3.6 Land Use and Infrastructure

3.6.1 Numinbah Valley Environmental Education Centre

Comments regarding the impacts associated with the increase in FSL and flood levels on the land uses associated with the Numinbah Valley Environmental Education Centre (NVEEC) were made. These issues have been addressed in **Section 3.7.2.**

3.6.2 Land Acquisition

Comments were made regarding the future of land acquired on Gilston Road. Currently no property has been acquired on Gilston Road. Discussions are currently being undertaken with the owners of a property on this road and if there is a requirement for acquiring of the property, the future land use/s of the property after project completion will be discussed with GCCC and community members. This would be undertaken upon finalisation of all commercial matters relating to the potential acquisition.

3.6.3 Recreation Facilities

Information was sought in relation to the replacement and or upgrading of the recreation facilities at the dam as part of the proposed works.

The recreation facilities proposed to be constructed as part of the Hinze Dam Stage 3 Project are detailed in Section 3.4.3 of Volume 1 and Section 6.6.1 of Volume 2 of the EIS.

3.7 Surface Water Resources and Water Quality

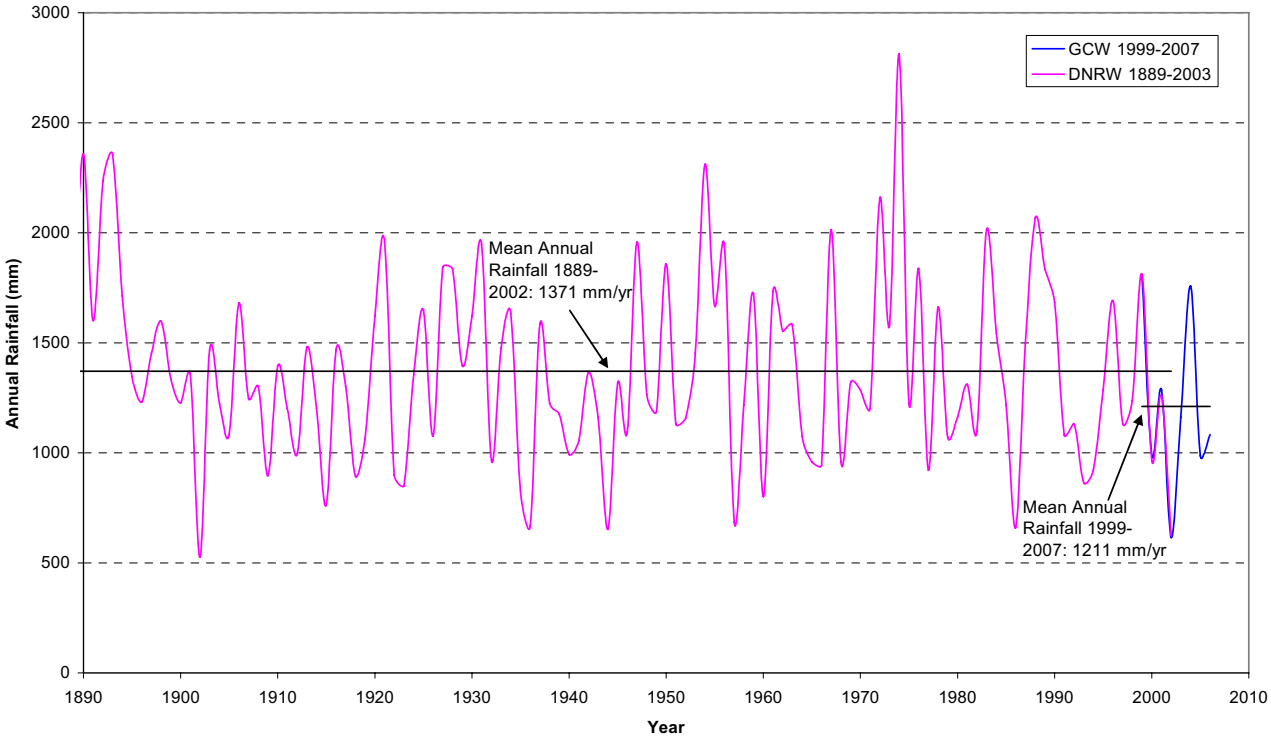
3.7.1 Rainfall Reliability at Hinze dam

Recorded rainfall at Hinze Dam has been supplied by Gold Coast Water (GCW) and the Department of Natural Resources and Water (DNRW). The long term rainfall data is summarised in **Table 15** and the annual record is graphed in **Figure 15**.

Table 15 Hinze Dam Rainfall

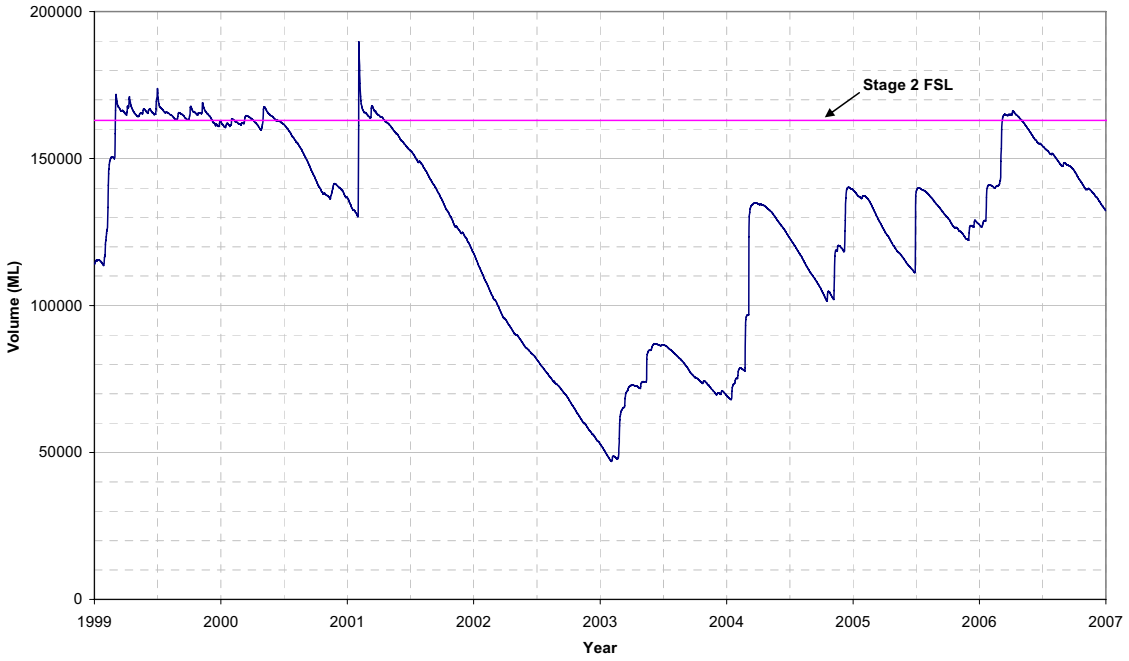
Source	Period	Mean Daily Rainfall (mm)	Mean Annual Rainfall (mm)	Minimum Annual Rainfall (mm)	Maximum Annual Rainfall (mm)
GCW	Jan 1999 – March 2007	3.33	1211	615.6	1808.4
DNRW	Jan 1889 – Dec 2002	3.75	1371	526.0	2812.0

■ **Figure 15 Hinze Dam Annual Rainfall**



Data supplied by Gold Coast Water and presented in **Figure 16** shows the recorded storage volume at Hinze Dam over the past 8 years. If the 'near full capacity' of the dam is defined as 90% of full supply level (FSL), or 146 700 ML, the storage would have been at full or near full capacity for approximately 2.5 of the past 8 years, or over 30% of the time. This indicates that it is not unusual for Hinze Dam to be at full or near full capacity given recent rainfall and climate conditions.

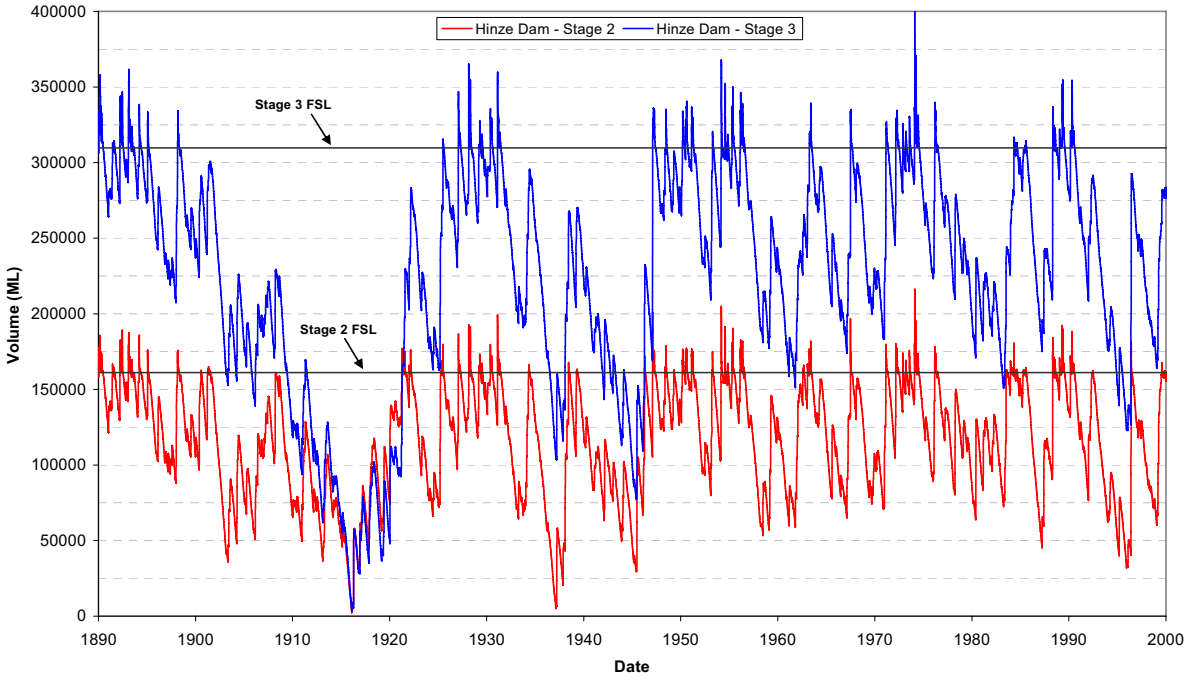
- **Figure 16 Hinze Dam Recorded Storage Volume (1999 - 2007)**



A long term analysis of storage volumes can also be undertaken using the Gold Coast Water Resource Plan (WRP) IQQM model. This is a computer model of water resources within the Gold Coast catchment which incorporates 110 years of historical climate data. The simulated storage behaviour of Hinze Dam Stage 2 and Stage 3 is presented in **Figure 17.** If the 'near full capacity' of the dam is again defined as 90% of full supply level (FSL) the storage can be expected to sit at full or near full capacity for over 27% of the time for both Hinze Dam Stage 2 and Stage 3, given climate conditions similar to those experienced over the past century.

It is therefore not unreasonable to expect that once the Hinze Dam Stage 3 upgrade has been completed the dam will achieve full or near full capacity for approximately 30% of the time.

- **Figure 17 Hinze Dam Simulated Storage Behaviour (1890-2000)**



3.7.2 Impacts on Numinbah Valley Environmental Education Centre (NVEEC)

Inundation of Waterfall Creek rainforest area and impact on the NVEEC

At the full supply level (FSL) of Hinze Dam Stage 3 areas along the creekadjacent to the NVEEC (referred to as Waterfall Creek in the submission from NVEEC) will be inundated, see **Figure 18**. This area has previously been rehabilitated by the Numinbah Valley Environmental Education Centre and is currently utilised as an outdoor teaching area.

The Centre has suggested that the Alliance provide a bus in order to allow the transportation of students to other appropriate local sites. Alternatively, there are sites in the vicinity of the Education Centre that are being considered for rehabilitation as part of the compensatory habitat strategy being developed. Opportunities exist for rehabilitation of these sites as a partnership between the Alliance and the Education Centre, with the Alliance providing financial and technical support for elements of the works required. These alternatives are currently under investigation and will be explored further in consultation with the Education Centre.

Flooding of the NVEEC access road

Additional ground survey has confirmed that sections of the current access road to the Numinbah Valley Environmental Education Centre are close to the Stage 3 FSL of RL 94.5 m AHD. The access is therefore susceptible to flooding when the dam is spilling. As this is the only road into the site any flooding across the road would isolate the centre. As a mitigation to this impact an alternative access is currently under investigation and is planned to achieve greater than 1 in 100 year flood immunity. The proposed roadway will require further consultation with the Education Centre and will be confirmed with detailed survey and design.

Proximity of the NVEEC to 1 in 100 year flood level

Hydraulic modelling associated with additional ground survey has identified that the no building floor levels at the facility will be inundated in the predicted 1 in 100 year flood. The assessment did identify that the predicted 1 in 100 year flood will encroach on some of the footings of one of the cabins at the Education Centre. The floor level of the cabin in question is elevated approximately 2 metres above this point. As such there is a very low probability that the cabin floor will be flooded and the building is considered not at risk based on flood immunity standards

applied to properties of this nature. The entrance to the cabin is on the uphill side of the building and is also not put at risk by the 1 in 100 year flood.

It should be noted that the 1 in 100 year flood event is the maximum level of flood water that could statistically be expected to occur once every 100 years. It is also referred to as the 1% flood as it has a 1% chance of occurring in any given year. It does not imply that it will be 100 years before a flood of this magnitude occurs.

G:\SpatialArc_MXD\EIS\Fig_3_5_070809.mxd Produced: 9/8/2007

N

0 25 50 100

Meters

Scale - 1:4,000

Projection: MGA Zone 56

Legend

- Q100 (101.1m)
- Proposed FSL (94.5m)
- Current FSL (82.2m)
- Contours (5m)

HINZE DAM STAGE 3 EIS SUPPLEMENTARY REPORT

FIGURE 18

Numinbah Valley Environmental Education Centre Inundation Impacts

This figure must be read in conjunction with the data disclosure in Appendix H of this document

3.7.3 Water Quality Downstream

Concern was raised during the public submission period that the concentration of activities downstream of the dam wall would increase the potential of downstream impacts of fuel/oil spills. Due to the construction requirements of the project, it is not feasible to have some construction activities upstream of the dam. Where practical, some construction elements are planned to occur upstream of the dam wall. Ensuring the water quality of the dam is not compromised is a key priority of the Alliance.

The likelihood of a fuel/oil spill will be mitigated by actions implemented under the detailed construction environmental management plan. Such mitigation measures to aid in removing the likelihood of a chemical spill include bunding and appropriate storage of fuels and other hazardous/flammable materials. In addition to such physical measures, all staff onsite will be required to complete environmental awareness training.

In the unlikely event of a chemical spill, an emergency spill response strategy has been devised under the emergency response plan and actions within this strategy will be implemented accordingly to reduce potential impacts. For further detail see section 19.2.4 of the EIS for the draft emergency response plan.

3.7.4 Stream Siltation

Concern was raised that the Project will lead to siltation of a stream used for water supply at a property on Gilston Road. The environmental management plan that will be developed for the clay borrow area will clearly set out erosion and sediment control measures to control discharges from site, minimising the risk of siltation.

3.8 Terrestrial Ecology

3.8.1 Project Consideration of Environment

A key initiative of the Project is the development of a compensatory habitat strategy which seeks to offset the impacts of the project on remnant vegetation . This strategy will be delivered even though the project is exempt from assessment under the VMA on Lot 4 on SP164198 only, and hence against the Regional Vegetation Management Code (Southeast Qld). This is a significant undertaking which demonstrates the Projects consideration and commitment to the environment.

3.8.2 Impacts to Fauna

Traffic Levels on Advancetown Road – Impact on Wildlife

The impact of increased traffic on Advancetown Road on flora and fauna is of concern to the Alliance. The anticipated traffic volumes during construction and upon completion are not anticipated to significantly increase the risk to wildlife in the area.

Noise and Vibration Impacts on Fauna

In general, noise and vibration can affect animal behaviour, mask acoustic signals, and affect their physiology if the disturbance is of sufficient intensity over an extended period of time. The impacts of noise and vibration on wildlife surrounding Hinze Dam will be reduced by a number of mitigating factors, including the following:

- Many Australian fauna (almost all mammals for example) are nocturnal, and reside in tree hollows, burrows or other forms of shelter during daylight hours. This suite of species will suffer minimal adverse effects due to noise or vibration because they are inactive during hours of operation.
- The majority of diurnal wildlife are birds, which are highly mobile, and can shift patterns of habitat use away from impact areas without compromising local population dynamics. It is very unlikely that any bird species or group of birds is completely reliant on habitats within or adjacent to the disturbance area.
- Fauna habituate quickly to disturbance stimuli, and many individuals across a variety of groups adapt to inhabit areas which suffer chronic disturbance (eg roadside vegetation, airports). The suite of species which occur within and around the existing dam wall are predominantly habitat generalists, which consistently display adaptability and a capacity to cope in disturbed environments.

Concern was also raised regarding the impact of noise and vibration on domesticated animals and the further noise impact of barking dogs. Domestic animals can also be affected by noise and vibration however as blasting will occur during daylight hours, the additional noise nuisance from barking dogs is considered unlikely to cause a major disturbance or make a substantial contribution to background noise.

Movement of Fauna - Little Nerang Creek and Nerang River

At Full Supply Level there will be some increase in gap crossing distances across Little Nerang Creek and the Nerang River. However, perpendicular movement distances (across the stream) will increase only slightly and for relatively short periods, primarily during flood events. Potential for parallel movement (along the stream) at a catchment scale was heavily compromised by the initial construction of Hinze Dam, which inundated substantial lengths of both systems. The Project will shift that impact further upstream, but should be viewed in the context of an existing disconnected riparian habitat system.

Tusked Frog

Comment was made that whilst Figure 9-9 in the EIS indicated that Little Nerang Creek is habitat for the listed Tusked Frog, the EIS did not discuss the potential impact the road realignment works may have on the Tusked Frog.

The clearing of vegetation adjacent to Little Nerang Creek may impact on individuals indirectly, however no habitat will be lost directly as a result of these works. In order to mitigate the potential impacts on the Tusked Frog, the following strategies are recommended:

- All plant, equipment, vehicles and shoes of contractors working at the Little Nerang Creek site must be sterilised to prevent the spread of Chytrid fungal disease. All activities on site must be consistent with the NSW National Parks and Wildlife Service Hygiene protocol for the control of disease in frogs;
- Environmental Management Plans must be developed for all works adjacent to Little Nerang Creek to prevent increased sedimentation, erosion, weed invasion and nutrient and chemical pollution; and
- If possible, construction works should be completed outside of the breeding season of this species to reduce potential impacts on pre and post breeding dispersal movements. As the species may breed opportunistically and in response to periodic rainfall events, this would be difficult to predict.

Glossy-black Cockatoo

Concern was voiced regarding the removal of identified Glossy-black cockatoo feed trees (*Allocasuarina littoralis*) for road embankment stabilisation work. A request was also made to avoid or keep to a minimum removal of these trees due to the potential impact on current populations of the species.

The area of habitat affected is located at Burns Creek, where cockatoos were observed feeding on a regular basis. The presence of dense regrowth of *Allocasuarina* is an artefact of disturbance associated with past road upgrades at Burns Creek and the foraging area is evenly divided between the western and eastern sides of the road. Some impact on this habitat is therefore unavoidable however removals will only occur where completely necessary.

Comment was also made on the length of time between removal of *A. Littoralis* and the colonisation and establishment to maturity of replacements trees and the predicted potential impacts of this time lag on current populations of the species in the area. Revegetation works were identified as a means to allow faster recovery of the food trees.

The high level of selectivity and fidelity to specific foraging trees exhibited by the Glossy Black Cockatoo is noted. With this in mind, it is intended that seed will be actively harvested from individual trees which are known to be preferred by the local Cockatoos, that these seeds be grown on in a nursery and that the tubestock will be planted in revegetation works. This approach has been proven in efforts to conserve the Endangered Kangaroo Island subspecies.

Avifauna – Birds and Butterflies

Comment was made that airborne avifauna and butterflies were emitted from the EIS. This is unfounded as they have been considered in detail in Section 9 of the EIS. Significant butterfly species have also been considered throughout. A Compensatory Habitat Strategy is being developed to offset the loss of vegetation associated with this project. The strategy will include rehabilitation actions which benefit both birds and butterflies, with an emphasis on planting the preferred food trees of threatened butterflies/moths.

Operational Phase - Fauna Management

Comment was made that according to the EIS "The propagation and planting of the larval food source plants of *Phyllodes imperialis* and the Richmond Birdwing Butterfly, *Carronia multisepalea* and *Pararistolochia praevenosa* respectively. These plants could be incorporated into rainforest rehabilitation programs." (HDA 2007) however no rehabilitation plan has been provided nor commencement and completion dates.

The Compensatory Habitat Strategy will identify priority areas for rehabilitation. These areas will be subject to weed control, enhancement planting and ultimately as receiving sites for translocated threatened plant species and the larval food plants of the target invertebrates.

3.8.3 Impacts for Flora

Flora of Conservation Significance

Comment was made that few details were provided on the recovery or management plans for affected species (e.g. *Randia moorei*, *Owenia cepiodora* and *Symplocos harroldii*). Specific recovery actions can not be fully documented until such time as translocation sites are identified and secured. However, the general approach to translocation has been finessed over numerous projects and a variety of species.

Further survey of remnant and regrowth rainforest surrounding the dam has substantially commenced and additional populations of significant flora species have been documented. A preliminary list of suitable translocation sites has been compiled for threatened flora taxa. These sites either contain the target species or have the potential to be significantly improved (in terms of condition) through specific and active management of threats.

Road Infrastructure Works - Construction Impacts

Comment was made that inadequate information was provided on the potential impacts the road realignment works may have on flora and fauna, and particularly the road realignment works on the Gold Coast-Springbrook Road near Little Nerang Creek.

The road realignment area has been comprehensively surveyed. The vegetation consists of a mix of both relatively intact open forest communities (of Flooded Gum, Grey Gum, Tallowwood and Northern Grey Ironbark) and exotic flora such as Coral Tree, English Oak and Liquidamber.

A single Rare species, Narrow-leaved Tuckeroo (Cupaniopsis newmannii) was recorded from the Road Reserve (2 specimens) and may be impacted by the proposed works.

Vegetation Inundation

Comment was made that there was a lack of scientific basis to the argument that vegetation would withstand a periodic inundation of up to 4 days in the event of a 1 in 100 year ARI event.

Flood modelling based on current conditions indicates that riparian vegetation on Little Nerang Creek and the Nerang River are inundated for a period of 3 days during a 1 in 100 year ARI flood event. The post construction scenario has been modelled, and it is likely that riparian vegetation on both systems will be inundated for up to 4 days during a 1 in 100 year ARI event (a 25% increase in inundation period).

There are few references in the literature which specifically consider these issues, however, the dominant Regional Ecosystems of the Riparian Zone on both Nerang and Little Nerang systems are 12.3.7 and 12.3.11. Both ecosystems are characterised by Queensland Blue Gum, a species which is highly tolerant of waterlogging. Dunn *et al* (1994) ranked *Eucalyptus tereticornis* alongside *Eucalyptus camaldulensis* in terms of tolerance of waterlogging. Moezel *et al* (1991) found 100% survival in *Eucalyptus tereticornis* after six weeks of inundation on non-saline waterlogged sites. As one of the dominant species in the riparian zone of Little Nerang Creek and the Nerang River, the tolerances of this species are likely to be reflected by those of associated species such as *Casuarina cunninghamiana* and *Callistemon viminalis*.

A commonsense approach to this issue suggests that riparian species which can tolerate inundation for three days under the current 1 in 100 year ARI scenario are likely to survive inundation for an additional 24hrs under the post-development scenario.

The statements made in the EIS are based on published accounts of the performance of several key species subjected to waterlogging stress.

3.8.4 Compensatory Habitats/Offsets

Compensatory Habitat Strategy

A Compensatory Habitat Strategy is being developed to offset the loss of vegetation associated with this project. The compensatory habitat strategy will include rehabilitation plans for selected areas primarily located in The Nerang River catchment. The compensatory habitat plan will be developed and implemented over a twelve month period from the date of approval. The EPA and other stakeholders will be involved in the development of the compensatory habitat plan.

The Compensatory Habitat Strategy is currently being developed for the Project and involves a number of actions. Some details remain (necessarily) confidential to protect both the interests of the Alliance and to ensure that desired conservation outcomes are met. The Strategy is evolving over time and currently consists of the following approach:

- Purchase of a key land parcel(s) for the conservation of biodiversity on the Gold Coast. There are currently three sites under investigation, each of which supports habitat for significant flora and fauna taxa and/or threatened regional ecosystems. Further details can not be released at this early stage as negotiations are ongoing.
- Rehabilitation and restoration of vegetation at strategic locations within the Nerang River Valley. At this stage a rainforest dominated site which includes an endangered regional ecosystem and suite of threatened species values is being investigated.
- Translocation of significant flora taxa of special conservation significance which will be impacted by the Project, particularly Spiny Gardenia which is an endangered species which will suffer the loss of several hundred individuals. It is intended that the translocation sites be established external to the Project Area to increase the distribution of the target species in the broader locality.

The Compensatory Habitat Strategy will include species specific translocation plans and area specific rehabilitation plans (including rehabilitation plans for the acquisition sites, rehabilitation areas in the Nerang River catchment and proposed translocation sites.)

Whilst a comment submitted as part of the EIS public submission period suggested that the compensatory habitat plan needs to be finalised as part of the EIS, this cannot occur. The plan is likely to involve the acquisition of land holdings as a key strategy, and this can not be accomplished within the suggested timeframes. Compensatory habitat outside of the GCCC area is not being considered as primary part of the strategy.

A comment was received which suggested that the EPA should be involved in the development and assessment of the vegetation offset strategy. The Alliance will welcome inputs from the EPA as part of the consultation process proposed as part of the delivery of the strategy.

The Compensatory Habitat Strategy is being developed and will be progressively implemented over the next three years. Initial actions will centre on the propagation and planting of threatened flora species. Land purchases will be negotiated concurrently to the threatened species recovery efforts.

Offset Targets

Comments were received pertaining to the mandatory requirements for offsets for of concern and threshold regional ecosystems. The Project is not required to "maintain the current extent" of "Of Concern" or "Threshold" Regional Ecosystems, Essential Habitat or Waterway Vegetation. From a statutory viewpoint there is no requirement to assess the proposed vegetation clearing against the Policy for Vegetation Offsets (the Offset Policy) within Lot 4 on SP164198. It is acknowledged that the policy will apply to affected areas outside Lot 4.

A comment was also received questioning if the essential habitat area for *Randia moorei* had been included in the calculation of the size for essential habitat to be inundated. The area of habitat to be lost for *Randia moorei* was considered in the EIS, and this issue is to be addressed by the Compensatory Habitat Strategy to be prepared for the Project.

More information was requested to determine whether additional offsets should be required because of disruption to wildlife corridors. Rather than avoiding obligations to provide an offset, the Alliance is committed to preparing and implementing a compensatory habitat strategy which delivers meaningful conservation outcomes within Gold Coast City.

Whilst the compensatory habitat strategy will be guided by the Policy for Vegetation Offsets, it will not be bound by that Policy.

Compensatory Habitat Budget

A comment was made that a budget and timeframe should be determined for the compensatory habitat offsets and the strategy should be negotiated with both GCCC and EPA involvement. Gold Coast City Council has made a significant commitment to the delivery of a compensatory habitat strategy commensurate with the impacts of the Project. A significant budget allocation for compensatory habitat has been set aside by Council, independent of the budget allocation that has been made for the Alliance's delivery of the Project. A time frame for the delivery of the habitat and the degree of consultation was detailed earlier in the **Section 3.8.4.**

3.8.5 Amendments to Figures, Tables and Text

Comment was made that many of the polygons in Figures 9-3, 9-3a, 9-3b, 9-3c lack labels and were not identified. These figures have now been labelled (see **Appendix D**).

Comment was made that tables 9-6 and 9-22 were missing several plant species (notably *Randia moorei* and *Owenia cepiodora*) which were shown in Figures 9-7a to 9-7e as occurring in the inundation area. These species were not included in theses tables as Table 9-6 provides a description of the existing mapped essential habitat across the study area. Prior to the field surveys, neither *Randia moorei* or *Owenia cepiodora* were known from the study area and essential habitat was not mapped. Similarly, Table 9-22 discusses the mapped essential habitat to be lost as a result of the project. There are no areas of essential habitat currently mapped for *Randia moorei* or *Owenia cepiodora*.

The classification of a rainforest community identified as RE 12.11.1 was questioned in a submission reflecting that the RE was probably more accurately mapped as RE 12.11.10. In addition to this, it was also noted that the RE 12.11.1 typically has an understorey in which *Archontophoenix cunninghamiana* is prominent and no mention of this species was provided in the detailed description of this community in Table 9-9. Whilst the broader Study Area supports Regional Ecosystem 12.11.1 with abundant *Archontophoenix cunninghamiana*, it is agreed that in some areas the rainforest community to be impacted at FSL is more closely aligned with RE 12.11.10, which lacks *Archontophoenix cunninghamiana*. In addition, these areas are not characterised by species in *Lauraceae*,

Myrtaceae or *Elaeocarpaceae*. Therefore, these patches align more closely with RE 12.11.10. Table 9-9 and associated Figures 9-3a, b and c have been amended to reflect these patterns (see Appendix D).

Comment was made that table 9-11 describes Sarcochilus hartmannii as "restricted to lowland subtropical and warm temperate rainforest on alluvial or basaltic soils" however, this species typically grows on steep basaltic slopes, often in full sun, e.g. on the western slopes of Lamington NP. This suggested amendment has been incorporated in table 9-11and now reads as follows (see **Table 16**):

- **Table 16 Likelihood of Occurrence of EPBC Listed Flora Species (*Sarcochilus hartmannii*)**

Species	Common Name	Status	Habitat	Likelihood of occurrence
Sarcochilus hartmannii	Waxy Sarcochilus	V	This species typically grows on steep basaltic slopes often in full sun.	Unlikely.

It was suggested in a submission that table 9-24 should be amended to include statements that the impacts on *Owenia cepiodora* and *Randia moorei* are likely to be greater than that indicted by the area lost, as the area of the population affected includes the larger individuals of these species. This table has been amended to reflect this consideration. It should be noted that whilst the area of habitat to be lost does contain large specimens of both *Randia moorei* and *Owenia cepiodora*, many of the largest specimens of *Randia moorei* are located above the FSL. This suggested amendment has been incorporated in table 9-24 and now reads as follows (see **Table 17**):

- **Table 17 Potential Impacts on Significant Flora (Randia moorei & Owenia cepiodora)**

Species	Potential Impact
Endangered	
Spiny Gardenia (*Randia moorei*)	Spiny Gardenia occurs in several discrete populations comprised of an estimated 1521 individuals. These plants occupy an area of approximately 9ha, at an estimated density of 165 plants per hectare. Initial clearing activities across the Project area will exclude areas of habitat known to contain this species, such that the ultimate loss of individuals will be determined by the impact of inundation to the proposed full supply level. It is envisaged that 15-20% of the area by Spiny Gardenia in the study area occupied (and total number of observed individuals) will be impacted by inundation in the long term, with the subsequent loss of 250-300 individuals of this species. **It should be noted that the impacts on *Randia moorei* are likely to be greater than that indicted by the area lost, as the area of the population affected includes the larger individuals of these species.**
Vulnerable	
Onion Cedar (*Owenia cepiodora*)	Onion Cedar occurs in several discrete patches, with a total population of approximately 237 plants over an area of approximately 9ha. Initial clearing activities across the Project area will exclude areas of habitat known to contain this species, such that the ultimate loss of individuals will be determined by the impact of inundation to the proposed full supply level. It is currently envisaged that 15-20% of the area occupied by Onion Cedar in the study area will be impacted by inundation in the long term, with the subsequent loss of up to 30-40 individuals of this species. **It should be noted that the impacts on *Owenia cepiodora* are likely to be greater than that indicted by the area lost, as the area of the population affected includes the larger individuals of these species.**

There will be an impact on several very large specimens of *Owenia cepiodora*, however, this loss will be offset by increasing the long term security and condition of several patches of habitat known to support this species which are currently threatened by a variety of processes.

Comment was made that areas containing any of the 8 EVR fauna inhabitants of the study area stated on page 9-67 (from table 9-17) should be excluded from mechanical vegetation clearing. A suggestion was made to insert the

following "All areas containing EVR fauna taxa will not be subject to mechanical clearing works i.e. vegetation will be left intact". This suggested amendment has been incorporated and the paragraph now reads as follows:

"A large proportion of the area to be permanently inundated at the proposed FSL (approximately 300 ha) will be cleared of vegetation. Clearing will be undertaken from the current FSL to the proximity of the proposed FSL. Where vegetation is not cleared it is assumed (for the purposes of this assessment) that it will be lost as a result of permanent inundation, although this may not necessarily be the case. Clearing will be prioritised as follows:

- *areas containing EVR flora taxa will not be subject to mechanical clearing works;*
- *riparian ecosystems adjacent to Little Nerang Creek and the Nerang River will not be cleared;*
- *areas of high visual impact will be cleared as a high priority (these areas do not contain EVR flora).*
- ***all areas containing EVR fauna taxa will not be subject to mechanical clearing works i.e. vegetation will be left intact and subject to inundation"***

A change of wording was requested for the "'Of Concern' regional ecosystem 12.3.2 Additional Requirements" text from" The proposed offset site should have weed cover" to "The proposed offset site may have weed cover that will need to be addressed". This suggested amendment has been incorporated and table 9-26 now reads as follows (see **Table 18**).

- **Table 18 Offset/Compensatory Habitat Targets ('Of Concern' RE 12.3.2)**

Attribute to be Offset	Area Lost (ha)	Minimum Offset ratio	Minimum Offset Area (ha)	Additional Requirements
'Of Concern' regional ecosystem 12.3.2	13.17	1:1.5	19.75	■ The proposed offset would ideally be the same regional ecosystem as the area proposed for clearing; ■ The proposed offset would ideally be within 20 kilometres of the area proposed for clearing; ■ The site must be non-remnant vegetation, or remnant vegetation that is otherwise committed to development; ■ **The proposed offset site may have weed cover that will need to be addressed;** ■ The proposed offset site should demonstrate the capacity to reach remnant status (with management), attain remnant status within a reasonable timeframe; and; ■ Ideally, the proposed offset site would require minimal revegetation.

3.8.6 Environmental Management Plans

Construction EMP

Comment was made that the Draft EMP does not contain sufficient information about the rehabilitation measures to be undertaken at the quarrying and clay borrow areas. A Site Rehabilitation and Decommissioning Report can be made condition of approval.

A suggestion was made during the pubic submission period of the EIS that the terrestrial fauna EMP for construction should be amended to ensure that within clearing sites identified on the subject site, large trees should be retained where possible to provide nesting hollows and habitat for native fauna. Retaining such trees would be of limited benefit as there would be a very restricted number of species that would use such hollow trees for nesting and habitat purposes considering the level of disturbance surrounding them. Clearing of any vegetation is to be conducted on a needs only basis.

Operational EMP

Concern was raised that the operational EMP does not cover terrestrial ecology and should cover how inundated vegetation will be managed, relocation of EVRs and compensatory habitat. These impacts will be incurred during the construction phase of the project, and have been considered at length in the construction phase EMP's.

Weed Management

Comment was also made that the EMP should include a statement that herbicide is not to be used to clear areas that will be inundated or affected by runoff. Whilst this is not feasible, a commitment has been made to ensure that any herbicide used to clear areas that will be inundated or affected by runoff will be non-residual.

3.8.7 Vegetation Clearing

Comments were made regarding the perceived lack of details provided regarding clearing of the inundation area and a call was made for a detailed clearing strategy to be defined prior to clearing commencing. A detailed clearing strategy can be made part of the conditions of approval.

A suggestion was made regarding the need for additional information for the clearing of vegetation on state land. The four parcels of land on state land are outside the CID and these parcels will be subject to a separate vegetation clearing application.

Comment was made in the EIS public submission period that the project is not justified in clearing areas of essential habitat, state wildlife corridors and threatened ecosystems. As the project has been classified as a "Significant Project", the Alliance is entitled to make an application to clear vegetation. Interruption to the State Wildlife Corridor will be minimal (disturbance will be on an existing bushland edge, not through integral bushland) and impacts on threatened ecosystems can and will be offset. Additional comment was also made suggesting that the damage to the environment will be high and irreversible. In order to ensure such a situation does not arise, a key initiative of the Project is the development of a compensatory habitat strategy which seeks to offset impacts on wildlife and the environment.

3.8.8 Vegetation Protection Orders

Gold Coast City already administers a Vegetation Protection Local Law, similar to that operating in other Queensland Local Government Areas. This Local Law protects all vegetation with a girth of 13cm (or greater) or a height of 4m (or greater) across the city. The local law is used to assess vegetation clearing outside of the formal development assessment framework.

3.8.9 Essential Habitat

It was requested that the legislative definition of "essential habitat" be included in the EIS and also be described in terms of what species use the essential habitat.

Essential habitat is defined as "vegetation in which a species has been known to occur that is endangered, vulnerable, rare or near threatened." The essential habitat of species is mapped by the Environmental Protection Agency (EPA). DNRW uses the essential habitat map as a tool when assessing vegetation clearing applications to assist in determining whether the vegetation is habitat for endangered, vulnerable, rare or near threatened species.

Essential Habitat is mapped across the study area for a variety of species, as listed in Table 9-22, Section 9.5.3 of the EIS.

There is no formal process in place for the Alliance to amend the Essential Habitat Maps and this task remains the responsibility of the Environmental Protection Agency. However, the loss of Essential Habitat for a variety of species is acknowledged, and the conservation requirements of all significant taxa likely to lose habitat will be addressed in the Compensatory Habitat Strategy which us currently being prepared.

3.8.10 Impact on Upstream Tributaries

Concern was voiced that no information had been provided on the potential for road works to impact the ecology of the upstream tributaries of the dam. The road realignment works will be undertaken in close proximity to a number of waterways. These waterway crossings are not "new" crossings, and ecological impacts have already been incurred during original construction. In relation to the condition, status and threats or the upstream tributaries, the following is noted:

- Drainage lines known as Beliss Creek and Burns Creek are in comparatively poor condition where they meet Nerang-Murwillumbah Road and are characterised by a proliferation of exotic flora species, carried downstream from the rural areas of Beechmont. Remnant vegetation at these sites was removed to accommodate the original construction works.
- Mitigation measures suggested for the Tusked Frog adjacent to Little Nerang Creek are equally applicable to other aquatic species and riparian communities.

3.8.11 Surveys

Concern was voiced that the surveys conducted to date were not adequate to provide a full picture of impacts on all species. The vast majority of target (significant) flora and fauna species were adequately surveyed by a wet and late summer field survey program. The EIS acknowledges the limitations of short term surveys, however, these are not unique to this type of project and can be addressed by comprehensive analysis of habitat attributes against known preferences of target species.

It was also suggested that the Coordinator General should impose condition with the recommendation of the project that further surveys for the remaining seasons of a full annual cycle are conducted and the EIS amended to cover findings and mitigation measures i.e. impacts on calculations of Vegetation Offsets. Further surveys are unlikely to provide any significant information that will influence the development of the details of the compensatory habitat strategy.

3.8.12 Inundation of Priority Areas

The Commonwealth Department of Environment and Water Resources suggested that the EIS should include a discussion of alternatives to the inundation of 'priority' areas, i.e. those areas containing a number of species of national environmental significance, including possible options (e.g. building infrastructure to prevent inundation) and a discussion of their feasibility and costs.

These priority areas are associated with the area known as Bass Bay on the western (Nerang River) reach of Advancetown Lake. Bass Bay supports an area of dry rainforest (notophyll vineforest) which contains sizeable populations of the Endangered Spiny Gardenia and the Vulnerable Onion Cedar.

The feasibility of constructing infrastructure to prevent the inundation of vegetation at Bass Bay has been investigated. Preliminary designs have been developed for a levee bank/saddle dam across the entrance to Bass Bay. Key design elements are as follows:

- The construction would require approximately 190 000m^3 of imported fill;
- The embankment would be 26m high and 235m long;
- The embankment would be approximately 175m in width;
- There are no existing access roads or tracks which could be used to transport construction materials and plant to the site; and
- The overall construction footprint would overlap with the area of vegetation containing the target species for protection.

The construction of a levee bank at Bass Bay is not considered feasible by the Alliance for the following reasons:

- It would require the construction of a new access road through a large, consolidated habitat block. This would require substantial habitat clearing (given steep grades) and introduce a new dispersal pathway for exotic plants and animals. The nearest access point is approximately 5.5km removed from Bass Bay;
- The levee bank construction would result in the removal of Spiny Gardenia and Onion Cedar, impacting on the area of habitat it intends to protect. It would also result in the loss of habitat to the northwest and southeast of the existing area of inundation;
- The levee bank would be located in an area which contains no existing services or infrastructure. Given that the levee bank has the potential to hold back water upstream, infrastructure would be required to prevent inundation of the dry rainforest area (and target species). This infrastructure creates a requirement to take power to the levee bank site and this would both increase costs significantly and create a new linear infrastructure corridor. Taking power to the site will necessarily involve vegetation clearing, habitat loss and fragmentation impacts.
- The remoteness of the site presents challenges for routine inspection and maintenance.
- No suitable source of construction materials has been identified. The construction may demand the expansion of quarries elsewhere or the establishment of new quarry/borrow areas, further increasing the overall development footprint.
- The cost of construction and maintenance of the levee bank and associated infrastructure would be excessive.

3.9 Aquatic Ecology

3.9.1 Fish Passage

The need for fish passage to be delivered as part of the Project was identified in the EIS. Considerable consultation has been undertaken with the Department of Primary Industries and Fisheries (DPIF) prior to production of the EIS. A summary of the consultation undertaken up until the publication of the EIS was provided in Sections 1.7.3 and 10.2.1 of the EIS. A preliminary design report for the Project was prepared concurrently with the EIS. This document provided details of the assessment and development of a preliminary design for fish passage. A copy of the relevant sections of the Preliminary Design Report was sent to DPIF in late July 2007. A further workshop to examine the details of fish passage for the Project was held with DPIF on 9 August 2007. Additional information in relation to the drivers for fish passage and the concept design discussed in the EIS is described in the Fishway section (and associated appendices) of the Preliminary Design Report presented in **Appendix E**.

Based on the information presented in **Appendix E**, the Alliance accepts the requirement to restore upstream fish passage as part of the Hinze Dam Stage 3 Project, despite the contraction of the Nerang River's fish community following the substantially reduced habitats and obstructed passage caused by the Stage 1 and Stage 2 dams. The assessment has also identified that the biological benefits of providing downstream fish passage would be extremely limited and delivery of the passage would be complex with the potential to compromise the water supply objective for the project. Consideration of the various factors identified lead to the conclusion that a fish passage to serve downstream-migrating fish at Hinze Dam is not justified.

The economic impacts of the long term provision of upstream fish passage where presented in Section 16.3.6 of the EIS.

The final requirements for fish passage at the dam are being developed in consultation with DPIF. Consultation is proposed to continue in relation to all structures being progressed by the Allinace that may have an impact on fish passage. The Alliance proposes early construction of the dam fish passage facility allowing opportunities for the refinement of the design and operation of the facility during the construction of the overall project. During this phase the Alliance is committed to on going monitoring of the fish communities in and around the dam.

Comparison with Paradise Dam

Comparisons have been made between the requirements for fish passage at Paradise Dam with those at Hinze Dam . This is considered inappropriate as the ecological considerations at Hinze Dam and the Nerang River differ markedly from those at Paradise Dam on the Burnett River. The Burnett is a much larger river system (catchment area = 33,380 km2) than the Nerang (catchment area = 495 km2). It is located in the mid-coastal region of Queensland, rather than the south-east, and has a distinctly different fish fauna. Extremely extensive and diverse fish habitats lie upriver from the Paradise site, whilst those above Hinze are far smaller, steep, headwater streams. Paradise Dam regulates downstream flows without significant diversion, while Hinze Dam diverts almost all flows and only an extremely small flow passes into the downstream channel. While there is an abundant and diverse community of fish requiring passage through the large-scale river habitats at the Paradise Dam site, the community seeking passage at the Hinze site is miniscule by comparison.

Trap and Haul Fishways

The comment has been made that '*trap and transfer fishways are generally used as an interim measure or a last resort method'*. Trap-and-haul fishways are long-established and effective technology. Three Alliance tem members visited the Tracy trap-and-haul fishway on the lower Sacramento River in California in June 2007. This facility annually passes an average of 7 million fish from numerous species but in 2006 it passed between 50 million and 100 million fish. They include highly sensitive, small-bodied fish such as delta smelt. Tracy fishway, operating on an irrigation flow of 128m3/s has been operating successfully over the past 50 years. It has a transfer bucket of 1700L capacity. The Hinze fishway, by comparison, will operate on a flow of only 0.08m3/s but has a bucket more than half as large as the Tracy facility, at 750L. While the Hinze fishway may be expected to cater for perhaps a few hundred fish per day at peak operation, Tracy copes with many millions.

The Hinze fishway is designed to accommodate fish sizes ranging from elvers, each weighing a few grams, to occasional large eels over 1 m in length. The system's operation is to be flexible to accommodate variations in the fish biomass to be transferred, and has a biomass capacity substantially greater than the maximum probable requirements. Assessments of these requirements are informed by experience with fish communities in comparable small coastal rivers, by visual and electrofishing surveys of the Nerang River during the project, by previous reports (Healthy Rivers Program 2005; M. Kennard unpublished report) and by professional evaluation of the likely fish-carrying capacity of the constrained and degraded river channel below the dam.

Hydrological and Biological Data Availability

The Alliance considers that suitable hydrological data are available for designing the Hinze Dam upstream fishway. The fishway is located downstream of the spillway on the right bank adjacent to the environmental flow release point (7.25ML/day) at the micro-hydro power station. The constant downstream releases mean that the facility will not need to cope with fluctuating flows and the entire environmental flow is available to facilitate fish transfer.

Fish trapping and transfer facilities are to be operable for floods up to the 1 in 20 year ARI flood. The issue of guidance for upstream-migrating fish in spilling flows is satisfactorily dealt with by creation of a barrier weir across the river channel beside the fishway. Construction of the barrier weir provides the extra advantage of improving downstream fish survival during spills by providing additional tailwater in the spillway-jet impingement zone downstream of the Stage I spillway chute's flip bucket.

The Hinze Dam site has been impounded for more than thirty years. Dam construction, water diversions and downstream urbanisation have led to ecological changes in the Nerang River's condition and its fish through the obstruction of fish passage, through the loss of fish-habitat area and quality because of water diversion at the dam and through various impacts on habitat quality in the urban areas. The biodiversity and abundance of the river's fish community has undoubtedly declined as a result of these effects. The end result is a fish community that is less diverse and much less abundant than under natural conditions. No programs are in place to restore Nerang fish communities through environmental flows or works to reverse habitat decline.

Few quantitative data are available on either the natural or the current distribution and abundance of the Nerang River's fish community. River-health monitoring (Healthy Rivers Program 2005) and surveys for the EIS indicate the occurrence of fish at most sites and this knowledge is supplemented by unpublished sampling data provided by Dr Mark Kennard of Griffith University. The likely patterns of fish distribution can be predicted from data on other south-eastern Australian systems (e.g. Harris 1988; McDowall 1996; Harris and Gehrke 1997).

Downstream Fish Passage

The intent of Queensland's fish passage legislation is 'to restore or maintain a functioning and, as far as possible, self-sustaining fish population'. Restoring upstream fish passage at Hinze Dam will increase biodiversity values in the storage and headwater streams and also alleviate mortality among fish congregating below the dam. But it is not important to restore full downstream passage at this site to sustain fish populations. The reasons for this conclusion are detailed below.

Population-dynamics models for fish have spatial components that act either as sources or sinks for the various life-history stages. 'Sources' are spawning and nursery areas and immigration, 'sinks' are associated with continuing mortality, especially during early life or at spawning or other stressful stages. Sustainability is determined by the balance between sources and sinks. In the Nerang River, both 'source' and 'sink' areas for fish are predominantly in the tidal or lowlands reaches, upstream reaches above the dam site are much less significant.

Catadromous, potamodromous and other, less-predictable fish-dispersal movements occur in the Nerang River. A few species such as bass and eels extend well upstream in the catchment. Many species such as mullets, bony herring and others live in the lowland reaches. The location of the Hinze Dam near the upper limits of the river's lowland zone interferes with the migrations and life-cycle of many fewer species than a barrier further down the system would do.

A review of what is known of the characteristics of the Nerang River species listed in **Table 19**, although this biological knowledge is incomplete, indicates downriver passage from the dam is not essential. The main species likely to benefit from downriver passage during spilling flows are the two eel species and the Australian bass. For the eel species, infrequent spills and downstream-resident spawners plus those from other systems could readily generate sufficient recruits. Like eels, bass are highly fecund and can recruit adequately from downstream spawners without any contribution to the spawning stock from Nerang River headwaters above the dam. The mullets are the remaining species of fisheries significance. They are widespread, lowland species, spawning extensively along the coastline, and sustaining their breeding stock and abundance would not require downriver passage over the dam of any individuals that may have been transported in the upstream fishway. Smaller fish species such as gudgeons and smelt could be expected to sustain populations both upstream and downstream of the dam, with occasional gene-flow interactions following spills and upstream movements in the fishway.

- **Table 19 Historical and current character of the Nerang River fish community***

Common name	Species name	Migration[1]	Occurrence[2]
Australian bass	Macquaria novemaculeata	Catadromous	confirmed
Australian smelt	Retropinna semoni	Potamodromous	confirmed
Bullrout	Notesthes robusta	Catadromous	confirmed
Common jollytail	Galaxias maculatus	Catadromous	predicted
Cox's gudgeon	Gobiomorphus coxii	Potamodromous	confirmed
Duboulay's rainbowfish	Melanotaenia duboulayi	Uncertain	confirmed
Dwarf flatheaded gudgeon	Philypnodon species1	Uncertain	confirmed
Eel-tailed catfish	Tandanus tandanus	Uncertain	confirmed
Empire gudgeon	Hypseleotris compressa	Uncertain	confirmed
Firetailed gudgeon	Hypseleotris galii	Potamodromous	confirmed
Flatheaded gudgeon	Philypnodon grandiceps	Uncertain	confirmed

Common name	Species name	Migration[1]	Occurrence[2]
Flyspecked hardyhead	Craterocephalus stercusmuscarum	Uncertain	confirmed
Forktailed catfish	Arius graeffei	Potamodromous	predicted
Freshwater herring	Potamalosa richmondii	Catadromous	predicted
Freshwater mullet	Myxus petardi	Catadromous	predicted
Gambusia[3]	Gambusia holbrooki	Uncertain	confirmed
Jungle perch	Kuhlia rupestris	Catadromous	predicted
Longfinned eel	Anguilla reinhardtii	Catadromous	confirmed
Marjorie's hardyhead	Craterocephalus marjoriae	Uncertain	confirmed
Midgley's carp gudgeon	Hypseleotris midgleyi	Uncertain	predicted
Mountain galaxias	Galaxias olidus	Uncertain	predicted
Mouth almighty	Glossamia aprion	Uncertain	predicted
Olive perchlet	Ambasis agassizi	Uncertain	confirmed
Oxeye herring	Megalops cyprinoides	Amphidromous	predicted
Oxleyan pigmy perch	Nannoperca oxleyana	Uncertain	predicted
Platy[3]	Xiphophorus maculatus	Uncertain	confirmed
Shortfinned eel	Anguilla australis	Catadromous	confirmed
Softspined rainbowfish	ornatus	Uncertain	confirmed
Southern purple-spotted gudgeon	Mogurnda adspersa	Uncertain	predicted
Spangled perch	Leiopotherapon unicolor	Potamodromous	predicted
Striped gudgeon	Gobiomorphus australis	Potamodromous	confirmed
Striped mullet	Mugil cephalus	Catadromous	confirmed
Western carp gudgeon	Hypseleotris klunzingeri	uncertain	confirmed

1. Migration: catadromous - migrates from freshwater to spawn in saline conditions; potamodromous - migrates between freshwater habitats; amphidromous - migrates between saline and freshwater habitats but not for the purpose of spawning; uncertain - includes species that make small-scale, local migrations within rivers and those whose movement patterns have not been described.

2. Occurrence: 'confirmed' - recorded in surveys or recent records in the Nerang River system; 'predicted' - includes species whose published natural distribution patterns probably included the Nerang River.

3. Alien species, originating outside Australia.

* 'Occurrence' data from the Healthy Rivers Program's 'Ecosystem Health Monitoring Report, 2005', and survey data by courtesy Dr Mark Kennard, Griffith University.

Since 1976, Nerang River fish have demonstrated that the proportions of the populations living downstream of the dam can continue to provide sufficient new recruits to sustain the whole system. The likelihood of remaining lag effects after this 30-year period appears low. Those fish currently surviving in the river have persisted after decades of blocked passage. Each of the catadromous species has been able to survive and reproduce adequately below the dam. It is important that the relatively large and unregulated tributary, Mudgeeraba Creek, which meets the Nerang in the tidal zone, provides substantial habitat for sustaining stocks in the river. Furthermore, species such as mullets, eels and others move along the coastline, immigrating from neighbouring systems (McDowall 1996; Allen et al. 2002). There are therefore several sources of recruitment to ensure that abundance of the present populations is maintained. Spawning by the small numbers of fish, of a few species, that might potentially be given downstream passage from the Stage 3 dam is irrelevant to sustaining Nerang fish populations. Provided that the fish transferred above the dam are not required downriver for recruitment, as was concluded previously, the upstream-only fishway has nothing but positive implications for fish biodiversity and abundance in the river.

Impacts of a Stepped Spillway

Knowledge of the adult fish survival rate over stepped spillways is limited. American studies so far have suggested that stepped spillways may in fact be less damaging to fish than smooth spillways. This is because the stepped design lowers velocities, limits shear stresses and may reduce the likelihood of impingement on solid substrates, particularly in moderate-to-high spilling flows. Further details of the assessment of the proposed spillways performance with respect to fish mortality is presented in **Appendix E.**

3.9.2 Riparian Habitat Loss

Stage 3 of Hinze Dam will result in the inundation of an additional 8.6km of riparian vegetation (this represents the combined total for Little Nerang Creek and the Nerang River) at Full Supply Level. Subsequently a maximum area of approximately 40ha of riparian vegetation will be inundated. This area consists of Queensland Blue Gum and Flooded Gum open forests and woodlands.

The EIS (Section 9.65) suggested a minimum offset ratio of 1:2 for riparian vegetation as per the Department of Natural Resources and Water Policy for Vegetation Offsets (November 2006), or a total offset area for riparian vegetation of 86.52ha. The actual offsets required will be determined in consultation with DNRW. The offset area is likely to be comprised of the management and/or rehabilitation of riparian habitats upstream from the Dam.

3.9.3 Recreational and Commercial Fisheries

Gold Coast City Council supports and encourages the recreational activity of freshwater fishing in Hinze Dam. The Hinze Dam Fish Management Committee has been established to coordinate the fish stocking of the Dam and to promote freshwater fishing (Gold Coast Council Local Law Policy No. 13 Hinze and Little Nerang Dams). Commercial fishing tour operators are permitted to operate on Hinze Dam. These operators do not require an operating licence or permit from Council, but must comply with all policies and regulations. Recreational fishing in the dam is not permitted except where authorised by a permit. Shore based angling as well as fishing from boats is possible. Fishing is only permitted during daylight hours and anglers are to use indigenous baits only. Fishing is not permitted within 150 metres of the Dam embankment, measured at the impounded water level. The use of nets, winged traps, explosives and electrical means is also prohibited, except where their use has been approved by Council and the appropriate permits have been obtained from the relevant authority.

On occasions, fishing competitions are held at the Dam. These require Council approval with the applications for the events being assessed by the Catchment Management Coordinator. As with all other applications, appropriate conditions are set and enforced by the Rangers. Proposed fishing competitions at Hinze Dam are only approved where it can be determined that there will be no detrimental effects on water quality, the environment and public amenity.

Downstream of the dam and upstream of the tidal limit the Nerang River provides limited recreational fishing opportunities when compared with other sites available in the Nerang River catchment. This is due to the modified flow regime created by the existing dam and limitations on access to the riparian areas of the river.

The Nerang River estuary is a popular recreational fishery area for species such as bream, whiting, tailor dart and Herring (bait).

Limited commercial fishing is undertaken in the estuary. Based on available records (1999) a maximum of 5 commercial vessels fished the river estuary for a total catch of 29 tonnes in that year.

Assessing the nature of the existing recreational and commercial fishing operations in the Nerang River system and the impacts associated with the Project it is considered that these fishing operations will not be adversely impacted by the Project.

3.9.4 Water Quality Impacts

The potential impacts of raising the full supply level of the dam on water quality was addressed in Section 7 of the EIS.

3.9.5 Middle Nerang Catchment

Stage 3 Impacts

The impacts of the Project on the Middle Nerang Catchment,being the reach of the river from downstream of the dam to Nerang, was examined in the EIS particularly in Section 7 Water Resources and Water Quality and Section 10 Aquatic Ecology. The environmental values of the river reach as identified in the *Environmental Protection (Water) Policy 1997* were presented in Table 7.9 of the EIS. This table is reproduced as **Table 20** below.

- **Table 20 Environmental Values for the Waters of the Nerang Catchment**

	Upper Nerang River	Hinze Dam	Little Nerang Dam	Lower Nerang River	Other Freshwater tributaries	Other wetlands, lakes and reservoirs	Ground waters	Tidal canals, constructed estuaries, marinas and boat harbours
Aquatic Ecosystems	H	✓	✓	M	✓	✓	✓	H
Human consumption	M	✓	✓	L	✓	✓		M
Primary recreation	M	✓	✓	L	✓	✓		H
Secondary recreation	L	✓	✓	M	✓	✓		H
Visual recreation	H	✓	✓	M	✓	✓		M
Cultural and spiritual values	H	✓	✓	L	✓	✓		L
Industrial use	L			L				L
Aquaculture	L			L				L
Drinking water	H	✓	✓	L			✓	L
Irrigation	H			H	✓		✓	L
Stock water	H			M	✓		✓	L
Farm supply	M			M	✓		✓	L
Oystering				L				L
Seagrass				L				H

Source: EPA 2006

1 ✓ means that the value is selected for protection

2 H, M or L indicate a high, medium or low importance on the value

3 Blank indicates that the value is not selected for protection

The Middle Nerang catchment reach identified above would lie in the Lower Nerang River area identified in **Table 20**. The Lower Nerang (freshwater component) contains a number of environmental values, only one, irrigation, was identified as high importance while aquatic ecosystems was rated as medium importance.

The environmental values of the Nerang catchment waterways were also assessed by the Technical Advisory Panel (TAP) as part of the development of the Moreton and Gold Coast Water Resource Plans (WRP) (DNRMW 2006b). The TAP rated the headwaters of the Nerang and Little Nerang Creeks as having natural or near-natural conditions, with very high ecological values. The other reaches of the Nerang River including the Lower Nerang River, were assessed as moderately to highly disturbed, although some of them support rare or threatened native flora and fauna. The TAPs role included the review of the water entitlements and environmental flow objectives adopted in the WRP with respect to sustaining the environmental values of the rivers and waterways within the plan area.

One of the primary objectives of the Gold Coast WRP is the sustainable management of water resources in the catchment. In order to achieve this the WRP specifies a range of environmental flow objectives (EFOs) and water allocation security objectives (WASOs) that must be met. Three key scenarios have been developed for the Gold Coast WRP IQQM; pre-development, current condition and full entitlement. The pre-development scenario represents the natural condition of the Nerang River catchment. The current conditions scenario represents the catchment as it exists at present, while the full entitlement scenario represents the catchment when all water licences are used to their maximum capacity. Future development scenarios, such as Hinze Dam Stage 3, are developed from the full entitlement scenario.

The environmental flow objectives for the Gold Coast catchment are outlined in the *Water Resource (Gold Coast) Plan 2006*, Schedule 5. Their aim is to maintain key flow conditions within the catchment in order to ensure ecosystem health. The Hinze Dam Stage3 Project as detailed in the EIS complies with all of the environmental flow objectives set out in the WRP. That is the Project outcomes comply with the intents of the WRP with respect to maintaining the environmental values of the Nerang River system below the dam.

Section 7 1.6 of the EIS examined the Projects impacts on downstream flows when compared to existing conditions. The assessment demonstrated that the Nerang River flow regime has already been highly impacted by the construction of Hinze Dam, as the dam captures all of the low and medium flows and some of the high flows. Flow duration curves presented illustrated that the Project will have very little further impact on the downstream river flow. The impact of the Project reduces as the river approaches the tidal zone. At Hinze Dam the outflow is greater than 10 ML/d for less than 10% of the time. For approximately 90% of the time the flow consists of a constant release of about 7.25 ML/d, which is released from the dam as an environmental release and compensation flow. This release will not be changed by the Project.

Further downstream the release from Hinze Dam is augmented by tributary inflows, increasing the flow regime but it is still heavily impacted by the existing dam. The EIS has identified that the construction of Hinze Dam Stage 3 will not significantly alter the existing heavily impacted flow regime of the Nerang River. As such mitigation strategies to offset the identified impacts are not justified.

Offset Strategy

Details of the assessments undertaken in determining the Projects impacts on aquatic ecology were contained in the Alliance sub consultants report presented as Appendix F10 in the EIS. For completeness the entire report was presented. In this report a range of options for mitigating the downstream impacts of the dam were identified in Section F10 7.3. One option that was identified was an offset strategy for the reach of river from the dam to Weedons Crossing. While the option was identified it has not been adopted by the Alliance, as evidenced by the option not being presented in the body of the EIS or in the list of Proponent Commitments identified. An offset strategy is not proposed and is not included in the scope of work for the Project.

3.9.6 Aquatic Ecology Operation EMP

Environmental flow requirements from the dam have not been included in the Aquatic Ecology Operation EMP. Current Environmental flow release arrangements are documented in the Interim Resource Operations Licence (IROL) held by Gold Coast City Council. The IROL will be amended as part of the development of the Resource Operations Plan for the Gold Coast WRP to include environmental flow requirements required for Hinze Dam Stage 3.

The Operations EMP will be finalised during construction of the Stage 3 upgrade. This will provide an opportunity to include such matters of the management of riparian vegetation and habitats and draw on existing management programs being undertaken by GCCC.

3.10 Air Quality and Greenhouse Gases

3.10.1 Modelling Results and Consistency with Guidelines

The air quality modelling methodology adopted in the EIS is outlined in Section 11.5.3. The dust deposition rates were determined on an average annual basis and divided by 365 to determine average daily dust deposition rates. Predicting dust deposition rates on a monthly average may result in higher deposition rates (for example, if monthly averages were determined during periods where a high proportion of prevailing winds are from a particular wind direction), but construction information is not available on a month-by month basis to undertake such a task. The modelling methodology is based on a worst case scenario in terms of construction activities and the average deposition rate on an annual basis would be close the maximum monthly average dust deposition rate.

As acknowledged in the submission the background dust deposition at this site is low and was assumed to be zero for the purposes of the air quality assessment. Dust deposition rates will be monitored at a number of locations with the goal of achieving less than120 mg/m^2/day at nearest sensitive receivers throughout construction.

3.10.2 Air Quality Monitoring Methodology

The background air quality data used as part of the air quality assessment is based on the EPA monitoring station at Helensvale. As stated in the EIS, Helensvale is located relatively close to the Pacific Motorway compared to the project area. The PM_{10} concentrations are expected to be lower at the project area than at Helensvale. The predicted concentrations of PM_{10} and TSP for the worst case construction scenarios investigated were well below the ambient air quality goals outlined in the EPP(Air), even when including the assumed background levels determined at the Helensvale monitoring station. These predicted concentrations of PM_{10} and TSP can be considered conservative because of the choice of Helensvale air quality data to establish background PM_{10} and TSP concentrations.

The Alliance is committed to establishing a dust deposition gauge in close proximity of residents properties that may be impact by dust generation. The gauge will monitor dust fallout from construction activities. Air quality data will be collected and analysed on a monthly basis. It is anticipated that this data will be communicated to the public but the form and method of communication has not been established at this stage. However, brief monthly environmental monitoring reports made available on the internet are being considered by the Alliance.

A range of mitigation measures for construction dust are outlined in Section 11.5.5 of the EIS and will be further refined as part of the detailed Air Quality Management Plan for construction works. This will ensure that if dust levels are higher than accepted levels, the appropriate management solutions will be employed to eliminate the impact on the local residents.

3.10.3 Impact of Dust Deposition on Water Quality in Rain Water Tanks

Comments were received in relation to the potential impacts of dust deposition on water quality in rain water tanks caused by the Project. The air quality impacts from construction of the project were assessed as part of the EIS. The air quality assessment determined that concentrations of PM_{10} and TSP were below ambient air quality goals in the EPP(Air). The dust deposition rates were lower than the EPA's guideline of 120 mg/m^2/day. However the EIS did acknowledge the potential for dust nuisance does exist particularly at residents close to the construction site. The Alliance will establish a dust monitoring program to identify significant dust generating activities, and proactively manage these activities to minimise the potential for dust impacts at sensitive receivers.

The maximum predicted increase in dust deposition rates at a sensitive receiver was 108 mg/m^2/day. Based on this deposition rate the maximum potential suspended solids concentration in rain water tanks in the driest month (August with 42 mm/month) is 2.6 mg/L. This assumes all deposited dust is captured in rainwater tanks (wind does not blow any from the roof) and remains as suspended solids within the tank (ie no settling out of solids in the tank). The water quality objective (EPP(Water)) for suspended solids in drinking water supply of the Nerang River is 20 mg/L. The maximum predicted suspended solids concentrations are well below the water quality objectives.

3.10.4 Health Impacts of Increased Vehicle Emissions During Construction

As stated in the EIS, exhaust emissions of construction equipment will contain carbon monoxide (CO), oxides of nitrogen, (NO_X) and sulphur dioxide (SO_2). These emissions are not expected to be significant because of their low levels of emissions. Daily traffic along Advancetown Road is expected to increase from 535 to 588 vehicles per day with the commencement of construction. Roadside monitoring data collected by the EPA on busy roads (greater than 10 000 vehicles per day) in Brisbane did not show any exceedances of the ambient air quality goals in the EPP(Air). There is a good dispersive environment along Advancetown Roads (open environment with no 'urban canyon' effects) for traffic pollution. Therefore the increase in vehicle traffic along Advancetown Road is not expected to have any significant air quality impacts.

Based on existing literature, the enHealth Council (2004) conclude that in most parts of Australia traffic emissions are unlikely to cause significant impacts on the quality of rainwater collected in domestic tanks. The existing ambient air quality at the project site and the predicted increase in construction traffic are not expected to have a significant impact on drinking water quality.

enHealth Council, 2004, *Guidance on the Use of Rainwater Tanks*, Australian Government Department Of Health and Ageing, publication approval number 3432(JN8304).

3.10.5 Dust Suppression Activities

As identified in **Section 3.4.3**, the Alliance will require approximately 1ML of water per day for construction purposes, including dust suppression. Recycled water (sourced onsite) will be used preferentially for dust suppression during construction. The Alliance is also assessing the feasibility of other water saving management measures such as the use of dust suppressants, to reduce water usage.

The outcome of these activities will be to mitigate the potential impacts on surrounding residents as well as providing a safe environment for the workforce onsite.

3.10.6 Greenhouse Gas Emissions

Comments were received suggesting that the Coordinator General should impose conditions for adequate carbon credits. Currently in Queensland, there is no legislation that enables mandatory conditioning of development approvals for greenhouse gas offsetting (including carbon).

However, the Alliance has committed to maintaining an inventory of greenhouse gas emissions for the Project once construction commences. This will include regular reporting on greenhouse emissions and progress on greenhouse mitigation measures as well as maintaining membership of the Commonwealth Government Greenhouse Challenge Program. Furthermore, some of the vegetation that will be obtained as part of the Compensatory Habitat Strategy will be eligible to provide carbon offsets towards the impacts of the project.

3.11 Noise and Vibration

The submissions received in relation to noise and vibration has been addressed in the following sections.

3.11.1 Construction Hours of Operation

Clarification of the hours of construction has been sought from the submissions received in relation to the EIS. This has been addressed in **Section 3.2.1** of this report.

3.11.2 Construction Hours Evening Shift

See **Appendices B** for the night time noise assessment.

3.11.3 Old Advancetown Road Access

The provision of providing an alternative access to the site through the opening of Old Advancetown Road was raised in the submissions. The submitters highlighted that this road would minimise medium and long term noise (and other environmental) impacts to residents adjacent to Advancetown Road.

The provision of this alternative access is addressed in **Section 3.12.6** of this report

3.11.4 Noise Impacts

The issues raised by submitters in relation to the noise impacts of the project are addressed in **Table 21**.

Table 21 Noise Impacts

Submission Issue	Response
Increased traffic along Advancetown Road associated with the Project during the early morning hours, from 4.00 am, is expected to impact sleep and compound current impacts from traffic associated with the Cedar Lake Equestrian Centre.	Section 12.4.5 of Volume 3 of the EIS indicates that the majority of construction works would be undertaken 5 days per week, generally Monday to Friday, between 6.30am – 6.30 pm. However, every fourth week works will be conducted Tuesday to Saturday to allow for shift rosters. The construction hours have been addressed in detail in **Section 3.2.1** of this report. An assessment of construction traffic noise impacts along local roads to the Project site, including Advancetown Road, was not included in the draft EIS due to the relatively low overall daily traffic flow (including construction traffic) travelling along Advancetown Road. An assessment of the change in road traffic noise levels has been undertaken based on the information detailed in the supplementary traffic report. The traffic study, contained within this report, Identifies the following totals for daily traffic generated by the site construction activities: **Description** / **Totals** Light vehicles: 199 Buses: 4 Heavy Vehicles: 22 Equipment Deliveries: 8 **Section 3.12** of the supplementary report (Traffic) also identifies the annual average daily traffic volumes (AADT) for both the existing road use and the future predicted road use during construction of the dam. The existing AADT for Advancetown Road is approximately 515 vehicle movements however this number would be much higher if only weekend movements were considered as the majority of movements are related to tourist traffic visiting the dam. With the closure of Advancetown road to through traffic during the construction period, only construction and local traffic movements would occur. The bulk of the additional vehicle movements would occur during the morning and peak hour periods and have been estimated at 100 one way movements for each period. These peaks would last for about 30 minutes each and only a few additional movements to and from the site would occur outside these times. Combined with local residential traffic movements, the expected AADT for Advancetown Road during the construction period would be expected to reduce to approximately 440 movements per day. Although the peak AM and PM periods would have a greater impact than currently experienced at these times, the overall daily L_{Aeq} noise levels from traffic on Advancetown Road is expected to reduce as the result of the works. Detailed traffic management plans will be prepared for the proposed works and would include restrictions to time of travel, routes, speeds, queuing and the like to minimise impacts to the local community It is beyond the scope of this study to address traffic noise and sleep disturbance impacts associated with the operation of the Equestrian Centre.
Some form of noise barrier adjacent to Advancetown Road would be of benefit	The EIS includes commitment to further investigation and ongoing management of noise impacts during construction. Specific control measures, such as noise barriers, may be implemented, as required, based on the outcomes of ongoing investigation and monitoring prior to and during the construction works and the acceptability of noise impacts during the works. The proposed noise management measures and associated modelling results indicate that a barrier at this location is not required at this location. However the Alliance is committed to managing any noise impacts on surrounding residents when and if they arise.

Submission Issue	Response
Noise from use of exhaust brakes along Advancetown Road	Section 13.1.2 of the of the EIS supplementary report estimates approximately 34 one way heavy vehicle movements would travel along Advancetown Road during the daily 12 hour construction period. This equates to approximately 3 heavy vehicle movements per hour. The noise from heavy vehicles will be a combination of engine, tyre, exhaust and air brakes, which will impact on residents along Advancetown Road. The impacts of vehicle noise are not easily mitigated however; heavy vehicle movements will be limited to the project construction hours during the daytime which is expected to provide an acceptable level of noise amenity during the quieter evening and night time hours. Further management strategies that may reduce noise impacts from heavy vehicles may include the following: ■ Coordination of regular deliveries to the site for the same time each day during the mid to late morning period to minimise the spread of vehicle movements. ■ Speed limits of 40km/h for truck construction traffic on Advancetown road to reduce the need for heavy braking and also minimise traffic noise impacts. ■ Limit all deliveries to site to the project construction hours with no deliveries or pickups to occur past 4:00pm.
Continuous construction noise during the day may impact the running of business, the lives of residents, the use of outdoor areas	It recognised that the project involves the use of heavy machinery which will generate noise. This equipment is necessary to complete the works and it is understood that this work will impact on the acoustic amenity of some nearby residents. An assessment of noise impacts has been undertaken as part of the EIS process in order to estimate noise from the construction activities and as the results of this assessment, voluntary noise limits have been adopted by the project to minimise the impact of construction noise on nearby residential locations. In the assessment of environmental noise impacts, an exceedance of the project goals was identified during some stages of the works. These exceedances will be managed and reduced where possible to meet the project limits. Although construction activities in Queensland are often not required to meet specific noise level targets for daytime works (6.30 am – 6.30 pm), the Alliance has voluntarily developed and adopted a construction noise level goal aimed at assisting with the management of noise and in protecting the amenity of adjacent areas. This noise level goal has been developed with consideration to the existing noise environment and aims to maintain acceptable internal noise levels within the most exposed living areas of nearest affected receivers, whilst allowing construction to proceed with the least impacts to amenity. The target has been set to allow normal conversation and daily activities to occur inside dwellings during the works. In recognition of the potential for disruption to community the Alliance proposes to operate 5 days per week, between 6.30am – 6.30pm, however some workshop activities will be required to be conducted during an evening shift between 3pm and 12:00am on each working day. A night time noise assessment was conducted and is attached in **Appendix B**. **Section 3.3.6** of this report addresses the night time works and proposed management measures in detail. These works are also subject to a separate EPA and Council approval process, and will be conditioned accordingly. As outlined in Section 19.1.1 of the draft EIS a detailed construction noise and vibration management plan will also be prepared for the daytime construction works associate with the Project, including procedures for ongoing investigation, monitoring and management and specific solutions for receivers subject to adverse impacts. Consultation with the affected community will be undertaken as part of the development of the EMP to better understand the types of activities which may be adversely impacted by construction works. The operation of home businesses and lifestyle activities will form key considerations in this management plan and where construction noise is unreasonable, appropriate noise controls would be developed and implemented in consultation with the affected members of the community. A monitoring program for noise emissions from the site will be undertaken during the course of the project to ensure that noise levels are at or near the project goals where possible. Mitigation measures will be investigated and implemented where feasible based on the level of exceedance, the number of affected residences and the cost of remedial works.
The expectation that residents can remain in a closed house 12 hours a day is neither acceptable nor healthy	The EIS investigates the potential for noise impacts at receivers near the construction works and recommends possible mitigation measures to allow a range of normal daytime activities to occur (such conversation, relaxing, working etc). Where noise controls at the source are not practical and residents are unable to carry out such activities, the option of closing doors and windows to achieve satisfactory internal noise levels (in accordance with Australian standards) is likely to be effective. The Alliance has committed to further investigation, ongoing monitoring and implementation of appropriate noise management measures, as required to ensure appropriate noise levels are achieved at the sensitive receivers.

Submission Issue	Response
Daytime construction noise is expected to impact ability to sleep during daytime hours, which is required to enable shift work	The EIS commits to further investigation of the potential noise impacts and appropriate mitigation measures for the works and includes commitment to the preparation of a detailed environmental management plan for the works. The EMP outlines a process for noise monitoring, investigation and implementation of further mitigation measures, as required, to maintain acceptable noise levels within the surrounding community, and would consider receivers within the broader area surrounding the dam, including Red Oak Drive. Consultation with the affected community would also be undertaken to better understand the types of activities which may be adversely impacted by construction works and to assist with managing the potential impacts, including sleep disturbance to shift workers requiring sleep during daytime hours.
Concern that traffic noise and construction works will continue into the early morning hours, as occurred with the Stage 2, and will limit ability to sleep.	Subsequent to the draft EIS, the likelihood of some limited maintenance activities during night time hours has been confirmed. The majority of construction works will be carried out during daytime hours (6.30am – 6.30pm Monday to Friday, and 6.30am - 6.30pm Tuesday to Saturday every fourth week). Some machinery maintenance and repair works will be undertaken during night time hours (currently proposed until 12 midnight). A night time noise assessment was conducted and is attached in **Appendix B**. **Section 3.3.6** of this report addresses the night time works and proposed management measures in detail. These works are also subject to a separate EPA and Council approval process, and will be conditioned accordingly. Noise impacts from shift changes may occur with the end of the shift at the maintenance workshop. There are 5 vehicle movements expected during this time, which would be exiting the site at midnight. This level of activity would not pose a significant impact in terms of traffic noise at residential locations. Management strategies would be implemented to control noise impacts during this time. These strategies would involve a code of conduct for employees to ensure the acoustic amenity of residents is protected during this time.
The EIS does not consider the noise impacts on the residents of Red Oak Drive, and no noise monitoring was undertaken in this location	The noise impact assessment presented in Section 12 of Volume 3 of the EIS investigates the potential for noise impacts at the nearest off-site receivers. The nature of noise, vibration and dust emissions from construction works of this type is such that if levels are controlled to levels near the project goal at nearest off-site residences, the levels would also be lower than the project goal at residences located further from the works, including those along Red Oak Drive. Noise monitoring was undertaken at two locations to the north of the existing dam wall and one location to the east. The noise monitoring results at all three locations indicate a quiet rural environment, with daytime noise levels around 31-34 dB(A). If pre-construction noise monitoring were to be performed along Red Oak Drive, the noise levels would be expected to be similarly quite, ie within the range 31-34 dB(A). Noise levels at Red Oak Drive and the Panorama would be less than those outlined at the eastern most locations shown on Figures 12-7 to 12-9 of Volume 3 or the EIS. The EMP outlines a process for noise monitoring, investigation and implementation of further mitigation measures, as required, to maintain acceptable noise levels within the surrounding community, and would consider receivers within the broader area surrounding the dam, including Red Oak Drive.
Concern that an increase in noise level of 10 dB(A) is a doubling in loudness of noise within the area	It is acknowledged that the character of the noise environment within the area surrounding the Hinze Dam wall will change during the construction period.
The tone, pitch and character of noise are an issue	The character of the noise environment within the area adjacent to construction activities will represent a change from the existing environment. Tonal impacts are not expected to occur (as these are generally restricted to continuous motor type sources such as fans, industrial refrigeration equipment and the like).
Have the physical and mental health effects of noise exposure been considered?	The assessment of physical and mental health effects of noise can be subjective, and heavily influenced by the health of an individual prior to exposure. The prolonged exposure to excessive noise levels referenced in the Department of Environment and Australian Health Department Publications relate to levels of exposure far greater than those likely to occur as a result of the Project construction activities. In order to control noise from the works, the EPP(Noise) acoustic quality objective has been adopted for general construction works and blasting noise goals outlined by the EPA have also been adopted. These levels have been developed with consideration minimising the potential for annoyance on the community.
Noise impacts from haul roads will be difficult to manage	Haul roads will be constructed for even running of construction vehicles to avoid significant gear changes and braking. Noise levels will be monitored and a range of mitigation measures available to the Alliance will be implemented as required.
What compensation will be provided for potential loss of rental income if tenants	Any compensation claim will be addressed on a case by case basis by Gold Coast City

Submission Issue	Response
What compensation will be provided for potential loss of rental income if tenants object to construction noise	Any compensation claim will be addressed on a case by case basis by Gold Coast City Council.
The noise and vibration levels will have a negative impact on property values both during and after construction	Noise and vibration during construction is unlikely to impact property values after construction of the project. Refer to **Section 3.14**.

3.11.5 Quarry Operations and Blasting

The issues raised by submitters in relation to the noise and associated impacts from the operation of the quarry and the undertaking of blasting are addressed in **Table 22**.

Table 22 Quarry and Blasting Impacts

Submission Issue	Response
Clarify the number of blasts per day	Section 12.7.2 of Volume 3 of the EIS indicates that one blast would occur each working day, with no blasting during night-time hours.
Impacts of "blast zone" on residents and the operation of the Advancetown Equestrian Centre (agistment, training, riding lessons).	Section 12.7.2 of Volume 3 of the EIS provides an assessment of the potential airblast overpressure levels which may result from blasting associated with quarrying activities. Nearest residential locations (approximately 900m from the quarry) are likely to be at the lower end of the range of airblast impacts (115 dB(A) for less than 10 milli seconds). The EIS commits to further investigation of the potential airblast impacts prior to the commencement of blasting works at the quarry and the preparation of a detailed management plan for these works. Consultation with the affected community would also be undertaken to better understand the types of activities which may be adversely impacted by construction works and to assist with managing the potential for impacts from blasting. Impacts to horses at the equestrian centre would be considered further as part of the detailed studies and management plans to be prepared for blasting works
Concern about the effect of blasting on the dam wall and prolonged effect on houses and other residential structures	Consideration of the potential effects of ground vibration from blasting on the dam wall are a key consideration for blast management. This is addressed further in **Table 23**.
Blasting at 5.00pm 4-5 days per week would be more intrusive on people's lifestyles than blasting at midday	The EIS proposes that blasting would be undertaken at a similar time each day, to assist with minimising impacts on community activities, so that families and community members could plan for this regular event. It also commits to consultation with the affected community to better understand the types of activities which may be adversely impacted by construction works, including blasting, and to assist with the development of specific management measures for the works. The draft EIS commits to further investigation and the preparation of a detailed management plan for blasting works to ensure that impacts to receivers are minimised.
Will blasting be avoided during periods of strong wind blowing in the direction from the blast site towards noise sensitive places?	The blasting management plan will incorporate measures, such as those outlined in the EPA blasting guideline, to minimise the potential for noise impacts at adjacent sensitive places.

3.11.6 Vibration Impacts

The issues raised by submitters in relation to the vibration impacts of the project are addressed in **Table 23**.

Table 23 Vibration Impacts

Submission Issue	Response
Vibration impacts from prolonged blasting activity may result in structural damage to the house	Section 12.7.3 of Volume 3 of the EIS provides an investigation into the potential for ground borne vibration impacts on nearby sensitive receivers. The assessment indicated expected vibration levels at the nearest sensitive receivers (~900m from blasting) of less than 0.3 mm/s when using a MIC of 15kg (this is the level corresponding to low probability of impact to human comfort for continuous vibration sources, BS6472:1992 Evaluation of human exposure to vibration in buildings (1Hz to 80Hz).

Submission Issue	Response
	The predicted levels are also well below those potentially resulting in structural damage to buildings (>15 mm/s, BS 7385 Evaluation and measurement of vibration in buildings Part 2) and are well below the EPA's blasting vibration limits outlined in Section 12.4.5 of the draft EIS. The EIS states that as the energy from a blast radiates away from the source, it dissipates and ground vibration levels therefore generally decrease with distance from the blast. Ground vibration predictions at receivers located further than 900 m from blasting activities, such as those along Red Oak Drive, would therefore be less than the levels outlined above and very unlikely to result in structural damage to buildings. The EIS commits to further investigation of the potential ground vibration impacts prior to the commencement of works at the quarry and the preparation of a detailed management plan for blasting works. The blasting contractor would prepare the management plan, including monitoring during trial to ensure that impacts to receivers are maintained at an acceptable level and minimise the potential for structural damage. As an assurance to the community, the Alliance has committed to undertaking condition surveys at residences within the construction community exclusion zone (~1000 m from the quarry) and at residences within up to 2000 m from the quarry, if requested. Follow the condition survey, if project related impacts are identified then appropriate compensation will be negotiated with the property owner. This, along with the monitoring program, will assist in managing impacts from the Project.
Request for pre construction condition surveys and that surveys should be conducted by an independent authority to minimize claims of bias	Experience gained during the Hinze Dam Stage 2 project has lead to the development of much stricter controls in the management of blasting for Stage 3 and the draft EIS commits to further investigation of the potential ground vibration impacts prior to the commencement of works at the quarry and the preparation of a detailed management plan for blasting works. Ground vibration predictions at receivers located further than 900 m from blasting activities, such as those along Prender Court, would be less than the levels outlined in the EIS and are therefore not expected to result in structural damage to buildings at this location. Condition surveys would be undertaken at dwellings located within 1000 m of the quarry blasting area and out to 2000 m from blasting, as requested. Condition surveys would be conducted, as required, by practitioners qualified and experienced in performing such surveys.

3.11.7 Noise Modelling, Monitoring and Environmental Management

The issues raised by submitters in relation to the noise modelling, noise monitoring and site environmental management are addressed in **Table 24**.

Table 24 Noise Modelling, Monitoring and Environmental Management

Submission Issue	Response
Has the effect of meteorological conditions been incorporated into the assessment?	Section 12.5.1 of Volume 3 of the EIS indicates that temperature inversion conditions have not been considered in the assessment of construction noise impacts, however wind effects have been considered. Although this section indicates that night-time works are not proposed, some limited maintenance works are proposed between 3pm – 12midnight, and would occur within an acoustically lined shed so that potential for sleep disturbance impacts are minimised (refer **Appendix B**).
The EIS assertion that temperature inversion conditions only occur during night-time hours seems at odds with statements outlined in the EPA's Planning for Noise Control Guideline	The reference to "night time" hours in the EIS relates to hours between 6.30 pm – 6.30am and outside of these hours temperature inversion conditions are highly unlikely. An appropriate time for blasting would be determined in as part of the detailed blast management plan, incorporating consideration to meteorological conditions and following consultation with the community. Works during June and July, when the sun sets earlier, are likely to cease around 5.30pm and blasting will not be conducted outside of working hours (i.e. 6:30am – 6:30pm).

Concern that simulation modelling does not produce 100% accurate results	Noise modelling has been used as a tool to assist with the identification of potential issues associated with the construction works, the prioritisation of appropriate noise mitigation measures, and the need for further investigation when project details become available. The EIS acknowledges that the noise impact assessment modelling is indicative of noise levels which could be expected during construction.
Results of baseline noise monitoring at Duncan Road	The EIS presents the results of noise monitoring undertaken at three locations, including H3 at Duncan Road. The monitoring results indicate a quiet rural environment, with rating background noise levels varying from 31 dB(A) during the daytime to around 25 dB(A) during the night time. Further information on the daily variation in noise levels at this location can be found in Appendix F.12.1 of Volume 4 of the EIS.
Does the noise modelling account for varying building structure and materials?	The level of attenuation provided by a building façade will depend on the building structure, materials and insulation, area of glass, seals around windows and doors and the like.
If monitoring shows unacceptable noise and vibration levels during construction, what management measures would be employed to minimise impacts on residents	The noise and vibration management section of the EMP (Section 19 of the Draft Environmental impact Statement) outlines a process for noise monitoring, investigation and implementation of further mitigation measures, as required, to maintain noise and vibration levels within the Project goals in adjacent sensitive receiver locations.
Permanent noise, vibration and dust monitoring should be conducted at nearest residents and locations further away	The noise, vibration and dust management programs will include monitoring at locations representative of the nearest off site sensitive places in order to assist with the development of mitigation measures for the project. The nature of noise, vibration and dust emissions from construction works of this type is such that if controls are incorporated to maintain levels within Project construction noise goals at nearest off site residences, the levels would also be within the goals at residences located further from the works.
Daily air quality, noise and vibration monitoring data to be made available on an internet	The environmental management plan for construction works will include commitment to ongoing monitoring and monthly reporting of air quality, noise and vibration levels. The monthly reporting would include analysis of compliance with Project performance goals and a summary of community complaints and issues associated with the Project, along with information on actions taken to address these complaints. The Alliance will consider making these reports available to the community on the Project website.

3.12 Transport and Roads

A number of submissions raised concerns relating to the traffic generated by construction of the Project and the ability of the local roads to accommodate traffic volumes given the configuration proposed following completion of the dam. This section provides responses in relation to the issues raised.

3.12.1 Existing Traffic

Existing Traffic Volumes

To describe the traffic volumes on the local access roads around the dam area, traffic counts were conducted at two locations as follows:

Spillway Road (road across dam wall)

A 2-way classified 7-day count was conducted on Spillway Road between Saturday 2nd December and Friday 8th December 2006 to determine the volume of traffic accessing the dam site over a week period. **Table 25** describes the traffic volumes on Spillway Road during each period for the entire week.

- **Table 25 Traffic volumes across dam**

Time Period	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	Week day peak	Week end Peak
AM[1]	8	14	13	20	14	18	31	**20**	**31**
Day[2]	35	43	78	34	38	64	150	**78**	**150**
PM[3]	21	24	24	28	31	44	49	**31**	**49**
Daily Total	305	380	449	341	342	512	975	**449**	**975**
Daily %CV[4]	8.9%	3.4%	6.2%	7.0%	6.4%	1.6%	1.8%	**8.9%**	**1.8%**

[1]7:00 to 8:00am
[2]highest hour outside AM and PM Peak