As a result of ongoing feasibility investigations, DPI has advised the Proponent that the provision of a fish passage at Keepit Dam is unlikely to be cost effective (refer to section 2.1, page 9 of this report).

Department of Lands

- supports option B1 as it would have the least impact on the facilities of the Lake Keepit State Park Trust and the Sailing Club.

NSW Dams Safety Committee

- states that it is aware all the three dam safety upgrade options will meet the requirements of the NSW Dams Safety Committee; and
- further states that it would continue to audit the dam and any improvement works in accordance with its regulatory duties under the *NSW Dams Safety Act 1978*.

Lake Keepit State Park

- supports Option B1 and states that this option will result in the least physical disruption to the parks functionality as a recreational facility for both the short and long term, incur the least upstream impacts, least visual impact, least impact on biodiversity and community health and activity and least impact from construction;
- states Options D2 and D3 would result in major physical changes to the park resulting in the loss of recreational facilities, substantial disruption to and relocation of key amenities and would result in significant loss of revenue generating capabilities of the Park's management and associated organisations;
- notes that increased upstream inundation will affect a variety of key utilities including power, water, sewer and phone lines necessitating their relocation. In particular, the State Park emphasise potential impacts to the sewerage system and the need for its relocation;
- requests that in the event of auxillary spillway releases (operational impacts), the fuse plugs are replaced and roads and other critical park infrastructure including the Sewage Treatment Works are repaired or replaced as soon as practical to minimise water loss, effects on the community and Lake Keepit State Park;
- requires compensation from the Proponent and associated bodies for any alterations to park facilities and infrastructure or adverse effects to trade and income earning capacity brought on by the dam for both the short and long term. Believes that option B1 will have the least detrimental effects compared to the two other options, thereby less compensation will be required;
- requests that the Proponent, with regards to impacts after an extreme flood event, prepares and makes public a plan guided by a strict timetable and response timeframe to replace the plugs in the B1 Option and if Option B1 is adopted, all critical infrastructure be repaired on a guaranteed publicly announced timetable;
- requests that the Proponent relocate Caravans within the Caravan Park only once to minimise damage and disruption to owners to a location agreed with the Lake Keepit State Park Trust. The relocation area must also be furnished with all necessary utilities to meet the requisite Government standards; and
- requests that the Proponent relocate the Sewage Treatment Works as part of the upgrade and prior to subsidiary dam spillway operation.

Tamworth Regional Council

- requests that should Option B1 be adopted, expects that any damage to the Keepit access road and associated infrastructure would be reinstated; and
- advises that Keepit Dam is located on the downstream western boundary of the Council area and the only impact on Council assets (for Option B1) will be on local roads. Therefore Council will not be commenting on other downstream impacts associated with the upgrade.

Gunnedah Shire Council

- finds that the outcomes of the Environmental Assessment appear primarily to be based on cost and supports option D3;
- states that the environmental damage that would occur to a section of the Peel Valley from Option B1 appears to have been ignored, given that it is acknowledged that the valley conditions in the Namoi River are more favourable to managing an extreme flood and any overflow of the dam was originally designed to pass into the Namoi Valley;
- states the loss of up to 30% storage from Option B1 is of concern in a cost benefit sense. Seems common sense to maximise storage capacity in an upgrade process as a community and environmental benefit;
- states that the differential in cost between Option D3 ($89 million) and Option B1 ($75 million) is not significant given the dam will be in place for up to another 150 years;

- states that the Environmental Assessment fails to clearly address the ranking of the relative differences between the options and the relative importance of each category or criteria having regard to the risk level;
- is most concerned that the process used to judge environmental impact is inconsistent with methods employed for other development proposals being assessed under the EP&A Act;
- states that by the employment of Option B1, an impact, which would under existing circumstances occur in the Namoi River, is now being transferred to the lower Peel River system with potentially devastating effects. This is contrary to good environmental analysis. It therefore questions how this environmental rationale can be contemplated as a solution. This approach would not be endorsed under good practice environmental assessment methods;
- states that the analysis of the comparisons between the options over simplifies the relative difference between the options. The particular ranking method employed is extremely coarse and provides little or no allowance for weighting the assessment and ensuring the rankings reflect all variables within the assessment process. The outcome of the rankings should satisfy a multi criteria triple bottom line as promoted by the Keepit Dam Upgrade Community Reference Panel;
- provides a more refined ranking assessment of the options, where it finds that Options D2 and D3 have a very similar risk level (approximately 73 units) whilst Option B1 (approximately 82 units) is significantly higher by approximately 12%;
- states that should Option B1 be the first preferred choice, would wish to ensure that the environmental, social and safety principles upon which it is based are retained and certain conditions are applied to its implementation and operation; and
- requests that the NSW Government be responsible for replacement of Council roads and other community infrastructure under Council's control and guaranteed reinstatement of release plugs following a release, based on a timetable established prior to construction.

Narrabri Shire Council

- advises no objection to the upgrade.

4.2 Submissions from Landowners, Organisations and Community Groups

Three Submissions from landowners located below the Option B1 subsidiary dam wall spillway

- question releasing floodwaters into the adjacent Peel valley;
- concerned about the various socio-economic aspects if a very large to extreme flood event were to occur, i.e. impacts to its house, potable water well located beside the Peel river, future viability of farming practices etc;
- state that a very large to extreme flood would result in catastrophic change to the existing river system and the long-term flow of the river would be affected;
- question whether insurance would cover the landowner's items lost during a very large to extreme flood event including water supply infrastructure;
- request Proponent clarify, as part of the determination for Option B1, how affected landowners would be compensated from the impacts following a very large to extreme flood event including loss of livelihood;
- find it difficult to plan for the future now this uncertainty has arisen; and
- raise the issue of social-equity of the upgrade option and possible compensation for impacts for the broader community benefit;
- one landholder clearly supports Option D3 on the basis that it would not result in loss of storage during a very large to extreme flood event, has a similar cost/benefit ration as the other options and does not discharge floodwaters into the Peel River Valley;
- one landholder states that the environment is largely overlooked in the Environmental Assessment and refers to the economic analysis report prepared in accordance with the NSW Treasury Guidelines (Hassall & Associates 2007), which states '*Two key identified impacts are unable to be quantified. They are, the environmental impacts downstream of the dam and the marginal additional benefits of water release control provided by gates compared with plugs*';
- suggest that the selection of the preferred option (B1) is biased towards cost considerations because the upgrade is being fully funded by the NSW Government;
- state that the Environmental Assessment has placed little emphasis on investigating the value of property both in its current state and as a result of potential future sub-division and use;

- note the uncertainty in relation to flood modelling and states that the Proponent should be prepared and provide for a scenario in which flooding is worst than expected. Also states that current modelling indicates that a minimum of 24 properties along the Peel River would be affected;
- request Proponent to clarify the following matters:
  - how would landholders along the Peel River be affected by insurances;
  - if landholders in affected areas would be allowed to develop and if so, who would bear the risk? Would it be possible to obtain insurance? If development was subsequently not allowed, or not advised, would compensation be provided?
  - Who would pay for damages to the affected properties and what would the timeframe be? Questions if the Proponent or the NSW Government would be responsible and the Proponent's capacity to pay compensation; and
  - if Just Terms Compensation Act applies to the issues raised previously in the submission.
- State that throughout the Environmental Assessment, it mentions where the Proponent would be liable for damages and compensation but advises of a potential conflict in terms of information attached to the submission from Section 398 of the *Water Management Act 2000*. I.e. it appears the Proponent does have an exclusion to pay compensation under this Act;
- state that the upstream inundation caused by Option D3 would be of shorter duration, slower and not result in the erosion as the downstream impact of Option B1;
- refer to Australia's only dam failure (tailings dam in Tasmania, 1924), where to this day, remediation has been unsuccessful and no vegetation has grown in that area. Thus identifies the contradiction of the scouring to occur due to Option B1, which will be within close proximity to one of the State's biggest inland water recreation areas and question the sustainability of this damage to future generations.

Downstream landowner (located between Gunnedah and Boggabri, on the Namoi River flood plain)

- concerned that Option B1 would increase the flood risk to their property located between Gunnedah and Boggabri; and
- considers that Option D3 provides a higher degree of protection for Namoi floodplain dwellers despite higher capital cost.

Keepit Dam Upgrade Community Reference Panel (CRP)

- Provides a summary of the CRP involvement in the project development process including interim works and options assessment process and reviewing the Environmental Assessment material;
- identifies Option D3 its preferred option based on the local benefits being considered to outweigh the additional cost - this being the initial recommendation to the Proponent which did not change following further more detailed technical studies after the initial recommendation was made;
- supports the implementation of the multi-level offtake considering it to be cost effective;
- does not support Option B1 or D2 due to the temporary loss of storage and the devastating erosion and environmental impacts in the lower Peel valley despite these impacts only occurring in a very rare to extreme flood event;
- states that the Environmental Assessment:
  - did not portray outcomes and reasoning of the extensive evaluations by the CRP and that this was supported by the release of an addendum after commencement of exhibition;
  - did not adequately rank the impacts of each of the options particularly in comparison with the extensive assessment undertaken by the CRP;
  - did not adequately convey the extent of damage Option B1 would create in the lower Peel River Valley;
  - overemphasises upstream inundation which is of relatively short duration, low velocities and low impacts;
  - while identifying all the construction impacts, could have indicated that the vast majority of impacts can be readily mitigated or offset; and
  - did not adequately convey the potential risks associated with the release plugs and loss of storage issues, particularly what guarantees that the release plugs would be reinstated after failure and how the release plugs are to perform as designed.
- Notes that private land inundated by the upgrade will reduce in value and the ability to secure insurance for the property will be affected. Recommends that this issue should be recognised by the Proponent and,

where sought by landowners, provide adequate upfront compensation including easements and purchase and lease back arrangements for properties downstream of the subsidiary dam wall; and

- requests a guarantee that the release plugs would be reinstated as quickly as possible to minimise temporary loss of storage as part of the Conditions of Approvals for the project and upfront compensation for landowners concerned about the loss of property value due to potential inundation and where the ability to obtain insurance coverage changes as a result of the upgrade.

Lake Keepit Sailing Club

- expresses support for the dam upgrade and support for Option B1 primarily based on environmental acceptability, least cost, least impact on State Park, least visual impact and least impact on vegetation;
- requests Proponent compensate for damage to Sailing Club during upstream inundation events;
- requests that the Proponent build a new boat ramp prior to construction commencing (Option B1);
- supports multi-level offtake based on cost-effectives and its environmental appropriateness;
- does not support fish-passage as the cost is extremely high and there is no evidence that it is essential from a environmental perspective; and
- requests opportunity to be part of the Community Liaison Group during construction.

Namoi Water

- states key upgrade issues will cause as little disruption as possible to the amenity at Lake Keepit and the operational capacity of the storage;
- states that it previously supported Option A3 (one of the early options now not considered in the assessment) and to a lesser extent Option D3;
- does not support preferred Option B1 based on loss of storage capacity, degradation of the lower Peel River and Carroll floodplain;
- considers Option B1 abrogates planning principles because of the proposed transfer of a large amount of water into an adjacent river valley and the associated impacts;
- states that compensation of landowners is necessary for the effects of scouring and siltation;
- supports fish passage in principle, however believes that this should be completely funded by the NSW Government; and
- questions why loss of storage is being considered as a feasible option.

The Department also received advice from the Department of Environment, Water, Heritage and the Arts (DEWHA) during the exhibition period of the Environmental Assessment. DEWHA commented that the Environmental Assessment appears to adequately address the potential impacts on matters of national environmental significance. However it stated that it requires further information on the proposed process for determining the offset package for the loss of 13.6 hectares of White Box Yellow Box Blakely's Red Gum Woodland (i.e. content, methodology and consultation steps) and that the Proponent should consult with DEWHA to ensure that any offset meets the requirements of the EPBC Act.

4.3 Submissions Report

On review of the issues identified in submissions, the Department required the Proponent to prepare a Submissions Report to address each of the issues raised in those submissions. As part of this process, the Proponent conducted additional investigations for geology, air quality, noise and vibration, construction traffic movements and approach to the biodiversity offset. The Department further discussed with DECC issues relating to ecological impacts, specifically biodiversity offsets and also sought comments regarding the air and noise assessments. The Department also further discussed issues relating to compensation (operational impacts) and water quality impacts with DWE.

The Submissions Report was submitted to the Department on 28 July 2008. However after a review of the report, the Department did not consider that the Report adequately addressed all of the issues raised, including the comments made by the Department. The Department had raised particular concerns after the exhibition of the Environmental Assessment, which were not fully addressed and resolved. The principal issues that required further attention related to biodiversity and landholder compensation matters. These issues were not only raised by the Department, but represent key issues from the public submissions process. Therefore pursuant to section 75H(6) of the Act, the Department found the Report to be inadequate, and required that it be updated and resubmitted to the Department to address the following issues:

1. Biodiversity Offsets – potential biodiversity offset sites must be identified now by the Proponent, to demonstrate that a viable offset outcome could be achieved; and
2. Compensation Issues for Landholders Affected by Operational Impacts – the Department required clarification regarding Proponent's position on providing compensation on a 'case by case basis', where it has statutory immunity under the *Water Management Act 2000*.

The amended Submissions Report was submitted to the Department on 23 September 2008, which included additional information regarding the Department's and DECC's concerns. The Submissions Report contained a detailed response to submission issues and the findings and recommendations of the additional impact assessments. Some minor changes to the Statement of Commitments were made to more thoroughly address issues raised by the Department and DECC. The revised Statement of Commitments is attached to this report as Appendix B.

The Proponent included as part of the Submissions Report, a Preferred Project Report. The Proponent stated that the Environmental Assessment outlined that Option B1 was considered to best meet the objectives of the project. Following its review of the submissions received, the additional information and investigations undertaken and consultation with stakeholders, it has reaffirmed its decision for this preferred option. Therefore Chapter 5 of this assessment report specifically focuses on Option B1, however where there are large differences between the options, these differences are also discussed and evaluated.

4.4 DECC Review of the Submissions Report

The Department provided extracts of the Submissions Report (air, noise and biodiversity) to DECC for review. The Proponent at this time was in the process of updating the Submissions Report, in light of the Departments comments. DECC noted that the assumption in the air quality modelling, that the blast area is 10,000m^2, may be significantly overstated against what is likely to happen in reality. It also stated that the Proponent should define clearly the proposed maximum blast area based on the 250kg MIC (maximum instantaneous charge), the amount of rock to be removed, likely average drill depth, and then model it again to see what the predictions are. It noted that given the PM10 (particles of 10 micrometres or less) is a health based not amenity based standard, it is of concern that the predictions are at such high concentrations for PM_{10} 24hr (i.e. 330.3$\mu g/m^3$ incremental particulate matter impacts and 349.3 g/m^2/month cumulative particulate matter impacts at the 1521 Bulga Road receptor).

Subsequently the Proponent revised the air modelling assumption from a blast area of 10,000m^2 to a realistic blast area of 600m^2 and clearly defined the blasting assumptions, i.e. based on an estimate of 600m^2 horizontal blast area and 250kg MIC, drilling depth of up to 21 metres and blasting occurrence details. When modelled again, the predictions were less significant and reflected better the actual situation that may arise from the construction works (ie 40.2$\mu g/m^3$ incremental particulate matter impacts and 55.4 g/m^2/month cumulative particulate matter impacts at 1521 Bulga Road).

DECC generally supported the mitigation measures provided for potential air quality impacts, it however provided additional comments to strengthen these measures, for example, the need to prepare a consultation plan with all potentially affected receivers, to discuss the Proponent's applied mitigation measures and monitoring. The DECC noted that such additional measures are necessary as unlike amenity issues, such as noise, where there are clear negotiation frameworks to compensate for impacts, this is a health issue and any health impacts would need to be specifically addressed through better consultation and the development of specific measures, as part of the Construction Environmental Management Plan.

DECC also provided comments regarding construction noise impacts, including the need for the Proponent to negotiate with affected receptors in accordance with the Industrial Noise Policy, as project specific noise goals are predicted to exceed criterion. DECC also provided additional comments to the Department regarding the Department's draft recommended conditions of approval. It particularly made recommendations concerning biodiversity offsets, water quality impacts and need for a noise monitoring program.

4.5 DEWHA Review of the draft Director-General's Assessment Report

As the project is declared to be a 'controlled action' under the EPBC Act (EPBC reference no. 2006/3186), the Department invited the DEWHA to comment on the draft Director-General's Assessment Report and draft Conditions of Approval for the project on 9 December 2008. The DEWHA advised the Department on 8 January

2009 that its primary concern in finalising its assessment is to ensure the provision of a suitable offset package for the loss of at least 13.6 hectares of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Woodland.

The DEWHA noted that the Department requires the details of the proposed offsets for impacts on this ecological community be included in a Biodiversity Offset Package and the Department's recommended condition 2.11 requires the Proponent to submit the Biodiversity Offset Package to the Director-General for approval prior to the commencement of any construction works. It also notes that it will not be possible for the Proponent to obtain final approval under the EPBC Act, until a suitable offset package for the ecological community is agreed to by the DEWHA.

The DEWHA does not require any amendments to the Department's recommended conditions of approval. However as noted above, it requires more detailed information on the outcomes to be achieved for the required biodiversity offset package, prior to it granting written approval for the project. This includes the identification of suitable offset areas and the determination of long term management arrangements for any sites that are to be purchased. The Department's recommended conditions require the Proponent to submit for the approval of the Director-General, a Biodiversity Offset Package, which must be developed in consultation with the DECC and DEWHA. Subsequently the Department considers that DEWHA's concern regarding the methodology of the offset package can be satisfied at this time. The Department will liaise further with the DEWHA when the Director-General is considering approving the Biodiversity Offset Package. The Department believes that during this time, DEWHA would be in a position to consider approval of the project under the EPBC Act 1999.

5. ASSESSMENT OF ENVIRONMENTAL IMPACTS

Key issues raised in the submissions in response to the public exhibition of the project and/or identified during the Department's assessment included:

- terrestrial ecological impacts;
- aquatic ecological impacts;
- impacts on property and land use;
- water supply security and loss of storage;
- heritage impacts;
- construction noise and vibration impacts; and
- construction air quality (dust) impacts.

All other issues are considered to be minor and have been addressed as part of the Proponent's Statement of Commitments.

5.1 Terrestrial Ecological Impacts

Issues

Construction Impacts

All three dam safety upgrade options that were proposed by the Proponent would require the clearance of native vegetation, including portions of the White Box Yellow Box Blakely's Red Gum Woodland, which is listed as a critically endangered ecological community under the EPBC Act. Table 3 below summarises the extent of vegetation clearing required for all three options.

Table 3 - Extent of Vegetation Clearance

Vegetation Type	Extent of Clearing (hectares)			Total in Study Area (hectares)
	B1	D2	D3	
Grassland (modified native or introduced)	23.3	12.8	14.0	1,524
Grassland/Cultivated agricultural land or otherwise highly modified	4.1	19	17.7	83
Poplar Box Open Woodland	0	0	0	273
River Red Gum Open Woodland	0	0	0	94
White Box Woodland, Yellow Box Blakely's red Gum Woodland (EEC)	13.6	18.0	17.6	902
TOTAL	**41.0**	**49.8**	**49.3**	**2,879**

As shown in Table 3 above, the preferred Option B1 would require the clearing of approximately 13.6 hectares of White Box Yellow Box Blakely's Red Gum Woodland. This clearing is required for the construction of the right-hand abutment area, located north-east of Keepit Dam and the access track, located in the travelling stock reserve.

The Proponent assessed the potential impacts the proposal will have on flora and fauna and followed the DECC's *Draft Guidelines for Threatened Species Assessment*. The assessment was based on desk-based searches of databases and historical records and preliminary field surveys. The Proponent has completed significance assessments for threatened species listed under the EPBC Act 1999, in accordance with the EPBC Act 1999 *Significant Impact Guidelines*. Species that are listed under both the *Threatened Species Conservation Act 1995* (TSC Act 1995) and the EPBC Act 1999 have been assessed by the Proponent in accordance with the *EPBC Act 1999 Significant Impact Guidelines* in order to assess the significance of impacts.

From the significance impact assessment of the White Box Yellow Box Blakely's Red Gum Woodland, it was found that the majority of this community within the proposal study area is highly disturbed and in poor condition. However it was also found that this vegetation type within the travelling stock reserve is in good condition and the vegetation at the right-hand abutment is in moderate condition. The travelling stock reserve is located below Keepit Dam, between Lake Keepit State Park and the Peel River. Clearing of this woodland for construction works is required at the right-hand abutment area and in the travelling stock reserve (for an access track).

Therefore these areas that are required to be cleared as part of the construction works for this proposal are not in poor condition.

The Proponent concluded that the construction of Option B1 would likely have a significant impact on the White Box Yellow Box Blakely's Red Gum Woodland. Any clearing of this community would result in fragmentation of woodland habitat in the right hand abutment area, which would significantly affect habitat connectivity for native animals in the area. The Proponent has also found that the action of clearing this vegetation is not consistent with the recovery plan for this community and therefore is likely to interfere with the recovery of this ecological community.

Therefore the Proponent has committed to offset this impact to the White Box Yellow Box Blakely's Red Gum Woodland and other threatened species. The Proponent will use the NSW DECC Biobanking Assessment Tool as a guide to determine the appropriate size of offset area required. The actual size and location of the offset site will depend upon a number of factors, which will be the outcome of the detailed investigations for the biodiversity offset. Both privately-owned lands and those in Government ownership will be investigated for potential use in the offset. As well as size and location, the proposed long-term management practices will also be determined. The Proponent states that the technical aspects of the study will be conducted by its consultant, Parsons Brinckerhoff, but NSW DECC and DEWHA will be involved at key stages of the study and particularly in the identification, short-listing and selection of possible offset sites.

The Proponent outlined the proposed biodiversity offset methodology to the Department, DECC and DEWHA and gained in principle support from all these agencies. DEWHA noted its primary concern is the development of a suitable offset package for the loss of at least 13.6 hectares of White Box Yellow Box Blakely's Red Gum Woodland, as it is listed as a critically endangered ecological community under the EPBC Act 1999. It also noted that the suitability of the offset package would need to be agreed by itself and as a consequence, if the project was to be approved by the Minister for Planning, EPBC approval cannot be given based on the identification of a suite of potentially suitable offset sites using the Biobanking scheme alone, and it will depend on:

- identification of a fixed offset package that contains sufficient EPBC listed White Box Yellow ox Blakely's Red Gum Woodland of suitable quality;
- purchase and management arrangements for the site agreed; and
- use of the principles in the DEWHA's draft offsets paper.

An area within the travelling stock reserve would be cleared for an access track to construction areas however the Proponent states this would unlikely result in significant invasion of weed species, subject to the preparation and implementation of a weed management plan for the construction and operational phases of the proposal. The selected option, B1, may require, if necessary, the clearing of dead wood and trees contained in this woodland. This type of clearing is listed as a Key Threatening Process under the TSC Act 1995. The Proponent states that logs and fallen branches are present in low to moderate numbers within this community and this activity would generally occur in disturbed habitats. The Proponent states that these habitats are unlikely to provide potential habitat for threatened or endangered species of plants and animals and therefore the removal of dead wood and trees is unlikely to result in a substantial impact on ecological communities in the study area. The Proponent has investigated alternative stockpile locations and construction vehicle access routes to avoid unnecessary clearing of the White Box Yellow Box Blakely's Red Gum Woodland community. The Proponent has also revised the sizing of construction work areas to minimise the extent of clearing required.

To minimise these impacts, the Proponent has committed to preparing a Flora and Fauna Management Sub Plan, as part of the Construction Environmental Management Plan for the proposal. The Sub Plan would be prepared in consultation with the DECC, DPI (Fisheries) and Gunnedah and Tamworth Regional Local Councils. This Sub Plan would illustrate detailed information on the management measures and biodiversity offsets proposed by the Proponent to minimise these impacts. These include reviewing and where possible minimising the need for clearing, temporarily moving dead logs within construction areas to an adjacent area outside the construction area, installing sediment control devices appropriate to land-based and water-based construction areas and preparing and implementing a clearing management plan for areas containing native woodlands, which would include protocols for tree clearing. The Sub Plan would also illustrate methods to protect vegetation retained within and adjoining the construction work areas from damage during construction, and detail a habitat tree management program and, where consistent with DECC requirements, strategies for re-using in rehabilitation works, individuals of any threatened plant species that would otherwise be destroyed by the construction works

Operational Impacts

Option B1 would only operate in the event of an extreme flood event (i.e. floods larger than approximately 1:2,400 AEP) and may therefore never be used. When outflow from the dam reaches that of a flood frequency of occurrence of 1:2,400 AEP (or less frequent), the first release plugs in the proposed auxiliary spillway at the right-hand abutment would start to operate. This means that below 1:2,400 AEP, flood management is unchanged from the existing situation.

For Option B1, the release plugs for the proposed subsidiary dam spillway would start to operate at a flood frequency of approximately 1:10,000 AEP. For flood events between 1:2,400 AEP and 1:10,000 AEP, impacts would be to the Namoi River downstream of the main dam wall. For flood events larger than 1:10,000 AEP, impacts would be to both the Namoi River downstream of the main dam wall and the lower Peel River, as Option B1 would divert the floodwater to the Peel River through the subsidiary dam wall spillway.

The main differing factor of Option B1 during a 1:10,000 AEP flood event is the discharge of a major part of the floodwaters into the lower Peel River rather than containing all flood flows in the Namoi River, as would occur naturally (and in Options D2 and D3). Option B1 also has the highest flowrate of flood water from the dam, when compared to Options D2 and D3. The implementation of Option B1 therefore would cause floodwaters to be discharged from a total of three spillways (right-hand abutment spillway; existing gated spillway; and subsidiary dam wall spillway). The subsidiary dam wall spillway would be the last of the spillways to operate and would erode the area downstream of this spillway due to the high velocity flood flows.

Upstream Impacts to Vegetation from Operation

As Option B1 will have the lowest wall raising, it would result in the least temporary upstream inundation (approximately 1,085 hectares) during a PMF event (i.e. During a large to extreme flood event (1:2,400 and 1:10,000 AEP)), additional upstream inundation would start to occur at approximately 1:17,300 AEP, 1:6,700 AEP and 1:5,000 AEP for Options B1, D2 and D3 respectively. This difference in frequency between the options at which additional upstream inundation occurs is due to proposed differences in the sill and crest levels of the release plugs in the proposed additional spillways. Table 4 below shows the additional area inundated and the durations of inundations during a PMF for all options.

Table 4 - Extent and Duration of Inundation

Option	Approximate Maximum Area of Inundation Above Existing Design Flood Level (hectares)	Approximate Maximum Duration of Inundation at Full Supply Level (hours)
B1	1,085	10
D2	1,485	25
D3	1,795	40

The duration of temporary upstream inundation would be unlikely to affect trees. The Proponent states that there has been almost no research on the effects of inundation on Dry Sclerophyll Woodland communities, similar to those that could be affected by additional temporary upstream inundation during operation of any of the three dam safety upgrade options. However grasses would probably die and those groundcover animal habitats affected would be destroyed. The rise of floodwaters into these areas would be gradual, allowing any ground-dwelling animals sufficient time to move to higher ground. However, animals that use the area could be affected by drowning, temporary habitat removal and/or increased exposure to predators associated with displacement. The Proponent finds that based on the short duration of the expected additional upstream inundation, it is unlikely to significantly affect the plant communities within the area.

Downstream Impacts to Vegetation from Operation

For extreme flood events, the majority of floodwater for Option B1 would discharge into the Peel River, whereas Option D2 and D3 would only discharge into the Namoi River. Option B1 would result in high velocity floodwaters in the lower Peel River, which would result in much greater impacts than Option D2 and D3. Both river systems are in degraded condition and therefore it is not clear that one option is superior to the others.

Option B1, under certain flood conditions, would result in the inundation of two threatened plant species: *Bothriochloa biloba* (Option B1 only) and *Hakea pulvinifera* (all options). *Bothriochloa biloba* is listed as vulnerable under the EPBC Act 1999 and is at risk of long-term disappearance through continued depletion. A single individual of *Bothriochloa biloba* was previously recorded downstream of the subsidiary dam wall. The

Proponent states that this individual and its habitat would be destroyed during the operation of the proposed subsidiary dam wall for Option B1. The Proponent conducted an impact assessment for this specimen, under the EPBC Act 1999 Significant Impact Guidelines. The assessment determined that it is unlikely to be an important population, the affected habitat is unlikely to be critical to the survival of this species, and the proposal is unlikely to significantly impact the species.

Impacts on the *Hakea pulvinifera* vary depending on the size of the flood and the option which would be implemented. For floods with frequencies between 1:2,400 AEP and 1:10,000 AEP, Option B1 has an approximately 15% greater impact on this plant species population than the D2 and D3 Options. For floods of 1:10,000 AEP or less frequent, Option B1 provides greater protection to the *Hakea pulvinifera* population, than Option D2 and D3. The maximum impact on the population would occur during a PMF when, Options B1, D2, and D3 are estimated to result in the loss of 31%, 54% and 56% of the population respectively, with flood velocities estimated at between 3.1 metres per second for Option B1 and 3.6 metres per second for Options D2 and D3. However, by comparison, all three proposed dam safety options would reduce the potential maximum impact to this species, if no upgrade were to occur (i.e. for the existing dam, a probable maximum flood would result in dam failure and inundation of an estimated 68% of the population and floodwaters velocity of 8.1 metres per second).

Hakea pulvinifera is listed as Endangered under both the TSC Act 1995 and the EPBC Act 1999. This species has a conservation rating of 2Ei, which means that it is a species with a geographic range of less than 100 kilometres in Australia; it is an endangered species that is at risk of disappearing from the wild if present land use and other causal factors continue to operate; and less than 1,000 plants are known to occur within a conservation reserve(s).

A population of *Hakea pulvinifera* is located near the Namoi River below Keepit Dam, where it grows on a hard, rocky hillside. The Proponent conducted an impact assessment for this species, under the EPBC Act 1999 Significant Impact Guidelines. The assessment found that although the upgrade options could result in the long-term decrease in the size of the population, this occurrence is likely to be less severe with a smaller impact on this population (i.e. Option B1 would incur a smaller impact to this population as during an extreme food event floodwater will be discharged into the Peel River, not only in the Namoi (where this population mainly occurs)). It also found that fragmentation of the population is unlikely and the impact is unlikely to disrupt the breeding cycle of this population, as this species is thought to be clonal. This means that this species is capable of naturally producing independent offspring by means of vegetative growth (i.e. originating vegetatively not sexually).

During large floods, areas of potential habitat are likely to be significantly modified due to erosion and sedimentation and as a result, are likely to also become invaded by weed species. The Proponent however states that these impacts would be similar to the current situation (i.e. if no upgrade were to occur) and are unlikely to increase as a result of this proposal. This is since the proposal is actually reducing the extent of potential impact to this population.

The Proponent has however proposed mitigation measures to minimise the likelihood of weed invasion, particularly by noxious species. A weed management plan would be prepared and implemented for the construction and operational phases of the project. The Proponent therefore states that, through the development and implementation of this plan, the proposal is unlikely to result in significant invasion of weed species within the study area of this project. Furthermore, the Proponent finds that given flooding is a natural event and the proposal would decrease the level and velocity of floodwaters, the action is unlikely to interfere with the aim of the recovery plan for this species, i.e. to protect the population from factors that may result in accelerated or 'unnatural' decline.

The Proponent's impact assessment for this species determines that the proposal would not directly impact this population or result in an increase in likely impacts during a flood event. The proposal is unlikely to significantly interfere with the recovery of this species.

Submissions

Five submissions were received that addressed impacts to terrestrial ecology as a result of construction and operational impacts.

DECC noted that biodiversity offsets should be designed with regard to all vegetation to be cleared (not just endangered ecological communities), and with due consideration for the pre-European condition of that vegetation. For example, the re-establishment of species in areas now occupied grassland but where evidence indicates it was previously yellow box woodland. DECC also proposed amendments to the Proponent's commitment 25.2, to include explicit reference to the methodology for determining the offsets, i.e. reference to consultation with agencies.

Submissions from Lake Keepit Sailing Club and State Parks NSW (Lake Keepit State Park) indicated support for Option B1 and noted that this option would have least impact to vegetation areas, when compared to options D2 and D3.

The submission from the Community Reference Panel identified Option D3 as the panel's preferred option and stated that if option B1 were to be implemented, the impacted area would not be able to recover completely from the impact (cumulative vegetation impacts after construction and operation). It also indicated, among other reasons, that Option D3 should be selected as it would not impact prime agricultural land (operational impacts).

Gunnedah Shire Council's submission compared all three options in terms of actual risk to the environment (environmental impact). In its option ranking for impacts to terrestrial ecology (construction) it found that Option B1 had the least impact to terrestrial ecology during construction, as less hectares of White Box Yellow Box Blakely's Red Gum would need to be cleared and Options D2 and D3 could have 20% more good condition woodland affected than Option B1. Its options ranking for impacts to terrestrial ecology (operation) found Option B1 would have the least risk to terrestrial ecology from upstream impacts and the risk level of downstream impacts to terrestrial ecology would be the same as for Options D2 and D3. However it should be noted that Gunnedah Shire Council indicated support for Option D3 and found that overall Options D2 and D3 have a very similar risk level (approximately 73 units) and Option B1 had a 12 % greater risk level, compared to Options D2 and D3 (approximately 82 units).

The DEWHA provided the Department with advice regarding this matter. It stated that potential impacts on matters of national environmental significance appear to be adequately addressed in the Proponent's Environmental Assessment. It however noted it required further confirmation on the proposed process for determining the offset package. As discussed within this section above, the Proponent has further liaised with DEWHA regarding the offset package.

Consideration

Construction Impacts

The Department recognises that the construction footprint of Option B1 on the threatened White Box Yellow Box Blakely's Red Gum Woodland ecological community is less than that of Options D2 and D3. The Department believes that the impact to the terrestrial ecology, including to this woodland, can be mitigated through the preparation and implementation of an appropriate biodiversity offset package. The Department has recommended a condition of approval that requires the Proponent to develop and submit for the approval of the Director-General, a Biodiversity Offset Package, which must be developed in consultation with DECC and DEWHA. The aim of this package is to offset the loss of White Box Yellow Box Blakely's Red Gum Woodland and native grasslands and habitat for threatened fauna species which may be impacted as a result of this project.

The Department has also recommended a condition of approval that requires the Proponent to undertake monitoring of threatened species in and adjacent to the project footprint, which have been impacted by the project. The aim of the monitoring program is to set targets and assess the effectiveness of the mitigation measures identified in the offset package against those targets. The areas adjacent to the project footprint contain threatened plant species. These areas could provide a refuge to fauna, who would have otherwise resided in the construction footprint area. It is proposed that the monitoring have both a construction and post dam upgrade element to it, identify changes to habitat usage adjacent to the footprint (by both flora and fauna) and indicate where possible whether these are attributable to the project. It is intended that monitoring continue until it can be demonstrated that the mitigation measures are effective over a minimum of three consecutive monitoring periods. This method allows monitoring to be finalised on the basis of having achieved the desired outcome, rather than completing monitoring at an arbitrary point.

Upon review of the draft Director-General's Assessment Report and draft conditions of approval for the project, the DEWHA advised the Department that its primary concern in finalising its assessment is to ensure the provision of a suitable offset package for the loss of at least 13.6 hectares of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Woodland. The DEWHA is satisfied with the Department's recommended conditions however it is not prepared to grant approval of the project at this stage. The DEWHA has noted to the Department that it requires more certainty that the biodiversity offset can occur locally, in the vicinity of the project site. That is, the Proponent must finalise the biodiversity offset methodology prior to seeking written approval from the Commonwealth for the project.

The Department's recommended conditions require the Proponent to submit for the approval of the Director-General, a Biodiversity Offset Package, to be developed in consultation with the DECC and DEWHA. The Department will liaise further with the DEWHA when the Director-General is considering approving the Biodiversity Offset Package. The Department considers that during this time, DEWHA would be in a position to consider approval of the project under the EPBC Act 1999.

Furthermore, the DEWHA notes that the principles in its offset paper will be used in determining suitable offset areas. Accordingly, DEWHA does not object to potential offset sites being assessed using the NSW Biobanking methodology and the profile and number of credits determined in order to meet NSW legislative and approval requirements. The DEWHA notes that this methodology will not be used as the final determinant as to the suitability or otherwise of any particular site.

The DEWHA has also informed the Department that it is satisfied that potential impacts on other listed threatened species have been adequately addressed based on information in this report and on information provided by the Proponent during the assessment process.

Operation

The Department recognises that Option B1 would result in the least temporary upstream inundation and this would be unlikely to affect trees and result in temporary affects to aquatic habitat. It also recognises however that for downstream impacts during an extreme flood event, options B1, D2 and D3 are estimated to result in the loss of 31%m 54% and 56% of the *Hakea pulvinifera* population respectively. However for floods with frequencies between 1:2,400 AEP and 1:10,000 AEP, Option B1 has an approximately 15% greater impact on this population than Option D2 and D3. Therefore as noted by Gunnedah Shire Council, it is not clear whether one option is better or superior than the other.

Operation of the subsidiary dam spillway would have a highly negative impact on the area immediately below the spillway, over a length of approximately 2.5 kilometres (Options D2 and D3 would not affect this area). Land within the flow path of discharges from the subsidiary dam spillway would be eroded and there would be loss of riparian vegetation for approximately five kilometres along the Peel River, from below the subsidiary dam spillway to the confluence of the Namoi and Peel Rivers. Sedimentation from this scouring would affect riparian terrestrial habitats along the Peel River. The Proponent formed a panel of experts group, from across a number of fields to consider the issue of erosion and sedimentation impacts resulting from a 1:10,000 AEP flood event for Option B1, including a fluvial geomorphologist, a terrestrial ecologist, and a heritage representative from DECC. It found that:

- in terms of relative effects on the *Hakea pulvinifera*, Option B1 is a better option based on the hydraulic modelling results. This is because even though for floods with frequencies between 1:2,400 AEP and 1:10,000 AEP, Option B1 has a 15% greater impact on this population, during a PMF event, the loss of 31%, 54% and 56% of the population is estimated for Option B1, D2 and D3 respectively.
- activation of the subsidiary dam spillway, by Option B1, would result in a major impact to the area below the subsidiary dam wall , although at a very low frequency of occurrence;
- there would be loss of riparian vegetation in the lower Peel River, between the subsidiary dam wall and the Namoi confluence, for flood events less frequent than 1:10,000 AEP;
- the currently available information in literature suggests that the Peel River instream habitat is highly degraded; and
- the operation of Option B1 would fundamentally change the local terrestrial and aquatic environments which is avoidable through the selection of another option (i.e. D2 or D3). The aquatic environment is unlikely to be materially affected in a flood more frequent than 1:10,000 AEP.
- No overall conclusion was formed by this group in terms of impacts to terrestrial ecology. It noted however, that the effect of a release from the subsidiary dam wall would be very small or insignificant in a

regional sense, given the scale of flooding and erosion processes which would occur in both the Namoi and Peel Rivers. Also the additional impacts between the subsidiary dam wall spillway and the Peel River would only occur at a very low flood frequency (less than 1:10,000 AEP).

The Proponent also commissioned an independent consultancy firm to estimate an erosion budget from the catchment upstream of Keepit Dam during a flood of 1:10,000 AEP and a PMF event was prepared to enable an estimation of downstream sedimentation impacts associated with the operation of a subsidiary dam spillway (i.e. Option B1). These estimates were considered at the expert panel workshop prior to the Proponent assessing the likely impacts.

The probable maximum sediment discharge for a PMF event was estimated to be 3,500,000,000 cubic metres and, for a flood of 1:10,000 AEP, 600,000,000 cubic metres (or 0.14 metres eroded on average across the entire catchment). The relative contribution of erosion resulting from the operation of Option B1 represents about 0.5 per cent of the expected total erosion budget for a 1:10,000 AEP event. The Proponent states that this was not considered significant by the panel, except in a local context. Further iterations of the calculations found that the relative proportion of erosion from operation of the downstream spillway of Option B1 represents only approximately two per cent of the total sediment moving though the dam. Therefore based on this and other findings, the panel concluded that the contribution to erosion from Option B1 would only represent a very small proportion of the sediment mobilised and at a regional scale, the effects would be insignificant.

The Department agrees with the expert panel that the impact to the downstream area (the Peel River) can be avoided through not implementing Option B1. The area below the Option B1 subsidiary dam wall, along the Peel River, contains riparian vegetation (to the confluence of the Namoi and Peel Rivers). However even though sedimentation from the potential scouring would affect the riparian terrestrial habitats along the Peel River, these habitats are highly degraded at present. The Proponent's field investigations revealed that the riparian vegetation is not extensive as it is within the lower Namoi River, and bank erosion is much more prominent. The sampling site at approximately three kilometres upstream of the Namoi and Peel Rivers confluence did contain both cobble stone riffle and pool habitat, however riparian vegetation was largely absent and banks were vegetated with grass species only, and very few aquatic macrophytes were present in this area. The Department finds that the cumulative benefits of Option B1, including the need to clear less native vegetation during construction, outweighs the local impacts to the downstream environment between the subsidiary dam wall and the Peel River, should an extreme flood event occur.

5.2 Aquatic Ecological Impacts

Issues

The project site contains four existing aquatic habitat areas:
1. Lake Keepit
2. Namoi River: Upstream of Lake Keepit
3. Namoi River: Downstream of the main dam wall; and
4. Peel River: Downstream of the subsidiary dam wall.

Water quality and macroinvertebrate sampling was conducted by the Proponent for 21 sites (nine sites downstream of Keepit Dam, which included the Peel River; ten sites in Lake Keepit; two sites in Namoi River upstream of Lake Keepit), in accordance with the *Australian River Assessment System (AUSRIVAS) Sampling and Processing Manual*. The Proponent found that aquatic habitats in the Peel and Namoi Rivers below the dam wall were generally degraded by land clearing and grazing impacts, which have resulted in reduced riparian vegetation, increased erosion and the introduction of exotic vegetation.

However, all the four existing habitat areas were classified as Class 1 – major fish habitat and aquatic habitats. The Peel and Namoi Rivers below the dam contained numerous important habitat features in the study area, including riffle/pool sequences, deep pool refuges, native riparian vegetation, beds of aquatic macrophytes, large snags (large woody debris) and a variety of stream substrata. The Namoi River upstream of Lake Keepit also consists of a variety of habitats, including long deep pools and rapid flow over cobble bed riffles. Riparian vegetation is highly variable and included areas containing extensive native trees along the banks, while other areas contained significant introduced species, such as willow or have been extensively cleared. Lake Keepit, a large artificial water body created by the flooding of the Namoi River (following the construction of the existing

Keepit Dam), contains extensive aquatic habitat, including snags which support a variety of aquatic fauna, rocky outcrops, deep holes and extensive shallow areas.

The main construction impacts on the aquatic habitat and biota are associated with mobilisation of sediment from earthworks into the main water body of Lake Keepit or into the Peel and Namoi Rivers downstream of Keepit Dam. The end result of these impacts can be summarised as follows:

- reduction of water quality including increased turbidity and increased nutrient levels;
- increased turbidity within Lake Keepit may result in reduced light penetration and therefore lead to the reduction of aquatic macrophytes and alter existing aquatic habitat;
- increased nutrient levels may encourage algal growth and therefore may instigate toxic algal blooms; and
- increased sedimentation within water courses which may result in the reduction of available deep water refuge areas for aquatic biota and the smothering of important habitat features.

The Proponent states that these potential impacts can be effectively minimised or mitigated by the incorporation of standard measures during the construction stage. These include placing sediment fences or using other erosion prevention devices between construction work areas and waterbodies to prevent sediment runoff; using a floating silt curtain or other techniques to prevent sediment dispersal for works occurring below the waterline of Lake Keepit; and revegetating disturbed areas following the completion of construction. The Proponent has committed to prepare, in consultation with DECC, DWE and Gunnedah Shire and Tamworth Regional Local Councils, a Soil and Water Quality Management Sub Plan (as a component of the Construction Environmental Management Plan), which would detail all the mitigation measures. Where relevant, this Sub Plan would be consistent with Landcom's (2004) guideline *Managing Urban Stormwater – Soils and Construction* and the Road and Traffic Authority's *Guidelines for the Control of Erosion and Sedimentation in Roadworks*.

The Proponent conducted assessments of significance for the potential impact of the proposal on threatened species, populations and ecological communities listed under the *NSW Fisheries Management Act 1994* (FM Act 1994), which have a distribution that may include the project area. Assessments which considered both construction and operational impacts, were conducted in accordance with the heads of consideration as specified in the DECC's *Threatened Species Assessment Guidelines* (2007). The following species, populations and ecological communities were assessed:

Endangered Species

River snail (Notopala sublineata)

Although the River snail is currently considered to be extinct within the study area, potential habitat within the Peel and Namoi Rivers downstream of the dam upgrade, does exist. A recovery plan for this species has been produced by NSW DPI (2007), and therefore these habitats could be considered as important for the River snail, if a reintroduction program within this area was to be incorporated into the recovery plan for this species. Due to this reason, an assessment of significance has been undertaken as a precautionary approach.

Living specimens of the River snail have only been recently found within artificial environments such as irrigation pipelines. As such, the Proponent finds that the potential impacts from the proposed dam upgrade including possible limited increased sedimentation during construction, and possible flow modification during operation, will not have an adverse effect on the existing habitat of this species. This is because there will be no direct or indirect impact upon the artificial habitats such as irrigation pipelines resulting from the upgrade. However the Proponent states that in the unlikely event that an unidentified population does exist, or that a reintroduction program is undertaken within the study area, mitigation measures proposed in the Environmental Assessment, to minimise sediment runoff and erosion would minimise changes to this habitat.

The Proponent also finds that the proposed sediment control measures enables the upgrade to be consistent with the objectives or actions of the recovery plan for this species, produced by NSW DPI in June 2007. I.e. "*protect habitats known to support, or with the potential to support river snail population.*"

One Key Threatening Processes (KTP) under the FM Act 1994, relevant to the upgrade is the removal of large woody debris. The Proponent has included recommendations for this action in the Environmental Assessment, which include where possible, avoiding removal of trees and temporarily moving any debris or dead logs within construction areas to an adjacent area outside the construction area to minimise loss of habitat. Both the Flora and Fauna Management Sub Plan and the Soil and Water Quality Management Sub Plan would contain measures and protocols for this action. The Proponent states that adhering to the measures will greatly minimise

or altogether avoid the temporal and spatial extent of any impacts from the removal of large woody debris. Therefore the action is not considered as a KTP or to result in the operation of, or increase the impact of, a KTP.

The degradation of native riparian vegetation along NSW water courses is also a KTP under the FM Act 1994. The Proponent has made specific recommendations to avoid the removal of native riparian vegetation, and presented protocols for the minimisation of this impact in circumstances when removal of native riparian vegetation is unavoidable for the required works. For example, the Proponent has stated that in cases where native riparian vegetation must be removed, following the required activity, revegetation with appropriate native species be undertaken. Erosion control and management of weeds are also measures to be undertaken by the Proponent and as such, the incorporation of these measures will greatly minimise the impact of the degradation of native riparian vegetation. As such, the proposed action is not considered as a KTP or to result in the operation of, or increase the impact of, a KTP.

The construction of new spillways will result in the alteration of existing flows and instream structures and other mechanisms that alter natural flows which are a KTP under the FM Act 1994. The Proponent however states that flows within the potentially impacted reaches of the Namoi and Peel Rivers downstream of these new spillways are already in a highly modified state due to the existing dam, and irrigation releases into these rivers. As such, the proposed upgrade is not considered to have a significant impact on natural flows in the context of the existing highly modified flow regime. Therefore the proposed action of upgrading the dam is not considered as a KTP or to result in the operation of, or increase the impact of, a KTP.

The Proponent concludes that the proposal does not pose a significant threat to a potential population of the River snail, provided the Proponent's recommendations for mitigation of impacts during construction are incorporated into the management of the upgraded dam.

Purple spotted gudgeon (Mogurnda adspersa)
The reaches of the Namoi and Peel Rivers potentially impacted by the proposal incorporate the historical distribution of the listed endangered population of the Purple spotted gudgeon. Bionet search and the DECC threatened species website revealed no records for this species within the Namoi CMA. However there is potential habitat for this species to exist in the mid to lower regions of the Namoi Catchment. As noted in section 2.1 of this report, the Proponent would be considering the provision of fishways at the three downstream weirs in the Namoi Catchment (Mollee, Gunidgera and Weeta) as separate projects, and not part of this particular Dam Upgrade proposal. DPI has advised that providing fishways at the three downstream weirs in the Namoi Catchment would be more beneficial than constructing a fishway at Keepit Dam. This is because the cost of construction of a high level fishway at Keepit Dam will likely exceed the potential benefit to the migratory fish community at the Namoi River. Also the lower areas of the Namoi Catchment, that do not include sites immediately surrounding the proposal study area, contain better assemblages of fish species.

Although this species is considered to be highly unlikely to be present within the study area, there is potential appropriate habitat within the reaches of the Peel and the Namoi Rivers downstream of the proposed dam upgrade. Due to the existence of appropriate habitat for this species, an assessment of significance was conducted as a precautionary approach.

In an unlikely event that an unidentified population exists, or that a reintroduction program is undertaken within the study area, the Proponent's proposed mitigation measures to minimise sediment runoff and erosion, and large wood debris management, would minimise any negative impact on this species lifecycle resulting from habitat modification. Rapid flow fluctuations from dams can cause reproduction and recruitment impacts to this species. The Proponent states that current operation of Keepit Dam results in some rapid river level fluctuations, however this is an existing situation and outside the scope of the proposed upgrade.

The same KTPs identified and the conclusions drawn in the significance assessment of the River snail, also apply to this species. The Proponent concludes that the proposal does not pose a significant threat to this species, provided the Proponent's recommendations for mitigation of impacts during construction are incorporated into the management of the upgraded dam.

Endangered Populations

Olive perchlet (Ambassis agassizii)

The western population of the olive perchlet was historically distributed throughout much of the Murray-Darling drainage of NSW and southern QLD, however it is now restricted to a few sites within the Darling River system. The reaches of the Namoi and Peel Rivers potentially impacted by the proposal incorporate the historical distribution of the listed endangered population of the Olive perchlet. From the Proponent's database search (Bionet), only one record of this species within the Namoi River at Walgett (Namoi-Barwon River confluence) was revealed, and this predates the year 1920. This species is known to exist within the Namoi Catchment Management Authority region, however not within the sub-regions that incorporate the study area (i.e. Liverpool Plains and Peel). Due to the existence of appropriate habitat for this species, an assessment of significance was conducted, as a precautionary approach.

The assessment found that the potential impacts from the proposal including habitat degradation through sedimentation and snag removal during construction, and possible flow modification during operation, will not have an adverse effect on the life cycle of the species. However the Proponent noted that in an unlikely event that an unidentified population exists, or that a reintroduction program is undertaken within the study area, its proposed mitigation measures to minimise sediment runoff and erosion, and large wood debris management, would minimise any negative impact on this species lifecycle resulting from habitat modification. The Proponent states that cold water releases and rapid flow fluctuations from dams have been identified as causing spawning failures in this species. Current operation of Keepit Dam incorporates cold water releases and rapid river level fluctuations, however the Proponent states that this is an existing situation and outside the scope of the proposed upgrade. The same KTPs identified and the conclusions drawn in the significance assessment of the River snail, also apply to this species.

The Proponent concludes that the proposal does not pose a significant threat to a potential population of the Olive perchlet, provided the Proponent's recommendations for mitigation of impacts during construction are incorporated into the management of the upgraded dam.

Vulnerable Species

Silver perch (Bidyanus bidyanus)

The reaches of the Namoi and Peel Rivers potentially impacted by the proposal incorporate the historical distribution of the Silver perch. A search of Bionet and DECC's Threatened species, populations and Ecological Communities of NSW website, revealed ten records for this species within the Namoi CMA since the year 2000, from DPI surveys. The closest of these to the proposed works associated with this upgrade, were within Lake Keepit, downstream in the Namoi River near Carrol, and upstream in the Manilla River at Split Rock dam. The Proponent has referred to DPI's fish stocking database, and has found that major stocking of silver perch has been undertaken in Lake Keepit in recent years for recreational fishing.

The Proponent states that the presence of stocked silver perch in the immediate vicinity of the proposed works is known, and it is considered possible that a non-stocked population may be present within the Namoi River immediately downstream of the existing dam and within the Peel River forming part of the study area of this proposal. Therefore an assessment of significance has been undertaken for this species. The Proponent believes that the proposed management and mitigation measures it has proposed including sediment control measures, enables the upgrade to be consistent with the objectives of the recovery plan for this species, produced by NSW DPI in 2006.

The same KTP's identified and the conclusions drawn in the significance assessment of the River snail, the Olive perchlet, and the Purple spotted gudgeon also apply to this species. The Proponent concludes that proposal does not pose a significant threat to populations of Silver perch (stocked or natural) that exist within the study area, provided the Proponent's recommendations for mitigation of impacts during construction and operation are incorporated into the management of the upgraded dam.

Endangered Ecological Communities

Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River

The River snail, the Olive perchlet, the Purple spotted gudgeon, the Silver perch, and the Murray Cod are all part of this listed endangered ecological community. This ecological community has been listed as endangered under the FM Act 1994, in recognition of the extensive and significant modification of the Darling River and its tributaries

since European settlement. The regulated tributaries of the Darling River including the Namoi and Peel Rivers within the study area for the proposal are part of this endangered community. Therefore an assessment of significance was conducted for this community.

It was found that Keepit Dam is likely to have historically had a significant adverse effect on the extent of and composition of the local occurrence of the Lowland Darling River Aquatic Ecological Community, as a result of:

- habitat fragmentation;
- flow regulation;
- cold water pollution; and
- habitat inundation, loss and degradation.

The Proponent has found that provided its recommended mitigation measures are implemented into the construction and operation of the upgraded dam, the proposal will not further exacerbate these problems nor will it rectify them. As such, the local occurrence of this community is unlikely to be placed at further risk of extinction because of the proposed works required for the dam upgrade.

The potential impacts to this community from the dam upgrade include limited increased sedimentation, degradation of riparian vegetation and removal of snags during construction and possible flow modification during operation. The Proponent finds that the incorporation of its proposed mitigation measures to minimise sediment runoff, snag removal, riparian disturbance and erosion would minimise or eliminate changes to this habitat. As such, the Proponent states that the extent to which habitat is likely to be removed or modified as a result of the upgrade is considered negligible.

The same KTPs identified and the conclusions drawn in the significance assessment of the River snail, the Olive perchlet, the Purple spotted gudgeon, and the Silver perch also apply to this community. The Proponent concludes that the proposal does not pose a significant threat to the lowland Darling River ecological community that exists within the study area, provided its recommendations for mitigation of impacts during construction and operation are incorporated into the management of the upgraded dam.

Vulnerable species listed under the EPBC Act 1999

The following two species associated with the proposal study area are listed as vulnerable species under the EPBC Act 1999, and therefore the Proponent conducted impact assessments for these species:

Murray Cod (Maccullochella peeli)

Populations of Murray cod exist within the Namoi River, up and downstream of Keepit Dam, in the Peel River and within the dam storage. It is unclear whether the fish represent natural populations or have been stocked. The existing Keepit Dam represents an absolute barrier to fish passage, regulates environmental flows and releases cold water downstream. The Proponent states that these continuing impacts will not be altered by the upgrade and therefore are not considered as part of the current proposal upgrade. The key threats to this species as a result of this proposal include the potential increase in sediment loads in downstream watercourses. The Proponent has recommended the following mitigation measures during construction:

- prevention of sediment entering the main body of Lake Keepit and the Namoi and Peel Rivers, through the use of sediment fences or bunding between earthworks and waterbodies;
- where sediment fences are not appropriate, sediment dispersal within the lake should be contained within a limited area in the vicinity of works by the use of a floating silt curtain;
- revegetation of disturbed areas such as access roads and stockpile sites following completion of construction to prevent ongoing erosion and resultant runoff into the Namoi and Peel Rivers and Lake Keepit; and
- where possible, to conduct work during periods of low rainfall and river flow.

The Proponent finds that if its suggested safeguards to mitigate sediment mobilisation are implemented for construction, then the proposal is unlikely to cause a long term impact to this species. During extreme flood events, Option B1 would result in a significantly greater volume of eroded sediment than the other options due to more susceptible soils found downstream of the subsidiary dam wall spillway. However the Proponent noted that the impacts of this increased erosion would be restricted to the Peel River downstream to confluence of the Namoi River. Beyond this point, sedimentation impacts from Option B1 would be indistinguishable from the other options.

Namoi River Turtle (Elseya bellii)
The Namoi River Turtle inhabits watercourses of the upper Namoi River catchment. It has been recorded in the narrow upper reaches of the Namoi and MacDonald Rivers, above 700 – 800m ASL, and although it is found only at a few sites, it is relatively abundant when present. Keepit Dam lies at an elevation of approximately 300m ASL. The maximum design level of inundation upstream under present conditions is 333.5m AHD, which would not increase appreciably following the upgrade, as the greatest initially proposed change to dam wall height is an increase of 5.5m under Option D3. The Proponent therefore finds that the Namoi River Turtle does not reside in watercourses potentially impacted by the proposed upgrade. The Proponent notes that the NSW TSC Act lists this species as occurring only in the Eastern Nanewars sub-section of the Namoi Catchment, upstream of the Keepit Dam. Therefore the Proponent determined that the proposal is unlikely to have an impact on this species, as it does not appear to inhabit or utilise any potentially affected sites.

Submissions

In Gunnedah Shire Council's Options Ranking Comparison, it found that there is potential for water quality and aquatic ecology impacts during construction, however any impacts would be the same for all options (B1, D2 and D3) and are considered to be manageable through implementation of the Proponent's proposed mitigation measures. It also found that the relative scale of impact was small and the chance of an impact was low.

The submissions from landholders and Namoi Water all showed concern for the potential scale of erosion and sedimentation that would be caused by Option B1, during a very large to extreme flood event. This erosion and sedimentation would subsequently impact the water quality of the rivers which may therefore affect aquatic habitats.

Consideration

The Department is satisfied that the impacts on aquatic biota can be effectively minimised or avoided by the implementation of the Proponent's proposed construction management and mitigation measures. The impacts from the main construction works associated with the dam upgrade (peninsula reshaping, construction of the right-hand abutment spillway and dam wall rising, the subsidiary dam wall raising and the construction of the subsidiary dam wall spillway and the construction of a saddle dam at the boat ramp, sailing club and caravan park) could result in runoff of sediment into the water bodies and negatively impact the aquatic habitats and biota. The Department agrees with the Proponent's proposed management and mitigation measures for the impacts that can result from the works. These measures are summarised below:

- the prevention of sediment from entering the Peel River, Lake Keepit and lower Namoi River during the relevant construction works. The Proponent would achieve this by utilising sediment fences or bunding between earthworks, stockpiles and access roads and the natural drainages to the river.
- revegetation of disturbed areas such as the access roads and stockpile sites following completion of construction of each component (e.g. spillway construction), to prevent ongoing erosion and resultant runoff into relevant water body.
- where practical, works should be undertaken when the storage is at a level that will minimise impacts, and this may require a lowered maximum storage level during the construction and stabilisation period.

To ensure that the potential aquatic ecology impacts of the project can be managed, the Department has recommended that the Construction Environmental Management Plan (CEMP) detail the measures described in the Environmental Assessment to minimise the impacts to water quality, by way of a Water Management Sub Plan. The Proponent would be required to outline the measures that will be employed to manage water on the site, to minimise soil erosion and the discharge of sediments and other pollutants to lands and or water courses throughout the construction stage of the project. The Proponent is also required to detail in the CEMP, the measures to monitor and minimise soil erosion and the discharge of sediment and other pollutants into local waterways or land during construction.

Similarly, the Department recommends that the Proponent be required to submit an Operation Environmental Management Plan (OEMP) for the approval of the Director-General no later than 12 months from the date of approval being granted (or as otherwise agreed to by the Director-General). This would detail the specific consideration of relevant measures to address any requirements in the Environmental Assessment documents and detail the overall environmental policies and principles to be applied to the project's operation. The Proponent proposes to incorporate design solutions to reduce the effects of erosion by the operation of the spillways. This

would reduce the velocity of the floodwaters leaving the spillway, and therefore reduce the amount of erosion. However alternatives would also be sought where design solutions are not feasible due to topography and geology constraints, e.g. the alternative of lining the spillway with concrete or other options. The Multi-Level Offtake Operational Plan is required to be submitted as part of the OEMP. This would detail the operation of the multi-level offtake, including operating conditions to improve the quality of the downstream waterways.

The construction impacts to aquatic ecology would be the same for all options and are considered to be manageable through the implementation of the Proponent's proposed mitigation measures and the Department's recommended conditions of approval. Option D3 with the highest wall raising would result in the greatest temporary upstream inundation during a very large to extreme flood event, whereas Option B1 would have the least upstream impact as it will inundate the least amount of area and be of minimum duration (1,085 hectares inundated for 60 hours, compared to 1,485 hectares for 75 hours and 1,795 hectares for 90 hours for options D2 and D3 respectively). As noted by Gunnedah Shire Council, the estimated volume of erosion occurring in the upstream catchment during an extreme flood event is 600 million cubic metres. Option B1 would contribute to an increase of 3 million cubic metres resulting from erosion of some 7.5 kilometres of floodway downstream of the subsidiary dam wall. This represents between 0.5 percent and 5 percent of the total estimated volume of erosion and if considered in the context of the overall sediment load, is minimal. However the local effect of this erosion on the landscape would be substantial and irreparable.

The Department notes that the volume of erosion and sedimentation from al options, including the additional load from Option B1, cannot be readily mitigated. However the potential amount of erosion and sedimentation may be reduced as a result of detail design solution investigations. The Department also notes that the operation of the spillways would not commence until a very large to extreme flood event (1:2,400 to 1:10,000 AEP) and the estimated frequency of the Keepit Dam PMF is expected to be a low as 1:500,000 AEP. This means that the operational impacts of the upgraded dam are highly unlikely to occur at the completion of construction and are unlikely to occur during the approximately 200-year life of the dam, if at all.

The Department believes that provided the Proponent implements all the nominated environmental commitments, its recommended impact minimisation measures, and the Department's recommended management measures in the conditions of approval, the impacts to aquatic ecology can be mitigated during construction and minimised during operation.

5.3 Impacts on Property and Land Use

Issues

The Proponent used a hydraulic software model (Mike-11) to model the downstream effects of the three dam safety upgrade options. The model indicated that flood attenuation increases with distance downstream of the dam. The confluence of the Peel and Namoi Rivers, approximately 13 kilometres downstream of the Keepit Dam main dam wall, was the farthest downstream point at which the relative performance of the options could be assessed by the Proponent. This therefore formed the downstream extent of the options assessment. The model also illustrated that, when comparing the dam failure and the dam upgrade options, the resulting depth of floodwaters at the confluence of the Peel and Namoi Rivers differed only by approximately 300 millimetres, i.e. the depth of the floodwaters during operation of the upgraded dam would be slightly less than if dam failure were to occur. This means that this difference is not significant in hydraulic terms, and the Proponent states that this is well within the range of accuracy of the software model. The conclusion drawn from this result is that Keepit Dam, both with and without the dam safety upgrade, is inherently unable to provide mitigation measures for extreme flood events, due to the relatively vast size of the PMF compared to the small size of the existing storage. The Proponent also states that while engineering options could be developed to achieve mitigation of extreme floods, the options analysis process conducted indicated that these are either not technically feasible or prohibitively expensive.

Downstream Inundation

Figure 7 and Figure 8 show the extent of downstream inundation predicted for all three safety upgrade options under a PMF scenario. The dam failure scenario is also shown for reference. When compared with the 'do nothing scenario', i.e. dam failure, changes in downstream inundation resulting from the dam safety upgrade options are generally beneficial. All options are predicted to result in a reduced area of downstream inundation compared to the dam failure scenario. Section 2 of this report details the changes to the frequency of flooding compared to the existing situation.

Figure 7 - Flood Mapping for all Options (1:10,000 AEP Flood Event)

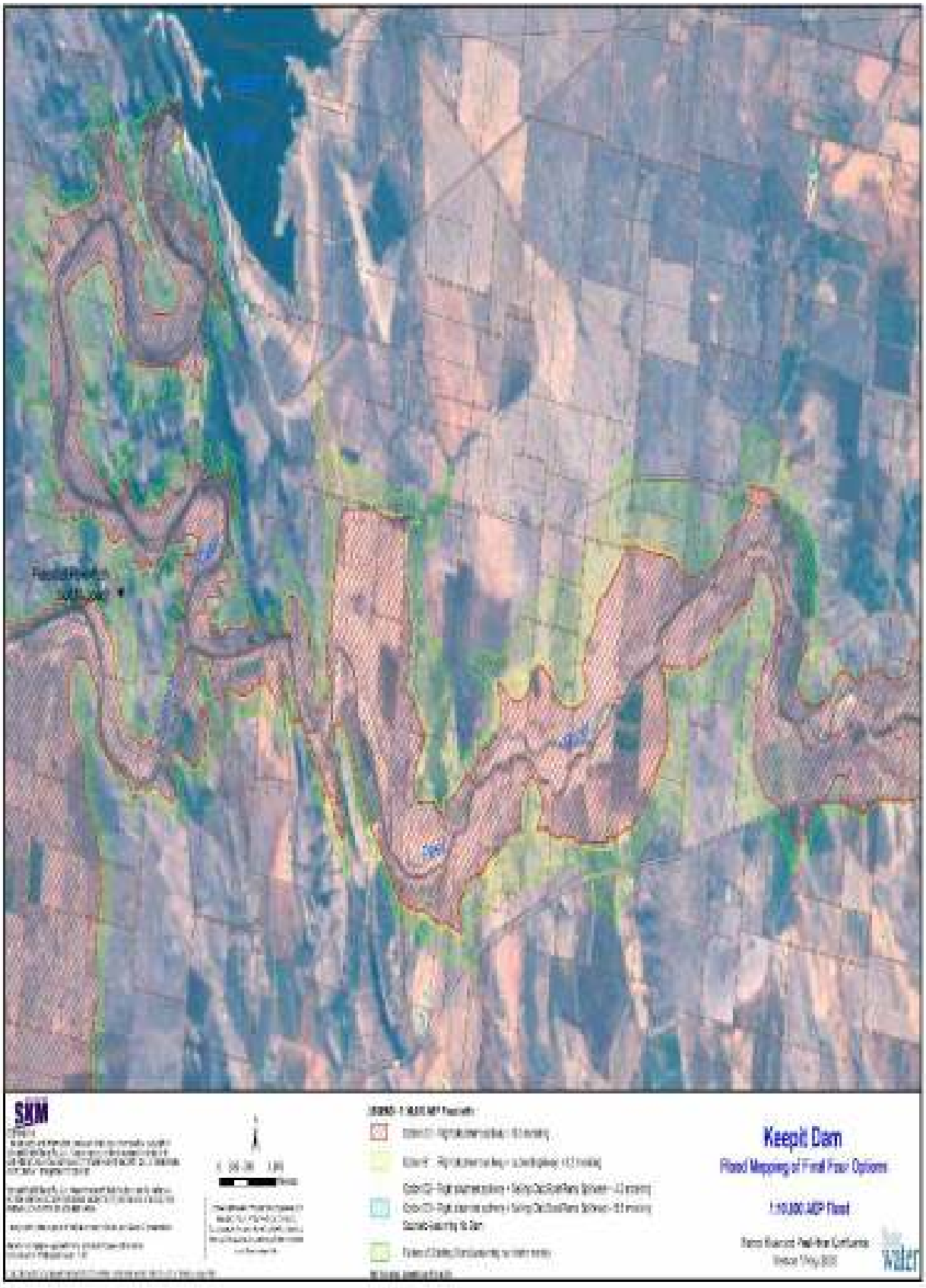
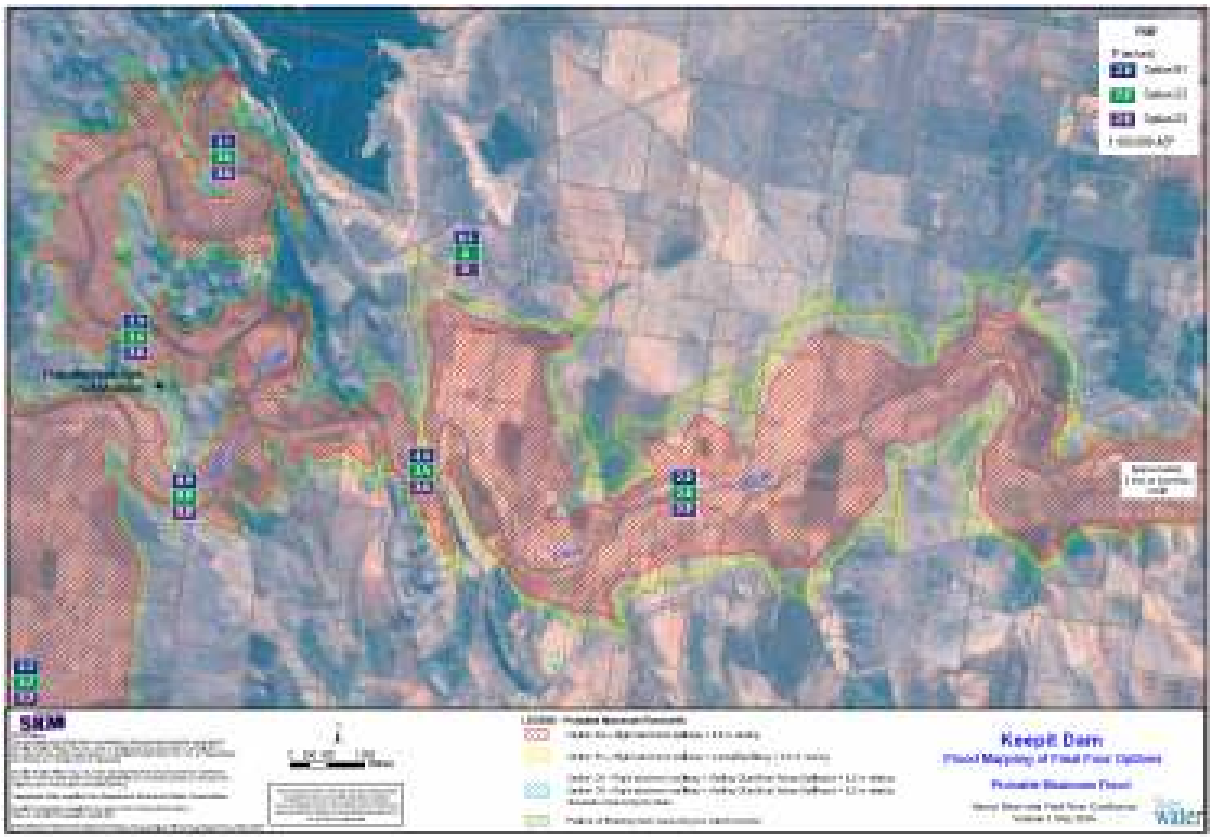


Figure 8 - Flood Mapping for all Options (PMF)



The operation of Option B1 is predicted to result in impacts to public infrastructure around the perimeter of the dam. For floods larger than approximately 1:10,000 AEP, the operation of the subsidiary dam wall spillway would result in inundation of the Lake Keepit State Park sewage treatment plant and golf course, a section of Keepit Dam Road within the State Park, and an area between the subsidiary dam wall and the Peel River currently used for grazing/ and agriculture. The sewage treatment plant would be entirely destroyed and more than half the golf course destroyed in the event of a spillway discharge. The Proponent states that the affected infrastructure would require repair or replacement following operation of the subsidiary dam wall spillway. The operation of this spillway will also affect an area of privately-owned land several hundred metres wide along a distance of approximately 2.5 kilometres between the spillway and the Peel River. The affected land is currently used for grazing/agriculture.

Option B1 would also result in a majority of floodwaters in floods larger than 1:10,000 AEP being discharged into the Peel River which is not the natural course of water from the Keepit Dam catchment. The existing subsidiary dam wall will be converted into an auxiliary spillway and flooding related damage on up to 16 downstream properties could be worsened as a result of high velocity flood flows along the Peel River. For note, for floods larger than approximately 1:10,000 AEP for Options D2 and D3, the operation of the sailing club spillway and the boat ramp spillway, would result in the inundation of a section of Keepit Dam Road in Lake Keepit State Park.

Upstream Inundation

The proposal may, subject to detailed survey, potentially result in temporary inundation of areas of Manilla Ski Gardens Caravan Park, the Lake Keepit Sport and Recreation Centre, Lake Keepit State Park, and a number of rural properties. The rise of floodwaters is expected to allow sufficient time for evacuation (if necessary). The Proponent states that the effects of inundation on these facilities may include the accumulation of settlement.

Compensation

The Proponent states that it would compensate individual land owners, only if it is statutorily obligated to do so or in its compete discretion, for damage incurred to any structures arising from inundation, should a large to extreme flood occur. This would be implemented in lieu of any upfront compensation, in view of the remote chance of

occurrence if such an event. The Proponent states that it has discussed this approach with various landowners and facilities managers that could be affected by the upgrade and has received in-principle agreement.

The Proponent has committed to rectify, where liable, any property or building damage caused directly or indirectly by the operation of the project, at no cost to the property owner(s). Alternatively it may negotiate just compensation for the damage with the property owner.

It will compensate landholders for any action, liability, claim or demand for insurance-related loss arising from proposal, only if it is legally obliged to do so and only if the statutory immunity contained in the *Water Management Act 2000* (NSW) is not available in relation to any such actions, claim or demand. The Proponent also states that, in its complete discretion, it may elect to compensate landholders on a case by case basis for insurance-related loss.

The Proponent considers that any payments contemplated, beyond any legal liability to pay, could only be considered on an ex gratia basis, which is consistent with the Treasury Circular TC 05/05 (contained in Appendix F of the Proponent's Submissions Report). The Proponent considers that ex gratia payments are entirely discretionary in nature and that it is entirely for itself to determine those cases in which such payments will be made. It has further stated that there are no formal or mandatory criteria for determining when such payments should be made and it will apply the principles set out in the TC 05/05 with respect to the consideration of ex gratia payments.

Submissions

Tamworth Regional Council states that should option B1 be adopted, it would expect any damage to the Keepit access road and associated infrastructure to be reinstated by the Proponent. Gunnedah Shire Council states that those persons whose properties may suffer damage from an extreme flood event, should be fully protected in terms of compensation and that legal provisions be instituted to protect them from such an event being considered an operational activity of the dam. It also requests that the NSW Government be responsible for replacement of Council roads and other community infrastructure under Council's control and guarantee reinstatement of release plugs following a release based timetable established prior to construction.

The Lake Keepit Sailing Club supports Option B1, as it would have the least impact on the Sailing Club. It also noted that should damage occur to the Sailing Club, the Proponent must be obligated to remediate such damage to the satisfaction of the Sailing Club, and the Minister must include this guarantee in any approval.

The Lake Keepit State Park supports Option B1 however requires compensation from the Proponent and associated bodies for any alterations to park facilities and infrastructure or adverse effects to trade and income earning capacity brought on by the dam for both the short and long term. It notes that Option B1 will have the least detrimental effects on its facilities, thereby requiring less compensation to be required. It also has requested that all critical park infrastructure including the Sewage Treatment Plant and access road be rectified immediately following a very large to extreme flood event.

The Department of Water and Energy advises that upstream inundation has the potential to impact on existing pump sites operated by water users. It therefore requests the Proponent to ensure that these users are identified in further detailed studies and develop mitigation measures for the identified impacts.

Four submissions were received from landholders, which raised issues relating to property and land use during operation of the dam, including:

- compensation for any damages caused by the operation of the project; and
- raised the issue of social equity of the upgrade option and possible compensation for impacts which benefit the broader community.

The Community Reference Panel notes that private land inundated by the upgrade will reduce in value and the ability to secure insurance for the property will be affected. It therefore recommends that this issue be recognised by the Proponent and, where sought by landowners, the Proponent should provide adequate upfront compensation including easements and purchase and lease back arrangements for properties downstream of the subsidiary dam wall.

Consideration

Construction

The Department is satisfied with the Proponent's commitment to develop, in conjunction with the Lake Keepit State Park Trust and local clubs, a Master Plan of Lake Keepit State Park to minimise and manage construction and operational impacts to the State Park. The Master Plan would contain measures to relocate facilities and services that would be either directly or indirectly affected by construction, e.g. impacts to caravans in the Gums Caravan Park and other identified facilities.

Operation

The proposed Master Plan of Lake Keepit State Park would also identify all other actions including the reinstatement of facilities and services affected, impact offsets including compensation negotiated, emergency management facilities and plans, land tenure issues and overall strategic approach. However this Master Plan would not take into account facilities that are not part of the Lake Keepit State Park.

The Proponent has stated in the Submissions Report, that it will compensate landholders only if it is legally obliged to do so, and only if it has no statutory immunity under the *Water Management Act 2000.*This includes all areas potentially affected by the operation of the project. However the Proponent has also stated that it may elect, in its complete discretion, to compensate landholders on a case by case basis for insurance-related loss. Similarly, it may, on a case by case basis, compensate landholders and other parties for the physical damages caused by floodwater releases and other effects. The Department required the Proponent to clarify its reference to 'on a case by case basis', i.e. what determining criteria would be used for impacts relating to insurance matters and non-insurance related matters (e.g. physical impacts that are not normally covered under insurance, such as extensive degradation of a paddock due to an extreme flood event).

The Proponent provided an explanation in the Submissions Report on it choosing to compensate on a case by case basis. The Department appreciated the inclusion of the Treasury Circular (NSW TC 05/05), explaining ex gratia payments (also known as act of grace payments), which states that there are no formal or mandatory criteria for determining when such payments should be made. However the Department finds this additional information does not clarify the Department's issue, as the Proponent should still be able to illustrate, regardless of there being no formal criteria, the actual criteria or process it may use to judge whether compensation should be granted.

Therefore the Department has recommended a condition of approval that requires the Proponent to form, prior to the commencement of construction, and maintain (until its purpose has been achieved), a Compensation Liaison Group. This Group is required to include the Proponent, representatives from DWE, Council and affected landholders. The aim of this Group would be to:

- identify those landholders actually affected by the operation of the proposal;
- form the criteria to be used to determine ex gratia payments; and
- determine the need, if found necessary and appropriate, for a public liability insurance fund.

The Department believes that the use of this Group would assist the Proponent in quantifying the possible extent of damage to property from the operation of the upgraded dam and forming criteria that would assist in determining compensation. It will also provide opportunities for affected parties to be involved in the process of determining the criteria and providing input on the management of operational impacts.

5.4 Water Supply Security and loss of Storage

Issues

The operation of the spillways for Option B1 would result in a temporary loss of storage capacity of 30 percent from Lake Keepit until the release plugs are rebuilt. The time required to rebuild these release plugs is stated to be approximately 12 months.

Submissions

Namoi Water does not support preferred Option B1 based on several issues, including the loss of storage capacity. Gunnedah Shire Council noted that the operation of Options B1 and D2 would result in a temporary loss of storage below full supply level until release plugs are reinstated and inflow of sufficient water to restore the storage to full supply level occurs.

Consideration

For a storm larger than 1 chance in 2,400 each year, Options B1 and D2 are designed so that if a release plug activates, the water released through the auxiliary spillways would include a portion of the full supply level storage (30% and 15% respectively). The concern is whether there would be changes in water availability or security in the period immediately following a very large to extreme flood event, e.g. should a drought occur after the flood event. Based on the Proponent's assessment, it is estimated that the chance that irrigation water availability would be affected following a large flood that triggers a temporary loss of storage at Keepit Dam for Options B1 and D2 would be approximately 1:3,000 AEP. This is based on the Proponent's analysis of rainfall data and the likelihood that there would be an extended drought after restoration of the release plugs following temporary loss of storage.

The Department finds that if this temporary loss of storage was to occur, Spilt Rock Dam, located upstream of Keepit Dam, could supplement water supplies on a short term basis. Therefore the potential of loss of storage temporarily will be able to be managed until the reinstatement of the release plugs.

5.5 Heritage Impacts

Issues

Construction Impacts

The Proponent identified and contacted interested Aboriginal stakeholders in accordance with DECC's *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment* (2005). Two field surveys were undertaken 12 months apart from on another, to target areas of potential construction and operational impacts unique to each dam safety upgrade option and those areas common to all options and that had not bee inspected in the earlier survey. The Tamworth Local Aboriginal Land Council attended both surveys, whereas the Red Chief Local Aboriginal Land Council attended the second survey. The Department also advised these two Aboriginal Land Councils and the Gunida Gunyah Aboriginal Corporation of the exhibition period for the Environmental Assessment, and invited comment from these groups. The Department received no formal response.

The construction works for Option B1 (and Options D2 and D3) have the potential to cause indirect impacts on an Aboriginal site (20-5-0021 - stone procurement source), e.g. excavating near this site. This site is located on the crest of a ridge adjacent to the location of the proposed boat ramp saddle dam. There is also a low potential for unrecorded archaeological heritage sites at all the proposed construction works area.

Additionally, the proposed raising of the main dam wall would result in direct impacts on the historic site KDH8, i.e. Keepit Dam wall. It should be noted that Option D3 would cause the greatest impact to this site, as it would raise the wall by a greater height (5.5 metres) than Options D2 (4.6 metres), with B1 causing least impact (3.4 metres). However it is considered that the differences between the heights for all three options are only small and that they all equate to a moderate impact to the heritage of the existing dam structure.

The Proponent has proposed specific measures to mitigate any potential impacts to the Aboriginal site (20-5-0021 - stone procurement source) during construction. These measures include the fencing off of the crest area of the ridge on which the site is situated, avoiding excavation of ridge deposits for fill in the boat ramp saddle dam wall and if impact cannot be avoided, salvaging this site. The Proponent has committed to the preparation and implementation of an Indigenous Heritage Management Sub Plan, as part of the CEMP. This Sub Plan would be prepared in consultation with all relevant Aboriginal Groups and the DECC and include detail of the archaeological investigations to be undertaken by the Proponent and any associated licences or approvals required. It would also provide further detail on mitigation measures for the stone procurement 20-5-0021 and details of an education program for construction personnel regarding their obligations for Aboriginal cultural material.

The Proponent has also committed to the preparation and implementation of a Historical Management Sub Plan, as part of the CEMP. This sub plan would be prepared in consultation with the Heritage Office and include details on the procedures for the management of unidentified historical relics discovered during construction. It would also contain details on an education program for construction personnel on their obligations for historic relics and contain specific measures in relation to the main dam wall. For example, the removal and secure storage of

historic items located on the top of the existing main dam wall, including the metal dedication and commemorative plaques and insignia.

Operation Impacts

Similar to the impacts to aquatic ecology, when compared to the dam failure scenario (no upgrade) for downstream impacts, Option B1 (and D2, and D3), would result in reduced inundation of potential Aboriginal archaeological heritage sites along the Namoi River, downstream of the main dam wall. Option B1 would provide greater benefit to potential Aboriginal archaeological heritage sites along the Namoi River between the main dam wall and the confluence with the Peel River, as it would divert a portion of the floodwaters into the Peel River. However this would be at the expense of known and potential Aboriginal archaeological heritage sites and European heritage sites in the lower Peel valley, between the subsidiary dam wall and the confluence of the Namoi and Peel Rivers.

There are ten known Aboriginal heritage sites and two European heritage sites located in the Peel River valley below the subsidiary dam wall. A further three known Aboriginal heritage sites are located further downstream along the Peel River. There are no known heritage sites immediately downstream of the subsidiary dam wall in the area that would be affected by the operation of Option B1. There is potential for significant damage to occur to known and potential heritage sites downstream of the main and subsidiary dam walls during very large to extreme floods as a result of erosion and sedimentation, regardless of the Proponent preferred option.

Option B1 would result in the least increase in temporary upstream inundation (approximately 1,085 hectares) during a PMF event, because it has the lowest design flood level (due to lowest raising of the dam wall compared to the other options).Three recorded Aboriginal sites (KDA23, KDA28 and 20-4-54) and part of the former Borah Crossing Aboriginal Reserve would be affected by longer duration of inundation (compared to existing situation) during operation of all three options in very large to extreme floods. A historic house ruin site (KDH1) would also be subject to inundation during very large to extreme flood events and also wave action during these events.

The Gunida Gunyah Community Development Employment Project group indicated to the Proponent that they would prefer to see recovery of the artefacts to be impacted by potential 1:10,000 floods, and indicated that they have a secure storage facility and also noted that the Red Chief Local Aboriginal Land Council (LALC) has a museum where artefacts could be stored. Similarly, the Min Min Aboriginal Corporation indicated that it would prefer to see the artefacts removed and kept in a safe location such as a museum rather than have them washed away by a flood. The Proponent has also stated that the Tamworth LALC could not be contacted regarding this particular issue, however their official response to the draft Environmental Assessment was that they were happy with the original recommendations. This included that it was not considered warranted to mitigate sites to be impacted only by extreme flood events. No formal response from the Red Chief LALC was obtained by the Proponent, however two of the four field participants from this LALC did provide a written response. They both indicated they preferred to see the artefacts left as they were found. It should be noted that there were no objections to the proposal by the Aboriginal community, however opinions regarding the management of Aboriginal sites were conveyed to the Proponent.

The Proponent states that it is not considered warranted mitigating impacts to the sites that only have potential to be affected by extreme flood events. However it states that it would further consult with DECC on long term management and consider the views of the Aboriginal groups that have been consulted.

Submissions

Gunnedah Shire Council found that the construction footprint of Options D2 and D3 has greater potential to disturb unrecorded archaeological heritage sites than the construction of Option B1. It also notes that only when excavation occurs, will it be certain whether unrecorded archaeological heritage sites exist. The Council agrees that the impact to cultural heritage can be mitigated by the implementation of the proposed mitigation measures.

For the construction related impacts, DECC supports the Proponent's commitment to prepare an Indigenous Heritage Management Sub Plan prior to the commencement of construction on the dam upgrade. This is because DECC would have an opportunity to consider the Aboriginal cultural heritage protection measures to be included in this Plan.

Consideration

The Department believes that provided the Proponent implements all the nominated environmental commitments during the design and construction phases of the project, including where required, archaeological investigations for all known sites, the resultant construction impacts to cultural heritage would be negligible. However, to ensure adequate protection of the Aboriginal stone procurement site (#20-5-21), the Department has recommended conditions of approvals to ensure this site and any heritage or archaeological materials uncovered that were previously not identified, are managed and maintained appropriately.

The Department finds that all three options would have a similar impact to cultural items during the project's operation and no one option is clearly better than another. The chance of this impact occurring would be during storms larger than 1:10,000 AEP and it concurs with the Proponent that it is not feasible to mitigate impacts to areas that only would be impacted by extreme flood events, as this would require a considerable amount of preparation, time and investment. It also however agrees with the Proponent's recommendation to further consult with DECC and the local Aboriginal communities on this issue, including the options for long term management of the Aboriginal sites.

The Department has recommended a condition of approval that requires the Proponent to submit an Operational Environmental Management Plan, to detail the environmental management framework, practices and procedures to be followed during the operation of the project. As most of the potential impacts to Aboriginal sites relate to the operation of the project, the details of the long term management options and further consultation with agencies and the community, would be detailed in this plan.

5.6 Construction Noise and Vibration

Issues

General Construction Noise Issues

Construction works are proposed at the right hand abutment, subsidiary dam wall and at the saddle dam locations (caravan park, boat ramp, sailing club), and the main dam wall and clay borrow pit. The key activities are ground clearance (site preparation), excavation and infrastructure construction.

Construction noise will exceed, at two sensitive locations, the criteria established within DECC's Environmental *Noise Control Manual*, which enables a 5 dB(A) increase above the current background noise levels:

1. exceedance at subsidiary dam wall works at Residential Property A and main dam wall.
2. cumulative noise impacts at 1521 Bulga Road receptor location.

The predicted noise levels during construction, indicate that the saddle dams and the right hand abutment works would be complaint with the adopted noise criteria at the sensitive receptors (35 dB(A)). However the subsidiary dam wall works would likely result in a worst case noise exceedance of 8 to 10 dB(A) at Residential Property A. Works for the main dam wall would result in a predicted exceedance of 0.5 dB(A) at 1521 Bulga Road.

Concrete Batching Plant and Aggregate Crusher

Predicted received noise impacts were determined to be compliant with the adopted noise criteria of 35 dB(A).

Clay Borrow Pit

Predicted received noise impacts, at the identified sensitive receivers, were determined to be compliant with the adopted noise criteria of 35 dB(A), this includes residential properties. However, at the Proponent's offices, potential peak noise levels of up to 45 dB(A) have been predicted, representing a potential 10 dB(A) exceedance of the noise goal. At the caravan park, potential peak received noise levels of 39.5 dB(A) have been predicted, representing a potential 4.5 dB(A) exceedance of the noise goal. The Proponent however states that occupation at the Caravan Park is seasonal and the works will be scheduled to avoid the peak tourist period.

Cumulative Construction Works, Concrete Batching and Crushing

The general construction works will occur simultaneously with concrete batching plant, aggregate crusher and clay borrow pit operations (refer to Figure 9 for impacts relative to the receptor locations). The following scenarios were investigated relevant to potential cumulative noise impacts, considerate of the geographic separation of the noise sources and sensitive receivers and the intervening topography:

- Scenario 1: Right hand abutment and batching plant and aggregate crushing (at 1521 Bulga Road)

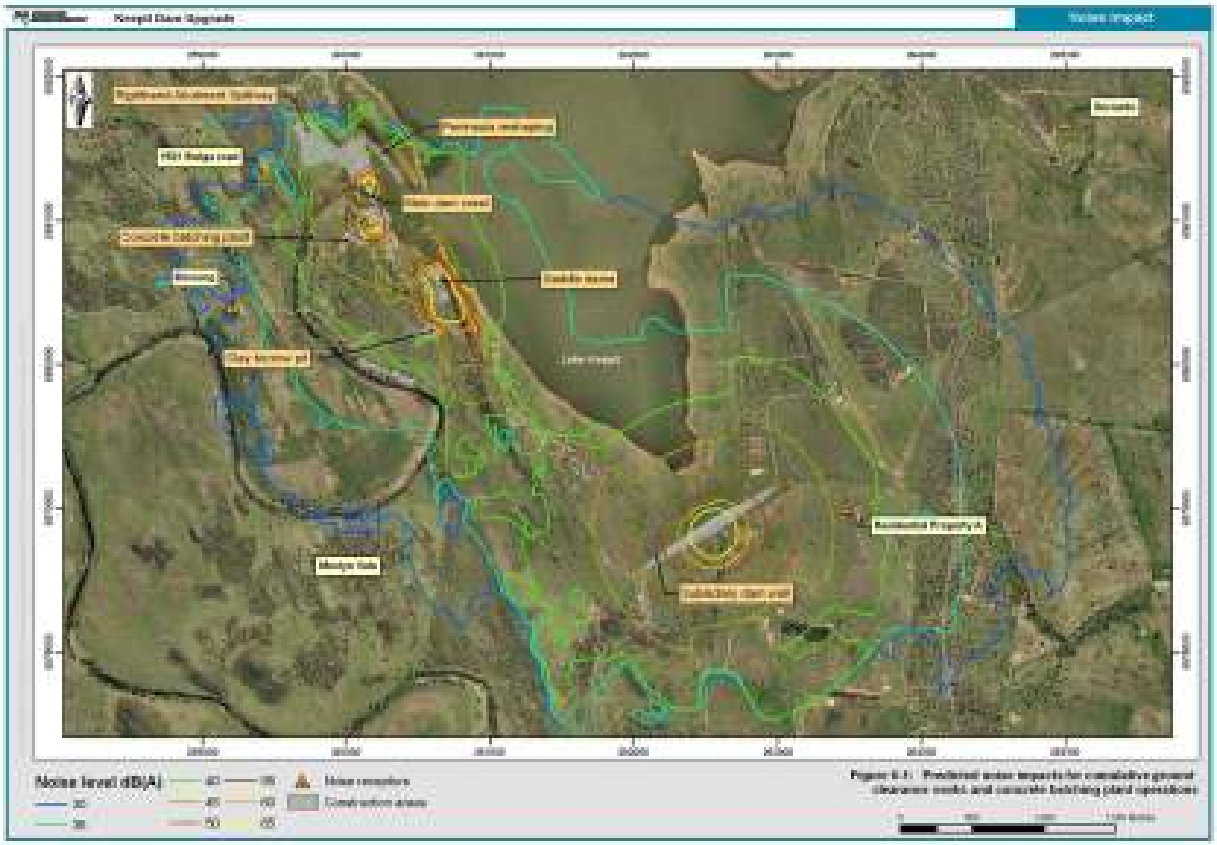
- Scenario 2: Main dam wall and batching plant and aggregate crushing (at 1521 Bulga Road)
- Scenario 3: Saddle dams and clay borrow pit (at Proponent's offices and caravan park).

It was found that potential noise from the concrete batching plant, crusher operations and clay borrow pit works would not be expected to additionally influence received dominant construction noise levels at all other receptors.

For scenario 1, cumulative received peak noise levels of up to 36 dB(A) are predicted to be 1 dB(A) in exceedance of the noise goal criteria. For scenario 2, cumulative received peak noise level during the main dam wall works is 37.5 dB(A) or 2.5 dB(A) in exceedance of the noise goal criteria. For scenario 3, cumulative received peak noise levels at the Proponent's offices of up to 51 dB(A) and 41 dB(A) at the nearest location at the Caravan Park have been predicted. Potential exceedance of the noise goal criteria by up to 6 dB(A) may occur at the Caravan Park. As noted above, the works program would be scheduled to avoid the peak tourist season, and therefore would be undertaken when the Caravan Park is mostly unoccupied.

The Proponent states that reductions in received worst case noise levels predicted would occur, where works are not undertaken concurrently, fewer plant are in cumulative operation, where batching and crusher operations are less intensive and borrow pit works are undertaken within the pit.

Figure 9 – Predicted Cumulative Noise Impacts



Construction Traffic Noise

Road traffic noise was assessed in accordance with DECC's *Environmental Criteria for Road Traffic Noise*. The recommended 'base' goals for land use developments with the potential to create additional traffic local roads are L_{Aeq}, 1hr levels of 55 dB(A) during the day time. Considerate of identified nearest receptor locations to proposed traffic routes, the Proponent conducted its assessment at 1521 Bulga Road, Residential Property A and the Caravan Park. Noise generated by heavy vehicle movements is expected to comply with the adopted noise design criteria at these sensitive receivers.

Blasting Noise and Vibration

The Proponent has undertaken preliminary investigations for the potential impacts from blasting. It has adopted the *Australian and New Zealand and Conservation Council (ANZECC) Guidelines for Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibratio*n. Blasting is proposed for

the right hand abutment and peninsula reshaping works to the north of the main dam wall. A blasting frequency of 1 to 2 blasting events per day is proposed.

The Proponent has determined recommended charge masses to achieve the desired noise criteria of 115 dB at receptor locations. E.g. for a 10 kilogram charge mass, a distance of 233 metres is required to achieve airblast over pressure less than 115 dB(Lin)(m). The nearest residential receptor location at 1521 Bulga Road is 0.75 kilometres from the right hand abutment works. Therefore a mass charge of less than 350 kilograms is recommended. The State Water offices (Proponent's offices) are the nearest commercial receptors, within 0.67 kilometres of the proposed blasting locations, a maximum charge of less than 250 kilograms is recommended. Similarly, distances from the blast location required to achieve vibration criteria for varying mass charge size have been predicted. The nearest residential receptor, 1521 Bulga Road, is approximately 0.75 kilometres from the right hand abutment. To achieve compliance with the 5mm/s adopted vibration annoyance criteria, a charge mass of less than 635 kilograms is recommended.

Also the Proponent assessed the potential for structural damage to buildings as a result of blasting-related vibration. Guideline values for the avoidance of 'cosmetic damage' have been adopted from *AS 2187.2 Explosives storage and use Part 2 Use of explosives,* and the limiting vibration levels for the avoidance of this damage from individual blasts was determined. The relatively close location of the existing dam wall to the areas where blasting is required will likely govern the maximum acceptable level of ground vibration during blasting events.

Submissions

The DECC noted that it could not undertake an adequate assessment or provide meaningful comments to the Department on noise and vibration, as the Proponent had not undertaken any noise impact assessment in the Environmental Assessment, to determine whether construction impacts would affect sensitive receptors. It therefore considered that this detailed assessment should be included as part of its selection process of the preferred option. It should be noted that this has since occurred and DECC has provided advice relevant to its areas of concern (refer to section 4.3 of this report).

Subsequent from the exhibition period, the Proponent provided a detailed noise assessment as part of the Submissions Report. Therefore the Department's discussion on the noise impacts is based on the information contained in the Submissions Report. The Department also sought technical advice from DECC regarding this study.

Consideration

The Proponent included a detailed noise and vibration assessment, as part of the Submissions Report. The works at the subsidiary dam wall and the cumulative noise from construction will impact Residential Property A and 1521 Bulga Road respectively, as compliance with the noise goals at these receptors would not be achieved. The Proponent has stated that the landowner at Residential Property A is not a full-time resident at the property and the Proponent is in discussion with this owner. Also the Proponent has had discussions with the owner of the property at 1521 Bulga Road, and the owner is keen to see the works commence and understands the potential noise exceedances. The Proponent has also stated that it would conduct monitoring at these and other sensitive receptor locations and intends to obtain a noise agreement with these landowners, regarding residual noise and vibration impacts prior to construction commencing. The Proponent has also committed to this type of monitoring, which will form part of the Construction Environmental Management Plan.

The DECC has stated to the Department that there is no evidence that any negotiations have taken place and the results of these negotiations. The DECC therefore recommended to the Department that negotiation between the affected receptors and Proponent take place, in accordance with the Industrial Noise Policy, and this be undertaken prior to approval of the project.

The Department recommends a condition of approval that states noise generated by the project must not exceed the construction noise criteria of 35dB(A) at any time at any residence on privately owned land. However the Department also recommends that, if the Proponent has a written negotiated noise agreement with any landholder and a copy of this agreement has been forwarded to the Department and DECC, then the Proponent may exceed this noise limit in accordance with the negotiated noise agreement. The Department also recommends that a Construction Noise Management Plan (CNMP) be prepared as part of the CEMP, which

would need to include details of the consultation process for noise mitigation measures with any affected residences. The CEMP requires the approval of the Director-General prior to the commencement of construction works. These recommendations will ensure that noise emissions are limited and any exceedances from the noise goals will be controlled and negotiated.

The Department also recommends a condition of approval that ensures airblast overpressure does not exceed 115 dB(Lin Peak). However of the total number of blasts over a 12 month period, a 5% exceedance is allowed. The absolute maximum permitted is a 120 dB(Lin Peak) airblast overpressure. The Department has also recommended ground vibration from blasting does not exceed specific criteria (peak particle velocity criteria of 5mm per second).

5.7 Construction Air Quality (Dust) Impacts

Issues

The construction of the project will require a significant amount of rock to be excavated (approximately 670,000m^3 over a 40 week period), including activities involving handling construction storage piles and heavy construction operations. Therefore there is a high risk of air quality (dust) impacts to occur during the construction. The Proponent conducted an air quality assessment for option B1, which included modelling of particulate matter, total suspended solids and dust deposition. Based on the construction timetable, two stages of construction were considered:

- Stage 1, with the main activities including simultaneous works on the subsidiary wall, right hand abutment and the three saddle dams. Blasting at the right-hand abutment would take place during this stage;
- Stage 2, with the main activities comprising raising the main dam wall. No blasting would be required for this work. Stage 2 works are anticipated to follow completion of stage 1.

Two modelling scenarios were therefore assessed for stage 1 only: scenario 1 – no blasting and scenario 2 – blasting. Compliance with the adopted 24-hour PM_{10} DECC goal of 50 $\mu g/m^3$ is predicted for all construction works with, and without blasting, at each sensitive receptor, apart from the receptor at 1521 Bulga Road. For this receptor, the cumulative impact is predicted to be 55.1 $\mu g/m^3$ (scenario 1) and 55.4 $\mu g/m^3$ (scenario 2), during standard construction hours. The Proponent has discussed that the weather conditions giving rise to the exceedance are expected to occur for approximately less than 1% of the modelling year and thus given the conservatism built in to other modelling elements, exceedances are unlikely to occur. The modelling of annual particulate matter, total suspended solids and monthly dust deposition demonstrated that there are unlikely to be exceedances of the specified air quality standards. For the operational phase of the project, no adverse air quality impacts are expected.

Submissions

DECC raised concerns that no detailed air quality assessment was included as part of the Concept Environmental Assessment, and stated that it would expect this prior to final project approval of the preferred option and be in accordance with the document *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales*. It noted that a detailed assessment could then be used to guide the development of construction plans, set mitigation measures and target any required air monitoring.

Consideration

The Department was provided with a detailed air quality assessment, which was included in the Submissions Report and is discussed above. The Department considers that the risk of air quality impacts during construction can be adequately managed through the implementation of an Air Quality Monitoring Program. The Department recommends this Program be prepared in consultation with DECC prior to construction commencing and use dust deposition gauges and ambient dust monitoring gauges. These gauges would monitor deposited dust and particulate matter during construction. The results of this monitoring is to be presented in the Construction Compliance Reports, which are to be submitted to the Director-General and DECC. The main purpose of these Reports is to ensure compliance with the CEMP and the Minister's approval. The results of the air quality monitoring, along with other required monitoring results (ecology, noise and vibration), are to be presented and discussed. Management measures for non-compliant air emissions would also be identified, and the effect of these management measures can be verified from the results presented in the next compliance report.

The Department also recommends a condition requiring the Proponent to undertake all construction works with the objective of preventing visible dust emissions and constructing the project in a manner that minimises dust impacts. The Department also notes that the Proponent has committed to the preparation of a Construction Dust Management Plan. This will further detail the potential sources of dust, management measures and potential monitoring requirements.

6. CONCLUSIONS AND RECOMMENDATIONS

The Department has assessed the Environmental Assessment, Statement of Commitments, submissions received and the Submissions Report, and is satisfied that the impacts of the project can be mitigated and/ or managed to ensure an acceptable level of environmental performance.

However this does not mean that there are no significant impacts associated with the proposed upgrade. The key activities that have the potential to cause significant impact to the environment can be seen as both construction type and operational type. It can be seen from this report, that the potential impacts from constructing the dam upgrade components can either be mitigated or managed. However it can also be seen that the operational impacts to downstream environments, from the implementation of Option B1, cannot be mitigated. This being that should an extreme flood event occur, there would be massive scouring in the area below the subsidiary dam wall down to the Peel River, which would fundamentally alter the existing landscape and habitat locally, and increase the impact in the Peel River down to the confluence with the Namoi River due to increased flood velocities.

The Department accepts that these operational impacts of the subsidiary dam wall spillway are unavoidable for Option B1 and that these impacts would not occur if either Option D2 or D3 were to be implemented. However the Department also accepts that the overall benefits of Option B1 outweigh the downstream operational impact from option B1, which may actually never occur (extreme flood event). Option B1 would not only achieve the dam safety requirements, it is financially more feasible, will cause lower impacts during construction (terrestrial and aquatic ecology, cultural heritage, social and visual) and cause less upstream operational impacts to ecology, heritage and social facilities. All options will result in the same level of operational damage downstream, in the Namoi River, to terrestrial ecology and aquatic ecology and cultural heritage.

The Department acknowledges that there will be direct operational impacts to the land downstream of the subsidiary dam wall for Option B1, regardless of the implementation of the recommended conditions of approval. I.e. for storms larger than 1:10,000 AEP, Option B1 would discharge about 60% of flood flows to the Peel River while Options D2 and D3 would discharge only to the Namoi River, and therefore high erosion and sedimentation would occur locally. However, as noted above, the Department has concluded that these impacts are considered to be acceptable given the benefits that Option B1, in its totality, would provide during construction (less impacts to the public through reducing public amenity disturbances, reducing impacts to cultural heritage and terrestrial ecology) and operation (reducing upstream impacts to terrestrial and aquatic ecology, cultural heritage and infrastructure, as with the lowest wall raising, least temporary upstream inundation would result).

The Department recommends that the Minister for Planning consider the findings and recommendations of this report and approve the project, subject to the conditions of approval.

APPENDIX A – RECOMMENDED CONDITIONS OF APPROVAL

APPENDIX B – SUBMISSIONS REPORT

APPENDIX C – STATEMENT OF COMMITMENTS

APPENDIX D – ENVIRONMENTAL ASSESSMENT