

Appendix 1 Concept design of the proposed facility

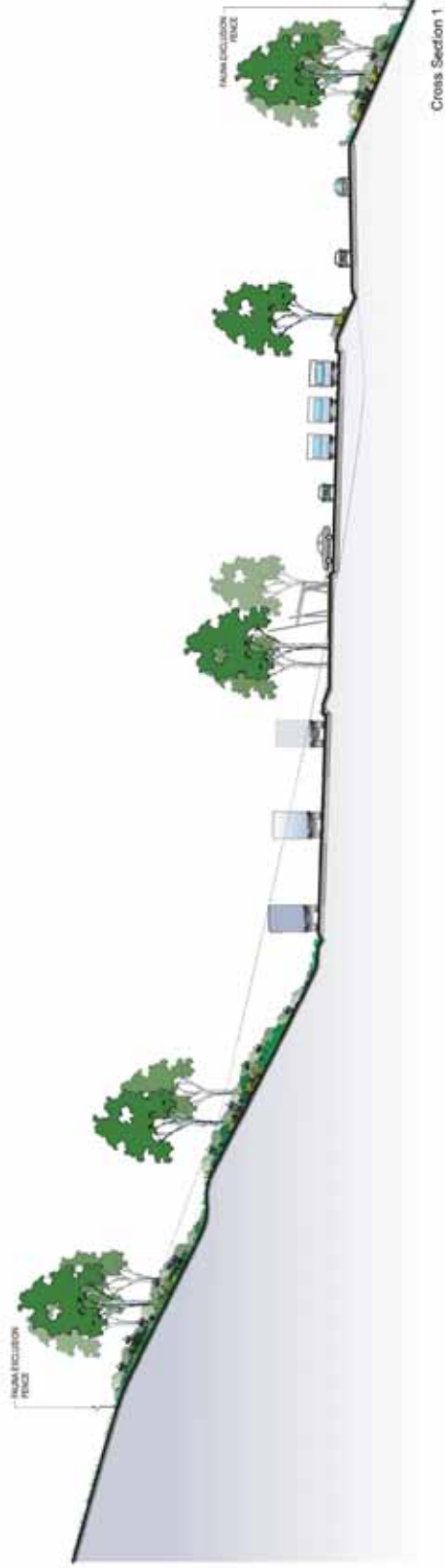


LEGEND:

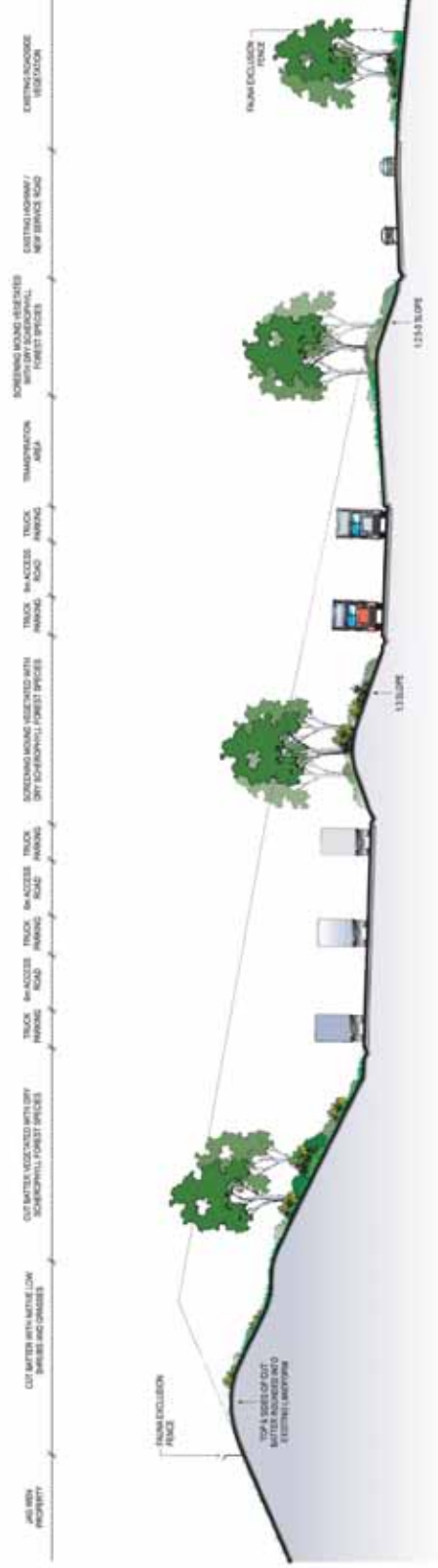
- Feature Trees
- Feature Shrubs & Groundcovers
- Cleared Grassland Landscape
- Constructed Wetland
- Dry Sclerophyll Forest
- Wetland (Mangroves)
- Wet Sclerophyll Forest
- Swamp Sclerophyll Forest
- Subtropical Rainforest



- LEGEND:**
- Feature Trees
 - Feature Shrubs & Groundcovers
 - Existing Vegetation
 - Turf
 - Native Grasses
 - Dry Sclerophyll Forest



Cross Section 1



Cross Section 2





Appendix 2 Flora survey and assessment

Flora Survey and Assessment

Proposed Rest Area and Truck Stop at the Yelgun Interchange,

Brunswick Heads to Yelgun Pacific Highway Upgrade

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1.0 INTRODUCTION

The Brunswick Heads to Yelgun section of the Pacific Highway Upgrade will entail construction of 8.5 km of new highway in the Brunswick valley within the Byron Shire Council LGA. In conjunction with the project, the NSW Roads and Traffic Authority propose to construct a combined truck parking / light vehicle rest area at the northern, Yelgun interchange.

The RTA require a vegetation survey of the proposed site and an assessment of impacts on flora and have contracted Andrew Benwell, Botanical and Ecological Consultant, to undertake this work. The following sections of this report describe the results of a flora survey of the site, assess impacts on threatened flora pursuant to Section 5A EP&A Act (the Eight-Part Test) and Commonwealth EPBC Act and make recommendations for threatened species management.

2.0 FLORA SURVEY

2.1 Method

A botanical survey of the subject land, which is located on part of the former Jagwen property, now owned by the RTA, was carried out on the 16th of July, 2004. The area circled in red on Figure 1 indicates the survey area.

All plant species encountered were identified while targeting rare, threatened and regionally significant species (see Table 1). Species conservation significance was assessed with reference to:

- Schedules 1 (Endangered) and 2 (Vulnerable) of the NSW TSC Act for plants of state conservation significance;
- Schedules of the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999;

- Briggs and Leigh (1996) for nationally significant plants also known as the ROTAP (Rare Or Threatened Australian Plants) register; and
- Sheringham and Westaway (1995) and NPWS (1998) for regionally significant plants.

The locations of threatened species were initially recorded with a GPS to an accuracy of 5-6 metres, and subsequently precisely recorded by RTA survey.

2.2 Results

2.2.1 General Description of Vegetation

Most of the survey area is cleared paddock on moderately steep, north-facing hill slopes. Common introduced grasses and herbs dominate the pasture including Carpet Grass (*Axonopus affine*), Setaria (*Setaria sphacelata*) and a species of *Sporobolus* (possibly Giant Paramatta Grass). Remnant rainforest regrowth occurs in the road reserve of the Pacific Highway on both the north and south side of the road. Most of the species listed in Appendix 1 are from the road reserve. A stand of planted Lemon Scented Gum (*Corymbia citriodora*) and some old Mango trees are found downslope of the house.

2.2.2 Significant Flora Species

One threatened plant species occurs in the survey area – Davidson’s Plum (*Davidsonia jerseyana*), an endangered (Schedule 1) species.

Davidson’s Plum was recorded at three locations, as described below and shown on Figure 1.

1. Immediately below house under planted Lemon Scented Gums.

A single small tree 1.5metres high with several stems probably joined underground.

GPS Location – 0551126 6847949

2. In the road reserve on the southern side of Pacific Highway.

A single remnant tree 5 metres high on the fenceline surrounded by 23 small stems and seedlings within 1 metre.

GPS Location – 0551057 6848020

3. In the road reserve on the northern side of Pacific Highway.

These plants have already been recorded in previous Environmental Impact Assessment surveys. They are just west of the culvert underneath the existing highway.



Figure 1: Locations of Davidson's Plum on the proposal

2.3 Discussion

Occurrences 1 and 2 of Davidson's Plum appear to be within or close to the boundary of the proposed rest area. Occurrence 3 is outside the proposed rest area and should not be impacted.

Discussions with the RTA indicated that it would not be possible to save occurrences 1 and 2 by re-designing the rest area, because it is already tightly constrained by the local topography and by the existing highway, which will be used by local traffic after construction of the new freeway. Occurrence 1 falls within a cut batter while occurrence 2 is on a fill batter, which cannot be redesigned without reducing the size of the rest area to an impractical size.

Davidson's Plum is an endangered species with a greatly reduced local population. It is important that any additional genetic diversity represented by the impacted plants be preserved if possible. Preferably this should be as living plants rather than as DNA held in a gene bank. Translocation provides a practical means of preserving the impacted individuals. If translocated to better quality habitat, they may have a better chance of long-term survival and contribution to the viability of the local population, compared to their present locations, which under present land-use have little potential for improvement.

3.0 ASSESSMENT

3.1 Assessment under the Environmental Planning and Assessment Act (1979)

Section 5A of the EP&A Act sets out eight factors which must be considered when determining whether there is likely to be a significant effect on species, populations, ecological communities or their habitats and whether a Species Impact Statement is required.

The following Eight Part Test has been completed for the Schedule 1 plant species *Davidsonia jerseyana* (Davidson's Plum) recorded on the site of the combined truck parking / light vehicle rest area (the Proposal) proposed at the northern end of the Brunswick Heads to Yelgun Highway upgrade.

(a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

The combined truck parking / light vehicle rest area (the 'Proposal') will require the removal of two (2) adult Davidson's Plum and approximately twenty five (25) juvenile saplings and seedlings growing within one metre of one of the adult trees. This tree occurs in remnant vegetation within the existing Pacific Highway road reserve and the other tree occurs in a cleared paddock beneath some planted Lemon Scented Gums. The RTA has indicated that it is not possible to modify the rest area design to protect in-situ these two trees. Another small stand of Davidson's Plum occurs on the northern side of the Pacific Highway adjacent to the site, which is not impacted by the proposal.

The appropriate way to define 'local population' is obviously relevant to part (a). The two remnant trees by themselves do not constitute a meaningful population, but rather represent individual occurrences. Locally, Davidsons' Plum occurs as widely scattered remnant trees or small stands, north from the Brunswick River. Previous environmental work defined the local population of this species as comprising those

individuals within 2 kilometres of the highway upgrade corridor, which is approximately 8km long. The latter definition was adopted for this assessment.

A total of 300-500 plants (mature trees and larger saplings) was estimated to occur in the local population of Davidson's Plum, as defined above. Of these, a total of 104 plants have been recorded on or adjacent to the highway corridor, of which 10 require clearing (have been translocated). A total of 1000-1500 mature/reproductive plants was estimated for the whole Brunswick Valley district, comprising more than half the total number of plants of Davidson's Plum growing in the wild.

In terms of the local population of Davidson's Plum, the removal of two adult trees represents about 0.5% of the total number of plants.

Remnant trees of Davidson's Plum have the potential to reproduce and increase the size of the local population, even where they exist as isolated specimens in degraded habitat, because single Davidson's Plum trees are able to self-pollinate, set viable seed and recruit seedlings (Refer to appended background ecological information). This is demonstrated by regeneration around the single remnant tree in the road reserve at the site. The removal of the two trees should therefore not disrupt the reproductive capacity of remaining trees in the local population (including those present close-by).

Nevertheless, it is clear that the Davidson's Plum population has been greatly reduced since settlement and there has probably been a significant loss of genetic diversity, which may affect population viability over the long term. It is therefore important that genotypes of all remaining remnant trees be preserved where ever possible. This species has been shown to have a reasonably high survival rate when transplanted, so it is recommended that the two impacted adult trees and all the juveniles be translocated to a secure and ecologically suitable location nearby.

In summary, the impact of the proposal is considered unlikely to place a viable population of the species at risk of extinction, particularly in view of the regeneration and translocation potential of this species.

(b) In the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

The population of *Davidsonia jerseyana* is not an "endangered population" listed as such on Schedule 1 of the TSC Act (1995).

(c) In relation to regional distribution of a habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The known habitat of *Davidsonia jerseyana* is distributed in the eastern half of the Brunswick and Tweed valleys in sheltered, forested sites on metasedimentary geology and adjacent alluvium.

The Proposal requires the removal of a small area of forested habitat (<1ha) in the road reserve of the existing highway, which is suitable habitat for this species. In terms of the local and regional distribution of habitat in the Brunswick and Tweed valleys, this is a very small area.

In summary, the Proposal is considered very unlikely to modify or remove a significant area of the known habitat of this species.

(d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

The local and regional population of *Davidsonia jerseyana* is already highly fragmented by past land clearing. Clusters of plants are generally separated by one to several hundred metres of cleared land or degraded regrowth.

The background information on this species indicates that it is poorly dispersed by seed vectors such as birds and fruit bats. Dispersal events away from parent trees are

apparently rare, so that remnant trees and stands are (already) effectively isolated from each other.

The Proposal does not entail any land clearing that would increase the current fragmented condition of the local population. The is considered unlikely to result in an area of known habitat becoming isolated from currently interconnecting or proximate areas of habitat for this species.

(e) Whether critical habitat will be affected.

No critical habitat, as listed in the TSC Act, occurs in or adjacent to the Proposal.

(f) Whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Davidsonia jerseyana is reserved in Billinudgel Nature Reserve (~50 mature trees) and Brunswick Heads Nature Reserve (<10 mature trees) only. The great majority of the surviving population of this species occurs on private property.

At least 1000 (mature) individuals of a threatened plant species is sometimes used as a criteria for assessing the reservation adequacy of a species (Briggs and Leigh 1996). Even in terms of this conservative threshold, this species is inadequately reserved.

(g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The clearing of native vegetation is listed as a 'Key Threatening Process', however, the small area of degraded vegetation proposed for clearing in the road reserve is not of a class of development or activity that is recognised as a threatening process.

(h) Whether any threatened species, populations or ecological community is at the limit of its known distribution.

Davidsonia jerseyana has a total range of about 50km, from the Brunswick River north to the Murwillumbah district, therefore it is not at the limits of its known distribution at the proposed site (near Yelgun).

Eight Part Test Conclusion

Development of the Proposal is not considered to represent a significant impact on *Davidsonia jerseyana* in terms of the area of known habitat to be removed and the number of plants impacted. The potential of this species to translocate successfully further mitigates the Proposal's impact. A Species Impact Statement is therefore not be required.

3.2 Assessment under the Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was introduced on 16 July 2000 and requires that Commonwealth approval be sought for certain actions. These actions are those that have, may have, or are likely to have, a significant impact on a matter of national environmental significance (NES) or Commonwealth land, including listed nationally threatened species.

Under the EPBC Act, an assessment of the impact of a proposal on any matter of national environmental significance and Commonwealth land must be undertaken to demonstrate whether there is likely to be a significant impact. If the assessment concludes that there is likely to be a significant impact then it will become a controlled action under the EPBC Act and the proposal must be referred to the Commonwealth. The Department of the Environment and Heritage is the agency responsible for making the decision as to whether an action is likely to have a significant impact.

An assessment of NES Matters is given below.

World Heritage Properties

The Proposal would not impact on any World Heritage property. There would not be any effect on this matter of National Environmental Significance.

Wetlands of International Importance

There are no wetlands of international importance within the study area. There would not be any effect on this matter of National Environmental Significance.

Nuclear Actions

The Proposal does not constitute a nuclear action.

Commonwealth Marine Areas

The Proposal would not impact on any Commonwealth Marine Areas. There is unlikely to be any effect on this matter of national environmental significance.

Commonwealth Land

The Proposal would not impact directly or indirectly on any Commonwealth land. No Commonwealth Land is directly affected by the proposal and no Commonwealth land is located adjacent to the Proposal.

Commonwealth Listed Threatened Species and Ecological Communities

The administrative guidelines for determining whether an action has, will have, or is likely to have, a significant impact on a matter of environmental significance under the EPBC Act list a number of criteria which must be addressed.

One Endangered species listed on the EPBC Act, *Davidsonia jerseyana* (Davidson's Plum), occurs within the Proposal site. An assessment under the 'administrative guidelines' of the Act has been undertaken for this species in order to determine whether the Proposal should be referred to The Department of the Environment and Heritage for a decision as to whether the proposal constitutes a controlled action requiring the approval of the Minister. The assessment has been prepared below, with consideration of the relevant criteria.

Survey work conducted for the Proposal and for the Pacific Highway Upgrade, Brunswick Heads to Yelgun (EIS, SIS) produced the following information on the population size of Davidson's Plum generally along the highway upgrade corridor and in the surrounding district:

Two mature trees and approximately 25 juveniles and seedlings beneath one of the mature trees are found within the Proposal area.

A total of 104 plants occur within or adjacent to the highway upgrade corridor (~8km), of which 10 occur within the road footprint and require clearing (to be translocated).

A total of 300-500 plants (mature trees and larger saplings) are estimated to occur in the local population, defined as within 2km of the highway upgrade.

A total of 1000-1500 mature/reproductive plants was estimated for the whole Brunswick Valley district, comprising more than half the total number of plants of Davidson's Plum growing in the wild.

Davidsonia jerseyana is reserved only in Billinudgel Nature Reserve (~50 mature trees) and Brunswick Heads Nature Reserve (<10 mature trees). The great majority of the surviving population of this species occurs on private property.

The most appropriate management measure to minimise the impact of the Proposal on this species would be to translocate the two mature plants and associated juveniles to suitable habitat.

***Davidsonia jerseyana* (Davidson's Plum)**

An action has, will have, or is likely to have a significant impact on an endangered species if it does, will, or is likely to:

(a) *Lead to a long-term decrease in the size of a population of the species; or*

Removal of the two mature Davidson's Plum trees and associated juveniles and seedlings from the site represents a very small proportion of the local population (within <2km of highway corridor) comprising 300-500 adult/reproductive individuals. Furthermore it should be possible to save the impacted plants by translocation to a suitable site close by.

(b) *Reduce the area of occupancy of a population of the species; or*

The Proposal would slightly reduce the area of occupancy, by removing the two adults and associated juveniles from the road reserve and cleared paddock.

(c) *Fragment an existing population into two or more populations; or*

The local and regional population of *Davidsonia jerseyana* is already highly fragmented by past land clearing practices. Clusters of plants are generally separated by one to several hundred metres of cleared land or degraded regrowth.

Background information on this species (attached) indicates this species is poorly dispersed by seed vectors such as birds and fruit bats. Dispersal events away from parent trees are apparently rare, so that remnant trees and stands are effectively isolated from each other.

The Proposal does not entail any land clearing that would increase the current fragmented condition of the local population.

(d) *Adversely affect habitat critical to the survival of a species; or*

It is considered unlikely that the Proposal would adversely affect habitat critical to the survival of this species because of the very small area of habitat to be removed relative to the local and regional distribution of the species.

(e) *Disrupt the breeding cycle of a population; or*

It is considered unlikely that the removal of the two trees would disrupt the reproductive capacity of remaining trees in the local population (including those present close-by), as even single Davidson's Plum trees can self-pollinate, set viable seed and recruit seedlings. This is demonstrated by recruitment beneath the tree in the road reserve within the Proposal area.

(f) *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline; or*

The Proposal requires the removal of a small area of degraded forested habitat (<1ha) in the road reserve of the existing highway, which is suitable habitat for this species. In terms of the local and regional distribution of habitat in the Brunswick and Tweed valleys, this is a very small area. It is therefore considered unlikely that the Proposal would affect the availability or quality of habitat to the extent that the species is likely to decline.

(g) *Result in invasive species that are harmful to a vulnerable species becoming established in the endangered species' habitat; or*

As part of the Proposal, removal of environmental weeds, which are a threat to this species habitat, would be undertaken.

(h) *Interfere with the recovery of the species.*

A draft recovery plan has been prepared for this species (DEC 2004). The removal of Davidson's Plum from the site does not interfere with specific actions proposed in the draft plan.

Conclusion

Based upon the assessment under the EPBC Act detailed above, it is concluded that the Proposal would not need to be referred to The Department of the Environment and Heritage as it would not have a significant impact on any matter of National Environmental Significance.

4.0 RECOMMENDATIONS

- 1 Translocate the two adult trees and associated juveniles to the translocation site for the Brunswick Heads to Yelgun Pacific Highway Upgrade, which is established at Billinudgel, approximately 3 km south of the Proposal.
- 2 Apply the 'direct transplant method' when transplanting. This method consists of transplanting when soil moisture and humidity are high and temperatures declining, by trenching around the plant with an excavator, lifting the plant out of the ground with a soil and root ball, pruning foliage to ~ 10%, immediate planting into the relocation site and thorough watering.
- 3 Seedlings and small juveniles should be transplanted to pots then grown on and stabilised before planting at the relocation site.
- 4 Undertake translocations in accordance with established/approved guidelines (e.g. ANPC 2004).

REFERENCES

Australian Network for Plant Conservation (2004). Guidelines for the Translocation of Threatened Plants in Australia. 2nd Edition. Australian Network for Plant Conservation: Canberra.

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DEC (2004 - Draft). Recovery Plan for the Davidson's Plum (*Davidsonia jerseyana*). NSW National Parks and Wildlife Service, Hurstville.

Floyd, A. G. (1989). Rainforest Trees of Mainland South-eastern Australia. Inkata Press, Melbourne.

Peakall, R. (1995). *The extent of clonality in a roadside population of the rare and endangered plant Acronychia littoralis.* Report to the NSW Roads and Traffic Authority.

Quinn, F.C., Williams, J.B., Gross, C.L. and Bruhl, J.J. (1995). *Report on Rare or Threatened Plants of North-Eastern New South Wales.* Report prepared for the NSW NPWS and Australian Nature Conservation Agency.

APPENDIX 1: Vascular Plant Species Recorded in the Proposed Rest Area and Truck Stop at the Yelgun Interchange – 15th of July 2004

PTERIDOPHYTES (Ferns)

<i>Calochlaena dubia</i>	Common Ground Fern	rare
<i>Cyathea cooperi</i>	StrawTree Fern	rare
<i>C. leichhardtiana</i>	Prickly Tree Fern	occasional
<i>Platyserium bifurcatum</i>	Staghorn Fern	rare
<i>Pteridium esculentum</i>	Bracken Fern	common
<i>Sticherus lobatus</i>	Coral Fern	rare

ANGIOSPERMS (Flowering Plants) – MONOCOTYLEDONS

Arecaceae		
<i>Archontophoenix cunninghamii</i>	Bangalow Palm	occasional
Dioscoraceae		
<i>Dioscorea transversa</i>	Native Yam	rare
Poaceae		
<i>Axonopus affine</i> *	Carpet Grass	common
<i>Imperata cylindrica</i>	Blady Grass	occasional
<i>Paspalum urvillei</i> *	Vasey Grass	occasional
<i>P. wettsteinii</i> *	Broad-leaved Paspalum	common
<i>Setaria sphacelata</i>	Pigeon Grass	common
<i>Sporobolus</i> sp.		common
Smilacaceae		
<i>Smilax australis</i>	Barb-wire Vine	common

ANGIOSPERMS - DICOTYLEDONS

Anacardiaceae		
<i>Mangifera indica</i> *	Mango	occasional
Apocynaceae		
<i>Parsonsia straminea</i>	Giant Silkpod Vine	rare
Araliaceae		
<i>Polyscias elegans</i>	Celerywood	occasional
Asteraceae		
<i>Ageratina. riparia</i> *	Mist Flower	very common
<i>Ageratum houstonianum</i> *	Blue Goat Weed	occasional
<i>Conyza bonariensis</i> *	Fleabane	occasional
<i>Hypochoeris radicata</i> *	Bear's Ear	rare
Caesalpinaceae		
<i>Senna pendula</i> *	Winter Senna	occasional
Dilleniaceae		
<i>Hibbertia scandens</i>	Twining Guinea Flower	occasional
Elaeocarpaceae		
<i>Elaeocarpus obovatus</i>	Hard Quandong	occasional
Euphomatiaceae		

<i>Euphomatia laurina</i>	Bolwarra	common
Euphorbiaceae		
<i>Croton verrauxii</i>	Native Cascarilla	common
<i>Glochidion sumatranum</i>	Umbrella Cheese Tree	occasional
<i>Omalanthus populifolius</i>	Bleeding Heart	rare
Fabaceae		
<i>Millettia australis</i>	Native Wisteria	rare
<i>Stylosanthes humilis</i> *	Townsville Stylo	rare
Lauraceae		
<i>Cinnamomum camphora</i> *	Camphor Laurel	common
Meliaceae		
<i>Synoum glandulosum</i>	Scentless Rosewood	common
Mimosaceae		
<i>Acacia fimbriata</i> (planted?)		rare
<i>A. melanoxylon</i>	Blackwood or Sally Wattle	common
Moraceae		
<i>Ficus coronata</i>	Sandpaper Fig	rare
<i>F. obliqua</i>	Small-leaved Fig	occasional
Monimiaceae		
<i>Wilkea huegeliana</i>	Veiny Wilkea	rare
Myrsinaceae		
<i>Rapanea variabilis</i>	Muttonwood	rare
Myrtaceae		
<i>Acmena smithii</i>	Lilly Pilly	occasional
<i>Archirhodomyrtus beckleri</i>	Rose Myrtle	occasional
<i>Corymbia citriodora</i> (planted)	Lemon Scented Gum	occasional
<i>Lophostemon confertus</i>	Brush Box	occasional
Pittosporaceae		
<i>Pittosporum undulatum</i>	Sweet Pittosporum	occasional
Sapindaceae		
<i>Diploglottis australis</i>	Native Tamarind	rare
<i>Guioa semiglauca</i>	Guioa	occasional
<i>Jagera pseudorhus</i>	Foambark Tree	occasional
<i>Sarcopteryx stipitata</i>	Steelwood	rare
Sapotaceae		
<i>Planchonella chartacea</i>	Thin-leaved Coondoo	rare
Verbenaceae		
<i>Lantana camara</i> *	Lantana	common

APPENDIX 2: Background Ecological Information on Davidson's Plum (*Davidsonia jerseyana*)

Distribution and population

Regional

Davidson's Plum has a total range of around 50km, extending from the lower Brunswick valley north through the Tweed Coast district to the lower Tweed valley. Davidson's Plum is restricted to within 10km of the coast in the Brunswick valley and occurrences in the Tweed valley are limited to between Murwillumbah and the base of the McPherson Range (Floyd 1989; Quinn *et al.* 1995; DEC 2004a).

The total population of Davidson's Plum is estimated as 1000-1500 mature/reproductive individuals in the Brunswick Valley district, representing probably more than half of the total population of the species (A. Benwell, pers. obs.). The total number of individuals in conservation reserves is probably less than 100 (only Billinudgel and Brunswick Heads Nature Reserves) and the great majority exist on private property.

Local (< 2km)

Local occurrences and estimated total numbers (trees and larger saplings) are as follows: Brunswick Heads Nature Reserve (<10); compensatory habitat land (50-80); Hilan's Corner (100-150); Billinudgel Nature Reserve (50-100); other freehold lands (100+)

Habitat attributes

Regional

Davidson's Plum occurs in lowland subtropical rainforest, wet Brush Box forest and regrowth on lower hillslope or gully sites. This species is restricted to red-yellow podzolic soil formed on metasedimentary rocks, or alluvium derived in major part from metasediment. These soils are moderately deep and heavy textured with clay-loam topsoil and clay subsoil.

Local

Lower to mid slopes on red-yellow podzol, and alluvium along creeks and gullies.

Regeneration behaviour

The survey of rainforest regrowth along the route of the highway upgrade carried out in 2002 found this species was regenerating next to widely scattered remnant trees. The distance of young trees and juveniles from remnant trees was generally 1-5 metres, which represented the rate of population expansion in 3-4 decades of habitat regrowth (A. Benwell, pers. obs.). Only a few locally isolated juveniles were present in

a 20 ha area between the Brunswick Heads Nature Reserve and the top of the Ocean Shores hill, indicating dispersal over distances of 20-50 metres, possibly by birds or fruit bats. At this rate, recolonisation of an area of 200 metres radius with a continuous population would take 400-500 years. Old paddock trees in the Mullumbimby district left by the early settlers (e.g. Vallences Lagoon) indicate that Davidson's Plum is probably a moderately long-lived species.

The size class distribution of Davidson's Plum regeneration within the 20ha area referred to above, indicated a slow and discontinuous rate of recruitment since the relaxation of agricultural activity in the last 30-50 years. Recruitment pulses may be dependent on the right combination of rainfall distribution and level of seed predator activity. Observations over the last few years showed that even though large trees fruit each year, seed is heavily predated by fauna. Nearly all seed appeared to be removed from fruits on the ground within 1 or 2 days of falling and were probably taken mainly by introduced rats (J. Taylor & H. Nicholson pers.comm.). However, a small number of seedling recruits (<5) were recorded under two large remnant trees (one to be transplanted) in February 2004, indicating that a small proportion of seed can escape predation and germinate successfully (~0.5% in the two trees/clumps mentioned). The distribution of juveniles indicates that birds and fruit bats only very occasionally disperse fruit and seed further away from parent trees.

Davidson's Plum can self-pollinate (F. Elliot, pers.comm.). Despite observations of the presence of fruit in isolated specimens, an absence of fruit production has also been observed in isolated cultivated specimens (A. Benwell, pers, obs.). This may be because these particular individuals require cross-pollination, or some other factor may be responsible. Individuals may vary in mating system. Seed crops usually have a high germination rate.

Vegetative reproduction by root suckering does not appear to play a role in the population dynamics of the Davidson's Plum. Closely grouped stems of Davidson's Plum transplanted during the Yelgun to Chinderah Pacific Highway upgrade were found to be separate individuals with tap roots and there was no evidence of clonal reproduction such as lateral root connections. It is considered unlikely that connections could have been lost as stems matured (Peakall 1995; Benwell 1996). In multi-stemmed individuals of Davidson's Plum, union of stems is usually visible at ground level. If the shoot system of Davidson's Plum is destroyed during clearing or natural disturbance, regeneration can occur from basal shoots produced near the junction of the stem and taproot, which is an elongated and slightly swollen structure probably containing food storage tissues for such an event.

Transplantation potential

The survival rate of 17 Davidson's Plum transplanted during the Yelgun to Chinderah Pacific Highway upgrade was 64.7% after three years (Benwell 2003). In addition, several juveniles were successfully transplanted to pots and planted out 12 months later, after stabilisation. Transplants were found to have an elongated taproot and little fibrous root system, making larger specimens difficult to transplant with an intact root ball and most plants were transplanted bare-rooted. Several individuals appearing to be quite dead after 6 months, later recovered successfully and one produced its first leafy shoots more than one and half years after transplanting (Benwell 2003).

Different pruning treatments were applied during transplanting – about half the stems were left intact and foliage pruned, while others had stem length reduced by half or more, removing all foliage. Stem pruning produced no difference in survival rate. New foliage grew either from epicormic buds on the stem or as shoots from the stem base. Several trees flowered in the first summer after transplanting (undertaken the previous autumn).

The potential for transplanting success in this species is considered to be high (>75%) given autumn implementation, adequate site preparation and post-transplanting management (improved by knowledge gained from the Yelgun to Chinderah translocation project).

Propagation potential

Seed - propagates readily from seed; drupe with 1-2 seeds ripens December to January.

Cuttings - the growth-form of this species makes it unsuitable for propagation by cuttings.

Recovery Plan

A draft Recovery Plan has been prepared for Davidson's Plum under the NSW TSC Act.

Appendix 3 Operational noise impact assessment

Report No 96233-TS
Version B

PROPOSED YELGUN INTERCHANGE
COMBINED TRUCK PARKING / LIGHT VEHICLE
REST AREA

NOISE ASSESSMENT

September 2004



PROPOSED YELGUN INTERCHANGE
COMBINED TRUCK PARKING / LIGHT VEHICLE
REST AREA

NOISE ASSESSMENT

Report No 96233-TS
Version B

September 2004

Prepared for

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Figure 1 - Location Plan

APPENDIX A – Noise Descriptors

1 INTRODUCTION

This report presents a noise assessment for a proposed rest area located to the east of the Yelgun Interchange on the Pacific Highway Upgrade between Brunswick Heads and Yelgun as shown in Figure 1. Noise level predictions have been undertaken based on activities likely to occur at the rest area including activities associated with both light and heavy vehicles.

Assessment has considered the potential impact of noise in relation to both the Department of Environment and Conservation (DEC-EPA) *Environmental Criteria for Road Traffic Noise (ECRTN)* and the *NSW Industrial Noise Policy (INP)*.

The most sensitive time is likely to be the use at night time by heavy vehicles, therefore the assessment has focused on the possibility of truck mounted refrigeration units operating continuously while a truck is parked, and the noise level associated with a truck changing up through its gears as it departs. It is not expected that trucks will need to use engine brakes while slowing to stop, although there will be some noise associated with trucks changing down through its gears to enter the site and the air release on stopping.

The rest area would be located on the eastern side of the upgraded highway adjacent to the Yelgun Interchange. An area to the south of the existing Highway would be excavated so the surrounding topography provides shielding to the south and west and there are no residences to the north or east. It has the capacity for up to 15 cars, 4 caravans, 5 light trucks and 21 heavy vehicles, although it will rarely operate at full capacity, particularly at night time.

The nearest residences have been identified to the north west, with the closest residence Lot 4(22) Stock Route Road approximately 550m away and slightly elevated. Due to the surrounding topography, landscaping and the requirements for fill for ramps at the Yelgun interchange the rest area would be shielded from this residence although there is line of sight to the service road (existing highway) and ramps for vehicles which leave the upgraded highway while entering and leaving and all other traffic. There are two other residences which have also been assessed which are located a little further away and are more shielded. These are at Lot 4(24) and Lot 3 Stock Route Road.

There is also an existing residence on the property where the rest area is proposed located above the rest area (Jagwen). This RTA-owned residence is approximately 50m to the south east. The RTA residence directly overlooks the site.

2 NOISE LEVEL GOALS

There are no specific criteria for addressing noise from rest areas so the most relevant assessment methodologies have been reviewed and a conservative approach adopted.

The *ECRTN* is primarily concerned with the assessment of noise from continually flowing traffic and does not specifically address rest areas adjacent to roads or freeways. The *ECRTN* requires assessment of L_{Aeq} noise levels over either the day or night time periods.

The *ECRTN* also recommends consideration of maximum (L_{Amax}) noise levels and suggests levels outside a residence of between 60-65dBA are unlikely to cause annoyance. The document also suggests that if typical maximum noise levels are less than 15dBA above the L_{Aeq} noise level from traffic noise, the L_{Aeq} parameter is sufficient to assess likely annoyance.

We consider that while a truck is slowing to approach the rest area or is accelerating away, the noise is associated with a moving vehicle within the road reserve and should therefore be assessed in accordance with the *ECRTN*.

Previous studies of vehicle noise when all vehicles are slowing to stop at tollgates and accelerate away indicate a reduction in L_{Aeq} noise levels, although the character of noise is different, particularly for heavy vehicles accelerating. In comparison, for a rest area adjacent to a highway, where only a relatively small proportion of the heavy vehicle component of traffic is stopping, then L_{Aeq} noise levels would remain unchanged compared with the situation without a rest area. For this proposed rest area, vehicles would need to use the Yelgun Interchange ramps and would detour from the highway.

Additional calculations of truck noise from the ramps have been conducted and these have been added to the L_{Aeq} levels presented within the EIA to compare with the *ECRTN*.

However, there would be a different character of noise associated with the small number of heavy vehicles which do stop and activities within the rest area. An additional method of assessment has therefore also been considered.

The additional procedure is to consider the rest area as if it were an “industrial” operation and assess the noise levels generated in accordance with the *Industrial Noise Policy (INP)*. This policy requires the L_{Aeq} noise level associated with the proposed operation over a typical 15 minute period at any time should not exceed the background L_{A90} noise level by more than 5dBA.

For night time use of the rest area it is also relevant to consider the EPA sleep arousal guidelines contained in the *Environmental Noise Control Manual (ENCM)*. This requires that the typical maximum noise level (denoted as L_{A1} in the *ENCM*) associated with noise from heavy vehicles at the rest area (engines starting/doors closing) should not exceed the background L_{A90} noise level by more than 15dBA.

For assessing annoyance at each of the residences in accordance with the *INP* it is considered appropriate to assess the potential impact based on a future background L_{A90} noise level which would exist once the upgrade and new interchange is completed, rather than the existing background level which would be influenced by the current highway.

This future background noise level is likely to be marginally higher than existing background noise levels in the daytime (currently typically 35-40dBA) but provide similar levels at night time (currently typically 30-35dBA). Reference was also made to the existing L_{Aeq} noise levels measured prior to the EIA, at other residences in the vicinity. These measured levels are considered as being representative of the locations being assessed, due to their proximity or similar set back from the highway and are summarised in Table 2-1.

Table 2-1 Existing Ambient Noise Levels

Location	Background L_{A90}		Existing L_{Aeq}	
	Day	Night	Day	Night
Jagwen (RTA owned)	44	35	55.5	52.5
Johnson	45	40	63	60
175 Billinudgel Road	44	34	63	57

The future background L_{A90} level has been estimated based on the future day and night traffic volumes (which were assumed in the EIA) and any natural shielding to the nearest residences. These are summarised in Table 2-2

Table 2-2 Future Background Noise Levels

Location	Background L_{A90}	
	Day	Night
Lot 4(22) Stock Route Road	39	34
Lot 4(24) Stock Route Road	39	34
Lot 3 Stock Route Road	38	33
Jagwen	39	34

2.1 Summary of Noise Level Goals

In relation to the *ECRTN*, the total traffic noise from the Upgraded highway and additional traffic on the ramps and service road at the residences to the west, should meet the Base Criteria for a road redevelopment of $L_{Aeq,15hr}$ 60dBA at daytime and $L_{Aeq,9hr}$ 55dBA at night time.

In relation to the *INP*, the noise level goals for the activities once vehicles are within in the rest area are as follows:

- Daytime $L_{Aeq} < L_{A90} + 5$
- Night time $L_{Aeq} < L_{A90} + 5$

The night time L_{Amax} goal is therefore a combination of either the lower end of the noise levels recommended in the *ECRTN* when on the ramps or service road or the standard EPA sleep arousal guideline for vehicles within the rest area of

Night time $L_{Amax} < L_{A90} + 15$.

As a sensitivity analysis, an alternative approach to this assessment considered the Yelgun Interchange ramps and the service road form a “private access road” to the rest area and the noise from vehicles on these parts of the road network is addressed in accordance with the *INP* rather than the *ECRTN*.

3 NOISE LEVEL PREDICTIONS

For noise within the rest area the following source noise levels have been assumed at 7m. These are based on previous measurements conducted by Wilkinson Murray of similar items.

- Truck L_{Amax} (high revs) 87dBA
- Truck start 85dBA
- Truck idle 66dBA
- Truck door close 75dBA
- Truck refrigeration unit 73dBA

Once the vehicles using the rest area were on the road network predictions of noise were based on the UK Calculation of Road Traffic Noise (CoRTN). For the ramps and the service road an average speed of 80km/hr was assumed with a Dense Grade Asphaltic Concrete road pavement surface.

The following daytime and night time scenarios, which are considered to be very conservative, were assessed:

Daytime

- 3 refrigeration trucks parked for 15 minutes
- 4 trucks at idle for 15 minutes
- 3 trucks arrive and leave in any 15 minute period
- 3 cars arrive and leave in any 15 minute period

Night Time

- 5 refrigeration trucks parked for 15 minutes
- 5 trucks at idle for 15 minutes
- 5 trucks arrive and leave in any 15 minute period
- 3 cars arrive and leave in any 15 minute period

Both L_{Aeq} and L_{Amax} noise levels were predicted whilst vehicles were manoeuvring or stationary in the rest area. Allowance was made for any shielding provided by natural topography or cut.

Both L_{Aeq} and L_{Amax} noise levels were also predicted based on vehicles slowing to stop and also departing and changing through the gears along the section of service road to the roundabout and separately along the interchange ramps. Allowance was made for any shielding provided by natural topography or cut.

These individual contributions of noise from the various activities have been presented for the various residences against the criteria/goals established using the *ECRTN* and summarised in Table 3-1 and against the criteria determined using the *INP* and summarised in Table 3-2

Table 3-1 Predicted Noise Levels (Comparison to Criteria Using the *ECRTN*)

Residence	Day / Night	Base Criteria L_{Aeq} (dBA)	Goal L_{Amax} (dBA)	L_{Aeq} (dBA)			L_{Amax} (dBA)		
				Level	"Meet Base"	From Ramp	From Upgraded highway	"Meet 60-65"	
								Ramp	F'way
4(22) Stock Route Rd	D	60	-	60	Y		-		
Lot 3 Stock Route Rd	N	55	60-65	56	N	61	63-68	Y	Y/N
4(24) Stock Route Rd	D	60	-	55.5	Y		-		
Jagwen	N	55	60-65	51.5	Y	50	60-65	Y	Y
Nth façade	D	60	-	54.5	Y		-		
	N	55	60-65	50.5	Y	54	55-60	Y	Y
	D	60	-	55	Y		-		
	N	55	60-65	51	Y	63	65-70	Y	N

The predicted noise levels from vehicles using the road network comply with the *ECRTN* Base Criteria, with the exception of the residence at Lot 4(22) Stock Route Road. However the exceedance at this location is dominated by traffic noise on the upgraded highway and not the ramps and has already been identified as a residence where mitigation treatment at the residence will be provided by the RTA in accordance with the requirements of the RTA *Environmental Noise Management Manual (ENMM)*.

At night time, the maximum noise levels from heavy vehicles remain below the L_{Amax} level of 60-65dBA and also the maximum levels associated with vehicles using the upgraded highway.

Negligible noise level difference is therefore expected comparing with and without the rest area, although some change in character from gear changing / engine breaking may exist as a result of additional heavy vehicles using the Yelgun Interchange ramps. This noise character would not be currently experienced as traffic is generally free flowing.

Table 3-2 Predicted Noise Levels (Comparison to Criteria Using the INP)

Residence	Day / Night	Future LA90	Goal (dBA)		Noise Source	LAeq (dBA)		LAmax (dBA)	
			LAeq	LAmax		Level	"Meet +5"	Level	"Meet +15"
Lot 4(22) Stock Route Rd	Day	44	49	-	Rest Area	35	Y	-	-
					Old Highway	39	Y	-	-
					Ramps	47	Y	-	-
					Road Comb	48	Y	-	-
					Total	48	Y	-	-
	Night	39	44	54	Rest Area	37	Y	41	Y
					Old Highway	41	Y	51	Y
					Ramps	47	N	61	N
					Road Comb	48	N	-	-
					Total	48	N	-	-
Lot 3 Stock Route Road	Day	43	48	-	Rest Area	33	Y	-	-
					Old Highway	37	Y	-	-
					Ramps	39	Y	-	-
					Road Comb	41	Y	-	-
					Total	42	Y	-	-
	Night	38	43	53	Rest Area	34	Y	39	Y
					Old Highway	39	Y	48	Y
					Ramps	38	Y	50	Y
					Road Comb	42	Y	-	-
					Total	43	Y	-	-
Lot 4(24) Stock Route Road	Day	44	49	-	Rest Area	34	Y	-	-
					Old Highway	38	Y	-	-
					Ramps	42.5	Y	-	-
					Road Comb	44	Y	-	-
					Total	45	Y	-	-
	Night	39	44	54	Rest Area	36	Y	39	Y
					Old Highway	40	Y	50	Y
					Ramps	42.5	Y	54	Y
					Road Comb	44.5	N	-	-
					Total	45	N	-	-
Jagwen RTA Owned	Day	44	49	-	Rest Area	52	N	-	-
					Old Highway	48.5	Y	-	-
					Ramps	38	Y	-	-
					Road Comb	49	Y	-	-
					Total	52	N	-	-
	Night	39	44	54	Rest Area	54	N	58	N
					Old Highway	51	N	63	N
					Ramps	38	Y	49	Y
					Road Comb	51	N	-	-
					Total	56	N	-	-

At daytime, the predicted L_{Aeq} noise levels indicate for noise only from activities within the rest area that the *INP* noise level goals are comfortably complied with (more than 10dBA below the criterion) at all non RTA owned residences. The *INP* criteria are also met even including the contribution of noise for the service road and the ramps. At Jagwen, the criteria are marginally exceeded by 3dBA, since the residence overlooks the rest area.

At night time, the predicted L_{Aeq} noise levels indicate the *INP* criteria are achieved at all non RTA owned residences from activities occurring in the rest area and along the service road, however if noise from the ramps is included the criteria would be met at Lot 3 Stock Route Road but exceeded by 4dBA at Lot 4(22) Stock Route Road and by 1dBA at Lot 4(24) Stock Route Road. At Jagwen, the criteria would be exceeded from activities in the rest area and service road.

At night time the maximum noise levels from activities within the rest areas and along the service road meet the EPA sleep arousal “background +15” criteria at the non RTA owned residences. Noise from heavy vehicles using the ramps would exceed the sleep arousal criterion at Lot 4 (22) Stock Route Road. However the maximum levels from vehicles using the ramps do remain below the L_{Amax} level of 60-65dBA and also the maximum level associated with vehicles using the upgraded highway.

At Jagwen, maximum levels would exceed the sleep arousal criterion but would remain below the 60-65dBA range suggested by the EPA and also levels from vehicles using the upgraded highway.

Consequently, no additional mitigation treatment is considered necessary at any non RTA owned residences, beyond that already proposed for the residence at Lot 4 (22) Stock Route Road, which was already identified as part of the EIA.

4 RECOMMENDATIONS AND CONCLUSIONS

This report has assessed the potential impact of noise associated with the proposed rest area location adjacent to the Pacific Highway to the west of the Yelgun Interchange.

Dual criteria (which arise from a combination of the EPA *Environmental Criteria for Road Traffic Noise* and the *NSW Industrial Noise Policy*) were established to assess noise from within the rest area (*INP*) and noise from the road network (*ECRTN*)

The report indicates at the three nearest residences to the proposed rest area located along Stock Route Road (Lot 4(22), Lot 4(24) and Lot 3), the *INP* noise level goals identified in this report for activity in the rest area would be achieved at all times. At the RTA owned property “Jagwen” the *INP* criteria would be marginally exceeded.

The maximum noise levels generated by activities associated with vehicles using the ramps at Yelgun to access the rest area are predicted to exceed EPA sleep arousal criteria at one residence (Lot 4 (22) Stock Route Road), but the noise levels would be less than noise levels suggested by the EPA in the *ECRTN* which are likely to cause annoyance (60-65dBA) and also lower than maximum noise levels associated with trucks using the upgraded highway. However, the character of noise in at the residences in these areas is expected to be different for vehicles changing through the gears and may result in some annoyance.

Since the future traffic noise levels at this residence as a result of the upgraded highway exceed the *ECRTN* criteria, it has already been identified that mitigation treatment will be offered to the resident at Lot 4(22) Stock Route Road in accordance with the requirements of the RTA *Environmental Noise Management Manual*.

At the other residences (Lot 4 (24) and Lot 3 Stock Route Road) the *ECRTN* Base criteria for a road redevelopment would be achieved for daytime and night time, therefore no mitigation treatment is warranted.

We recommend that noise monitoring is conducted following the opening of the rest area to confirm the findings of this report.

At this time the effects of noise from the upgraded highway and rest areas can be reviewed at the Jagwen residence in order to determine the most cost effective "at residence" mitigation treatment.

Note

All materials specified by Wilkinson Murray Pty Limited have been selected solely on the basis of acoustic performance. Any other properties of these materials, such as fire rating, chemical properties etc. should be checked with the suppliers or other specialised bodies for fitness for a given purpose.

Quality Assurance

We are committed to and have implemented AS/NZS ISO 9001 : 2000 "Quality Management Systems - Requirements". This management system has been externally certified and Licence No. QEC 13457 has been issued.

AAAC

This firm is a member firm of the Association of Australian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.

Version	Status	Date	Prepared by	Checked by
A	Draft	19 August 2004	Tim Dean	Neil Gross
B	Final	1 September 2004	Tim Dean	Neil Gross

Figure 1 – Location Plan

APPENDIX A

NOISE DESCRIPTORS

NOISE DESCRIPTORS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}). The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} . The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} . The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

L_{Aeq} . The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

L_{A50} . The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

L_{A90} . The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

ABL. The Assessment Background Level is the single figure background level representing each assessment period (day, evening and night) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL. The Rating Background Level for each period is the medium value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period, day, evening and night.

