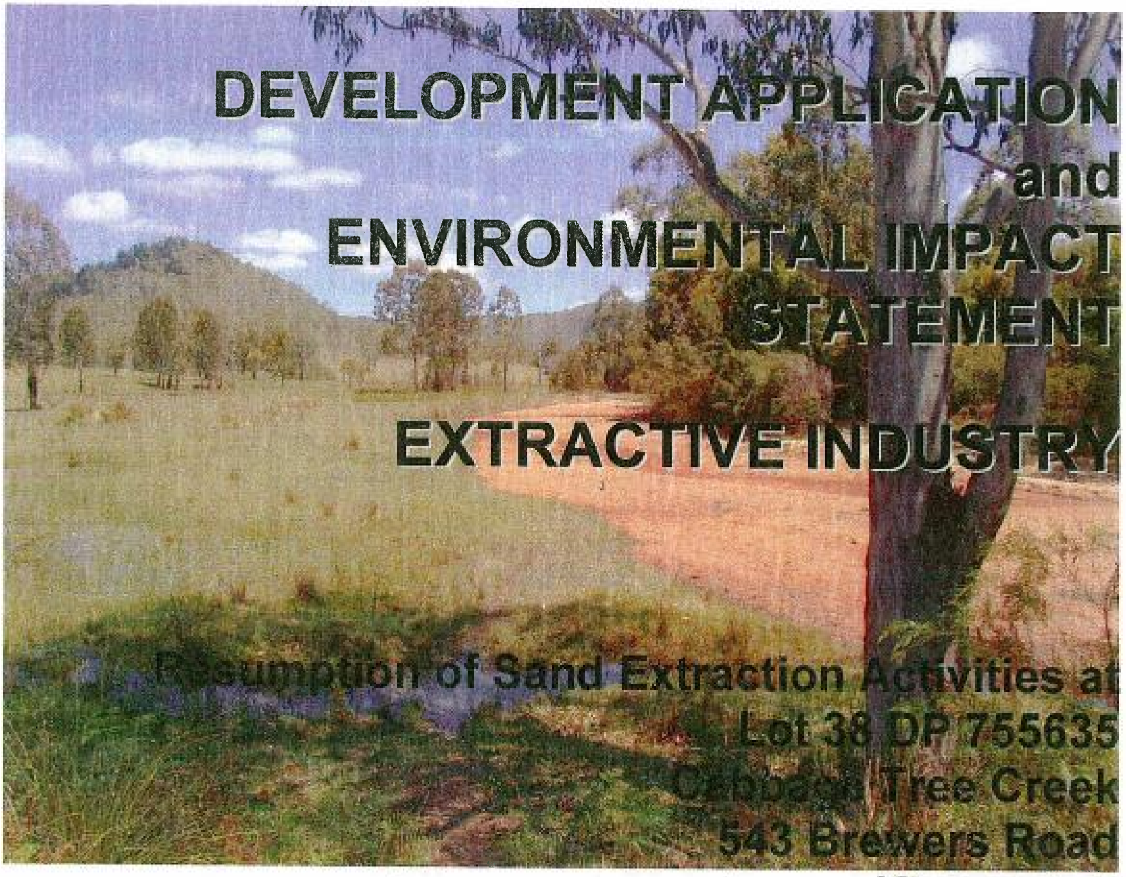
EIS 21367

AB017426

Environmental impact statement : extractive industry (sand quarry), Cabbage Tree Creek, 543 Brewers Road, Kippenduff, Lot 38 DP 755635 for Kingsbrae Partnership Pty Ltd, July 2008

Ardill Payne & Partners

Civil & Structural Engineers, Project Managers
Surveyors & Town Planners



DEVELOPMENT APPLICATION and ENVIRONMENTAL IMPACT STATEMENT

EXTRACTIVE INDUSTRY

Resumption of Sand Extraction Activities at
Lot 38 DP 755635
Cabbage Tree Creek
543 Brewers Road
Kippenduff

FOR
KINGSBRAE PTY LTD

July 2008

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EIS 21367

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Ardill Payne & Partners

Civil & Structural Engineers, Project Managers
Surveyors & Town Planners

ENVIRONMENTAL IMPACT STATEMENT

EXTRACTIVE INDUSTRY (SAND QUARRY)

CABBAGE TREE CREEK
543 Brewers Road, Kippenduff
Lot 38 DP 755635

for
KINGSBRAE PARTNERSHIP Pty Ltd

July 2008

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1 INTRODUCTION

This section introduces the proposal and provides a general overview of the project, including the planning and land use history of the site. Details of public authority and agency consultations that have been undertaken in conjunction with preparation of this EIS are also provided.

1.1 Background

Ardill Payne and Partners (APP) has been engaged by Kingsbrae Partnership Pty Ltd to act as Town Planning consultants to prepare and lodge a development application (DA) and environmental impact statement (EIS) with Richmond Valley Shire Council.

Development consent is sought for the re-commencement of a sand extraction operation from within the bed of Cabbage Tree Creek at Kippenduff. The proposed extraction rate is up to a maximum of 20,000m^3 per annum for a period of 30 years. The site has been the subject of a previous development consent for sand extraction (DA 55/95). It is understood that sand extraction activities occurred at the site during the period circa 1995 to 2000.

The proposed extractive operation essentially involves the removal of unconsolidated coarse dry river sand from a substantial sediment "slug" that was likely largely deposited in Cabbage Tree Creek in the period from 1947 to 1954. This sand deposit migrated upstream through the proposed sand extraction area, leading to a deeply incised and unstable channel.

In addition to seeking development consent, this DA and EIS establishes a sustainable operational methodology and framework for a plan of management that will control extractive operations and in doing so, protect the affected area and minimise environmental impacts.

Figure 1 is a map identifying the regional location and context of the site.

Figure 2 is a topographic map showing the locality of the site.

Figure 3 is an aerial photograph showing the site and associated fluvial system.

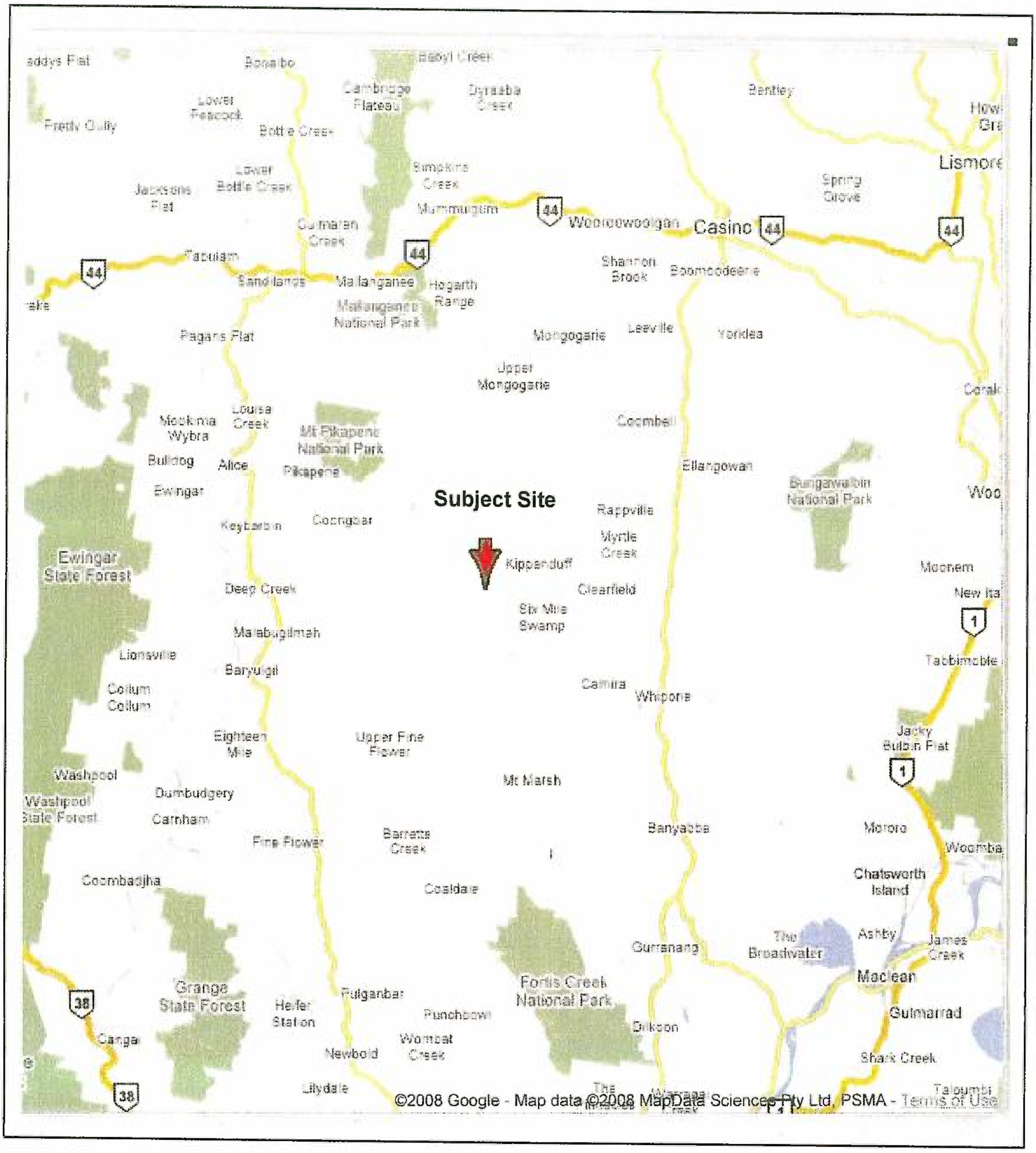


Figure 1- Regional Location

Source: Google Maps Australia, 2007

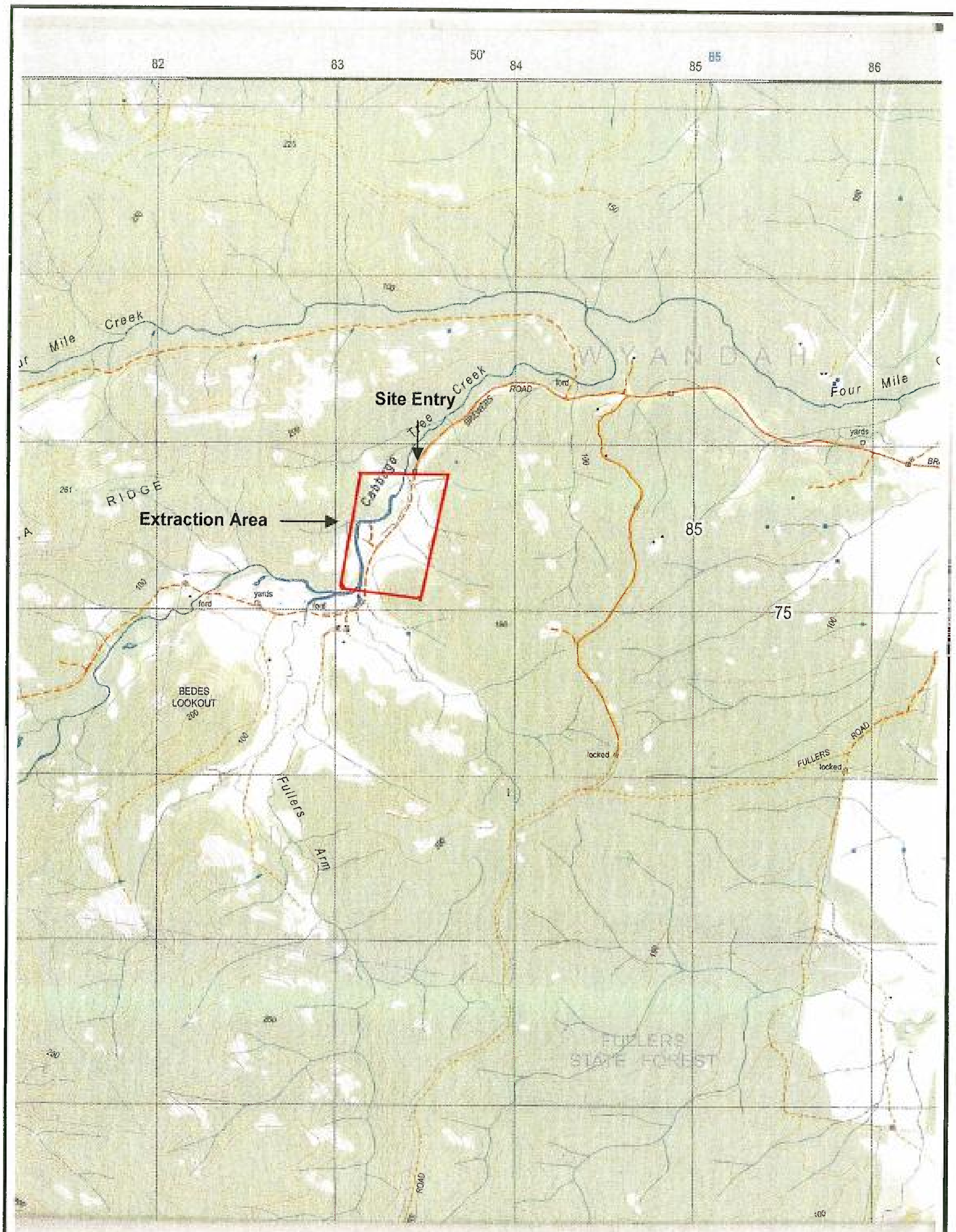
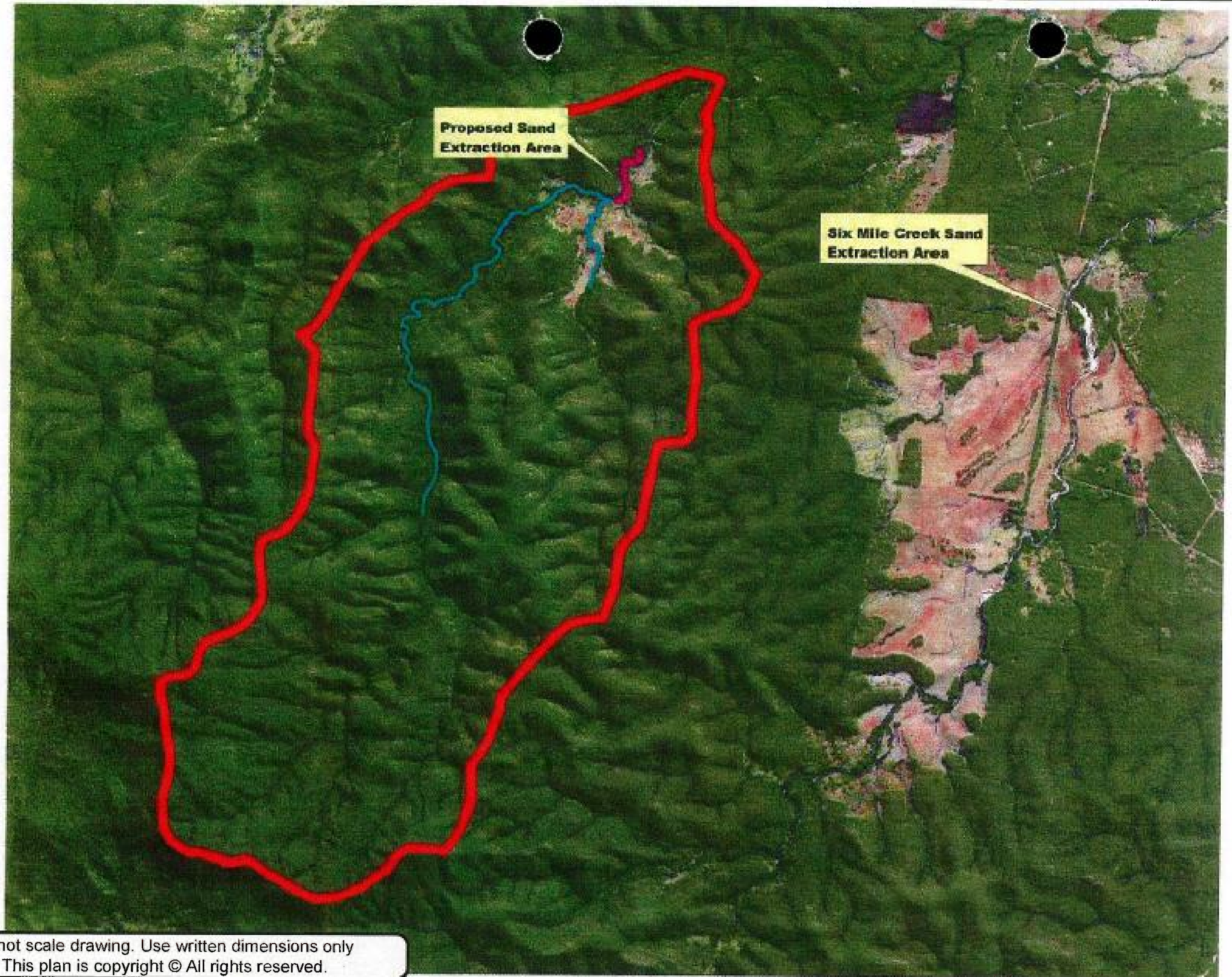


Figure 2- Locality Map

Source: Clearfield 9439-1S 1:25 000 Topographic Map

Department of Lands 2006



Title: Cabbage Tree Catchment Area

Project: Fluvial Geomrphic Assessment of Proposed Sand Extraction, Cabbage Tree Creek, Wyandah.NSW

Project No.: RE2

Client: Ardill Payne & Partners Pty Ltd

Figure No.: Map 1

Legend

- Proposed Sand Extraction Area
- Upstream Sediment Supply
- Streams
- Cabbage Tree Catchment

Prepared: TD
Approved: PS
Date: 10 February 2008
Status: Final
Projection: AMD 1984 Zone
Scale: As Shown

Riparian Engineering

This map is not guaranteed to be free of error or omission. Both Riparian Engineering Pty Ltd and its employees disclaim liability for any act done on the information in the map and any consequence of such acts or omissions.

PROJECT:	LOT 38 DP 755635 BREWERS ROAD KIPPENDUFF
TITLE:	FLUVIAL SYSTEM
CLIENT:	KINGSBRAE SAND QUARRY

ARDILL PAYNE & PARTNERS
Consulting Civil and Structural Engineers
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Scale at A4	NTS	Datum	AHD
Design	PS	Date	JULY 08
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1.2 Structure and Scope of Report

Section 2 describes the physical characteristics of the subject land and its local and regional environmental context.

Section 3 describes the development proposal in detail.

Section 4 reviews the key environmental interactions and proposed management measures.

Section 5 lists each identified potential environmental impact and the proposed method of monitoring, managing and ameliorating such impact. This Section also provides the framework for a plan of management.

Section 6 reviews the statutory and planning policy provisions applying to the project.

Section 7 provides a summary and conclusions.

A number of appendices form part of this EIS which are identified below:

Appendix A	Development application form (including landowner's consent) and EIS Certification Form
Appendix B	Development Consent 55/95 (Copmanhurst Shire Council)
Appendix C	Consultations undertaken in the preparation of the DA and EIS
Appendix D	Fluvial Geomorphic Assessment (Riparian Engineering Pty Ltd, 15 February 2008)
Appendix E	Flora and Fauna Assessment (Conacher Travers Pty Ltd, September 2007)
Appendix F	Traffic Impact Study (Ardill Payne & Partners, March 2008)
Appendix G	Agricultural Assessment (Wilkie Fleming & Associates Pty Ltd, December 2007)

Appendix H Site rehabilitation plan (Conacher Travers Pty Ltd, September 2007)

Appendix I Acoustic assessment (Ambience Audio Services, 22 July 2008)

1.3 Planning and Land Use History

1.3.1 Planning and Regulatory History

Copmanhurst Shire Council granted consent to Development Application No. 55/95 for the extraction of 12,000m³ of sand per annum at the subject site on 23 November 1995. This consent was valid for a period of five years and expired on 23 November 2000. A copy of this consent is provided as **Appendix B**.

The EIS prepared by Peter A Jelliffe (August 1995) in conjunction with DA 55/95 sought consent to extract 12,000m³/year of river sand from within the active bed of Cabbage Tree Creek. The extraction area was approximately 1km in length with a varying width of between 25-40m (with a minimum 2m setback from the creek banks). The maximum excavation depth was 1.5m.

The 1995 EIS reported that an extractive industry had operated at the site prior to 1995.

A Part 3A Permit under the Rivers and Foreshore Improvement Act 1948 to extract sand from Cabbage Tree Creek was issued by the Department of Water Resources (now Department of Natural Resources) on 16 September 1994.

1.3.2 Land Use History

The site has previously been used for sand extraction activities, both prior to and under the terms and conditions of DA 55/95. It is understood that sand extraction was conducted at the site in accordance with DA 55/95 for a period of 5 years (from circa 1995 to 2000).

The land outside of the watercourse consists of unimproved pastures and vegetated woodlands.

It is noted that despite the extraction of river sand from the site prior to and between 1995 and 2000, there is no obvious evidence of environmental degradation or adverse impact at the site. With the exception of several small mounds of previously stockpiled material (which have now become vegetated), no visible signs of the prior extraction operations exist at the site. This is because sand that has been extracted from the site has been replenished by natural processes.

1.4 Overview of Statutory Framework

Richmond Valley Shire Council is the consent authority for the proposed development.

The proposed development comprises designated development for the purposes of Section 77A of the EP & A Act 1979 because it meets the criteria for an "extractive industry" as defined in Schedule 3 of the EP & A Regulation 2000.

The development also comprises "integrated development" for the purposes of Section 91 of the EP & A Act 1979. The following approvals are required in addition to development consent before the development can be carried out:

- Controlled Activity approval under Part 3, Chapter 3 of the Water Management Act 2000, and
- Permit under the Fisheries Management Act 1994

Section 6 of this report includes a detailed commentary of the environmental planning instruments and controls applying to the project.

1.5 Consultation

Ardill Payne and Partners has formally consulted a number of Government Agencies and stakeholder groups during the preparation of this EIS. Details of these consultations are as follows:

Government Agencies – APP wrote to the following Government Agencies (letter dated 14 May 2007) requesting specifications and requirements for the preparation of the DA and EIS. A copy of each response is provided in the respective nominated appendix:

- Department of Planning - Northern Region - **No response**
- Department of Planning – Mining and Extractive Industries - **Appendix C1**
- Department of Environment & Climate Change – Head Waters & Catchments Unit – North Coast - **Appendix C2**
- Department of Primary Industries – Fisheries Conservation Manager - **Appendix C3**
- Department of Primary Industries – Agriculture, Fisheries & Mineral Resources - **Appendix C4**
- NSW Roads and Traffic Authority - **Appendix C5**
- Richmond Valley Council - **No response**

Where applicable and appropriate, the requirements stipulated in these responses have been duly addressed in the EIS.

Aboriginal Land Council

The subject site is located within the Boolangle Local Aboriginal Council area. APP wrote to the Boolangle Local Aboriginal Council (LALC) on 14 May 2007 and requested any comments in regarding the project.

The Casino Boolangle LALC responded by letter dated 30 May 2007 (**Appendix C6**) and requested amongst a number of other matters, that APP write to the local Junbung Elders and request their input.

So as to comply with the above a letter was sent to the Elders, but was incorrectly addressed to the Bunjung Elders (dated 31 May 2007). A subsequent letter was duly sent to the Junbung Elders dated 24 October 2007 to which no response has been received.

APP wrote to the Casino Boolangle LALC on 24 October 2007 requesting a meeting with the LALC and the Junbung Elders to which no response has been received.

Neighbouring Land Owners

APP wrote to Richmond Valley Council on 16 May 2006 requesting information on adjoining property owners. Council by letter dated 22 May 2007 provided the names and addresses of 7 adjoining owners. All such persons were formally notified by letter dated 25 September 2007.

It should be noted that one letter was returned by the post office as 'unclaimed'. The postal address was checked with Council's records and it was confirmed that the letter was sent to the same address as was recorded at Council. The owner of this property was ultimately located and a letter was sent on 2 November 2007.

Of the seven (7) adjoining owner notifications, one was to Forests NSW and another was to the DECC (NPWS). A total of four (4) written submissions were received in response to these notifications. A précis of the main points raised in the submissions is provided below:

Submission 1 (letter attached to email dated – 30 October 2007)

- The proposed sand extraction is not appropriate at this location for a number of reasons including:
    - adverse impact of trucks on local roads (poor standard of Brewers Road – subsiding in places and not on original alignment)
    - inadequate maintenance regime for existing road – who will maintain road damage caused by trucks?
    - dust nuisance (health hazard) from dirt road
    - reduced safety of road due to increase in large truck movements – increased potential for accidents
    - adverse impacts of the extraction on creek flow, turbidity, hydrology and ecohydrology
    - adverse impacts from noise on adjoining properties and on wildlife
    - adverse impacts of extraction on vulnerable and endangered species (including the creek's own ecosystem)
    - original consent was for limited extraction (12,000m^3) and limited life (5 years) to which there was a lot of local opposition
    - sand extracted was too dirty to screen and could only be used as fill sand

Submission 2 (letter attached to email dated – 31 October 2007)

- A number of concerns were raised including:
    - potential adverse impacts of increased truck traffic on Brewers Road which is already in very poor condition
    - conditions should be imposed to provide for on-going maintenance of the road

- the severe erosion problems upstream should be addressed by some remediation work
- intend to build house on the land in the future and question whether the quarry will have adverse impacts on the lifestyle of the future residents

Submission 3 (letter attached to email dated – 31 October 2007)

- A number of objections were raised including:
  - potential adverse impacts of increased truck traffic on Brewers Road which is already in very poor condition
  - prior extractive operations at the site did not comply with consent conditions
  - noise and traffic will disrupt the peace and quiet of the area and of the existing dwelling house
  - sand is being hauled from the site without consent
  - operations will adversely impact the wildlife in the Mount Neville Nature Reserve

Submission 4 (email dated – 5 November 2007)

- Forests NSW advised that they have no issues with the proposed development and that the sand quarry is not in the mini catchment as Fullers State Forest

1.6 Specialist Technical Advice

Specialist technical advice was obtained from the following sources in the preparation of the EIS. The findings and recommendations of these reports are included in the relevant sections of this report:

- Tim Dilworth (Riparian Engineering Pty Ltd) – Fluvial geomorphic assessment
- Trent Doyle (Conacher Travers Pty Ltd) – Flora and fauna assessment
- Tony Cromach (Ardill Payne & Partners) – Traffic impact study
- Graeme Calnan (Ardill Payne & Partners) – Site survey
- John Allen (Wilkie Fleming & Associates Pty Ltd) – Agricultural assessment
- Trent Doyle (Conacher Travers Pty Ltd) – Site rehabilitation plan
- Garry Hall (Ambience Audio Services) – Noise impact assessment

- Wayne Erskine (University of Newcastle) – Geomorphologic investigations of Six Mile Swamp Creek
- Peter A Jelliffe – EIS for sand extraction on subject property (August 1995)

Should Council or any other Statutory Authority require any additional information or require further clarification on any matter raised in this submission or to the exhibition of the DA and EIS, it is requested that contact be made in the first instance with Paul Snellgrove of Ardill Payne and Partners prior to final determination of the application.

1.7 Landowner and Project Proponent Details

The land that is subject of this application is owned by Mrs Margaret Smith of "Broadacres", 543 Brewers Road, Kippenduff, via Rappville. The landowner's consent to the lodgement of this application is provided in **Appendix A**.

The project proponent is Mr Robert King of Kingsbrae Partnership Pty Ltd, 485 McDonalds Bridge Road, Stratheden.

The project applicant is Ardill Payne & Partners, PO Box 20, Ballina.

Kingsbrae has significant experience in haulage, landscape supplies and related industries in the region and is therefore well experienced and credentialed to operate the proposed sand quarry.

2 THE SITE AND ITS CONTEXT

This section describes the subject land and identifies the geographical context of the site and its relationship to the surrounding locality.

2.1 Location and Property Description

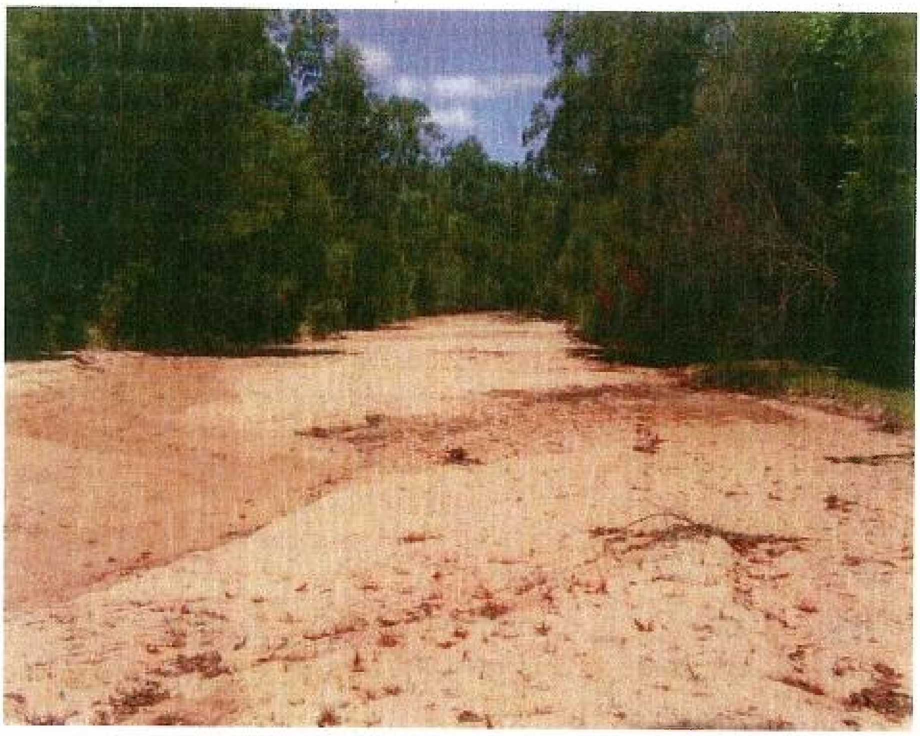
The land is described in real property terms as Lot 38 DP 755635, Parish of Wyandah, County of Richmond. The land is commonly known as No. 543 Brewers Road, Kippenduff via Rappville. The land has an area of 710.2ha.

The subject land is accessed via Brewers Road and is approximately 5km to the west of Old Tenterfield Road, 22km north-west of the Village of Whiporie and 49 km south-west of Casino.

The sandy channel on the subject property is in excess of 1000m in length with a variable width. The proposed extraction area is approximately 800m long and 20m (average) wide and has been designed to provide a minimum 3m buffer to the creek banks and a minimum 50m buffer to both the adjoining upstream and downstream properties. A minimum 200m buffer will be provided to the lagoon area which is located adjacent to the southern bend of the creek. The proposed extraction area is therefore approximately 16000m^2 (1.6ha) in area. The site is described in additional detail in **Section 2.2**.

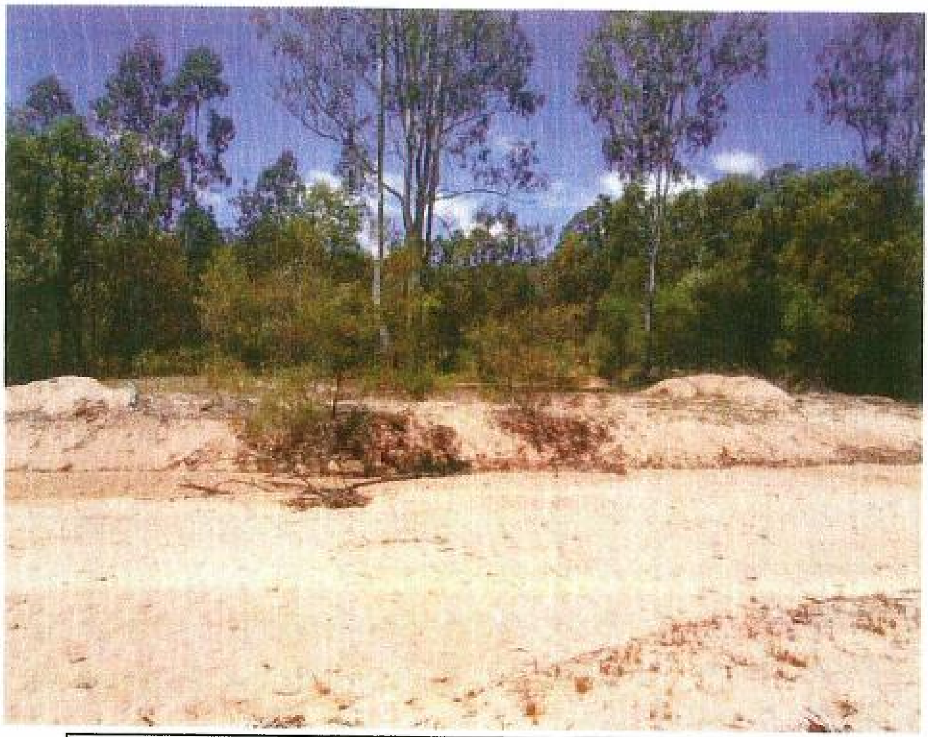
Figures 2 and **3** identify the subject land and the surrounding locality.

Photographs 1-7 identify the characteristics of the site and immediate locality.

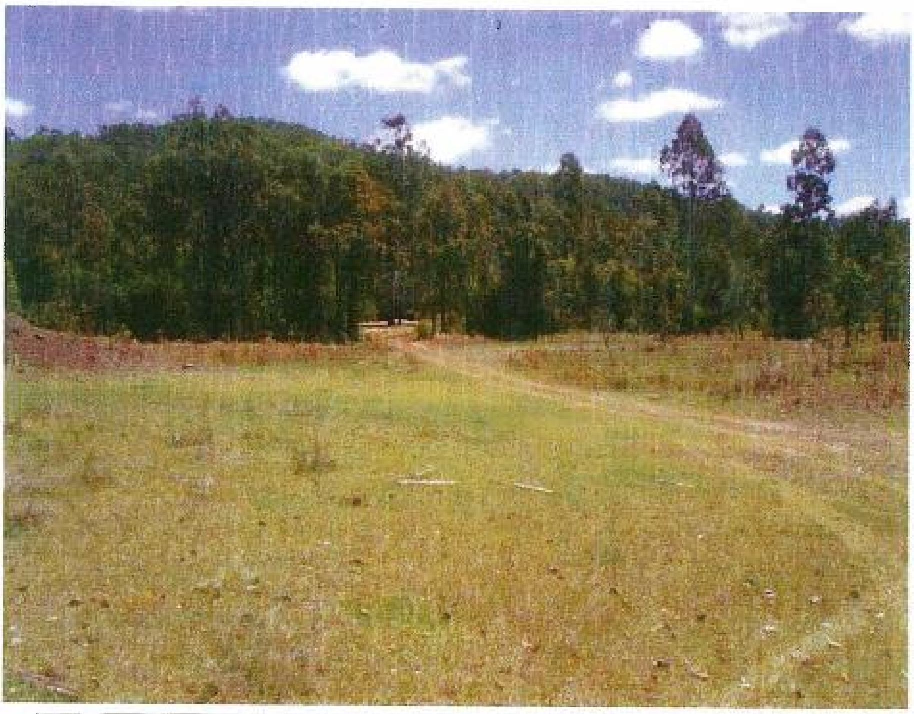


Photograph 1 – View along creek bed of sand deposit proposed for extraction.

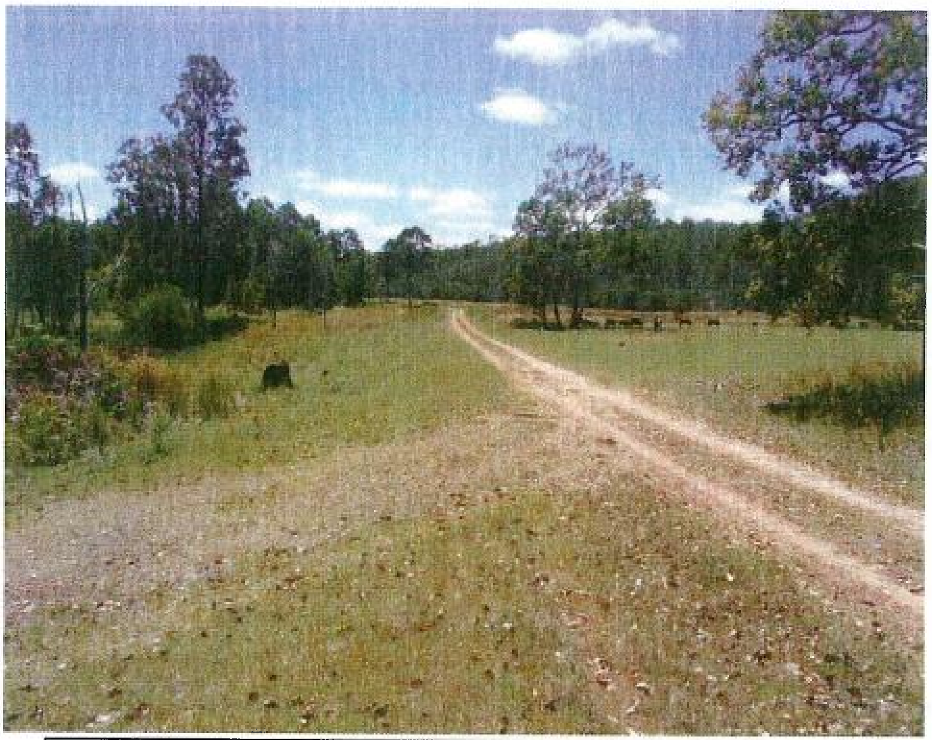
Photograph 2 – View along creek bed of sand deposit proposed for extraction. Note existing access to eastern side of creek on right of frame. This will be retained as a creek access point.



Photograph 3 – View to the east of the existing access to eastern side of creek on right of frame. This will be retained as a creek access point.



Photograph 4 – View to the west of existing creek access track from existing property access track towards creek and stockpile area.



Photograph 5 – View to the north from the existing creek access track towards property entrance to Brewers Road.

Photograph 6 – View to the north of the existing front gate and main access track of the property to Brewers Road.

Photograph 7 – View of section of Brewers Road.

2.2 Site Analysis

The subject land is irregular in shape with an area of 710.2ha. An aerial photograph of the land is provided as **Figure 3**.

The adjoining locality is characterised by low intensity agricultural uses (predominantly cattle grazing), stands of forest and woodland and sparsely scattered rural dwellings.

Fullers State Forest is situated to the south-east of the subject land. Mt Neville Nature Reserve is situated to the west and south-west. Uncleared scrub/forest is situated on private land to the north.

2.2.1 Topography

The subject land is dissected by Cabbage Tree Creek, which flows in a northerly direction from the catchments of Mount Neville, Mount March and associated ranges located between 3km and 6km to the west, south-west and south.

The main landform pattern throughout the site is described as being Low Hills with associated landform elements being hill-slopes, drainage depressions, stream-bed (Cabbage Tree Cree) and valley flat. According to the inherent landform pattern and associated elements, land slope varies considerably.

The lower elevated valley flat areas that exist predominantly within the west and north-western areas of the site contain the gentlest sloping land and in this location, slopes fluctuate between 0 and approximately 5%. The remainder of the site is characterised by land which has slopes that range from 10 to approximately 40% or greater.

2.2.2 Fluvial System

The catchment of Cabbage Tree Creek, upstream and including the proposed sand extraction site, has an approximate area of 33km^2 and is part of the Clarence-Moreton Basin.

The fluvial geomorphic assessment (**Appendix D**) details a chronology of catastrophic channel changes that have occurred to the Creek, viz:

- 1917 – A permanent chain of ponds, with permanent water, intact riparian vegetation which high loadings of large woody debris (LWD), narrow deep channel. Bed-load sediment consisted of a mix of coarse sand to small gravel.
- Post European settlement – Clearing of riparian vegetation and removal of LWD from with the channel.
- 1900-1946 – Catchment experienced lower rainfall throughout.
- 1947-1990 – Catchment experienced statistically significant increase in annual rainfall.
- February 1954 – Extremely large rainfall event causing catastrophic bed and bank erosion in adjacent Six Mile Swamp Creek. Likely that Cabbage Tree Creek experienced catastrophic morphogenesis (channel change) during this rainfall event.
- 1954-1947 – Series of smaller but still statistically significant rainfall events likely to have caused significant channel morphogenesis.
- 1947-1954 – Dramatic creek bed level adjustment which migrated upstream through the proposed sand extraction area, leading to a deeply incised and unstable channel.

The surveyed section of Cabbage Tree Creek was found on an alluvial valley setting where the channel abuts the valley margin less than 10% of the time with continuous floodplains along both valley margins. The macro-channel has a low sinuosity, is single thread and relatively stable.

The channel comprises an assemblage of sand dominated geomorphic units, although it has been completely eroded and subsequently in-filled with sand and the floodplain comprises a levee in proximal locations, extending to back-swamps in distal sections. Flood channels short-cut the flood-plain.

A flood-out is a form of channel failure where substantial sediment storage occurs because bed-load is not transported by all stream-flows and hence the channel becomes poorly defined. Intermediate flood-outs occur when channels reform further downstream but terminal flood-outs mark the downstream limit of channels. Flood-outs form by rapid localised reduction in channel capacity and in-channel specific stream power, causing displacement of stream-flow onto the floodplain. This, in turn, causes rapid deposition (Erskine 2005).

The extractable resource was deposited by, and is replenished during, flood events.

Dilworth (2008) reported that Cabbage Tree Creek has experienced irreversible geomorphic change since European settlement. The low sinuosity sand bed River Style now operates under fundamentally altered channel boundary conditions and upstream catchment conditions and recovery to its pre-European settlement or 'intact' condition is impractical.

At present, extensive sand deposits in the channel prevent the recruitment of riparian vegetation on stream banks smothered by sand. Furthermore, the depth of the existing sediment slug and the continuous reworking of sand prevent the recruitment of pioneer vegetation within the channel. Extensive sediment loads also prevent the natural formation of in-stream geomorphic features such as small scour pools, bars and channel islands.

Appendix D comprises a full fluvial geomorphic assessment that provides further details of the site and associated fluvial characteristics and processes.

Photographs 1-3 identify the typical character and extent of the flood-out area.

2.2.3 Geology and Soils

The catchment is located in the Clarence-Moreton Basin, which is an extensive intracratonic, Mesozoic sedimentary basin. Three formations are present in Cabbage Tree Creek upstream of the proposed extraction site, namely Kangaroo Creek Sandstone, Grafton Formation, and Quaternary Alluvium. The three formations are briefly described below:

- *Kangaroo Creek Sandstone.* Soils on the Kangaroo Creek Sandstone consist of sands, earthy sands, earths and podzolics.
- *Grafton Formation.* Soils developed on the Grafton Formation were usually various types of earths and podzolics.
- *Quaternary Alluvium.* Soils on the Quaternary Alluvium consist of well developed clayey soils interlaced with sand.

Sand in the extraction area has a D^{50} particle size of 0.699m which corresponds to a coarse sand classification.

Wilkie Fleming (2007) dug eight test holes throughout the site so as to access soil profiles and to determine soil types. The soils in the sampled area are characterised as being predominantly Siliceous Sands with isolated areas of Grey-Brown Podzolics. Grey-Brown Podzolics are located in areas of poorer soil drainage (eg upper reaches of the Valley Flat areas).

With the exception of the isolated occurrence of the Grey-Brown Podzolic soils, soils throughout the majority of the sampled area were found to be Siliceous Sands which are recognised as being very poor quality agricultural soils that are only generally capable or supporting limited plant growth, due primarily to poor water retention characteristics and very low levels of nutrient fertility.

2.2.4 Drainage

The extraction site consists of a significant alluvial sand deposit within Cabbage Tree Creek. Surficial water collecting in the vicinity of the site as a result of rainfall, drains vertically though the sandy topsoil into the groundwater or by way of lateral run-off into and within the creek.

The flood-out is generally dry. Surface flows are generally only visible after rainfall events.

2.2.5 Climate

The prevailing climate of the project area is sub-tropical, characterised by mild winters and warm summers.

The Australian Bureau of Meteorology's Climate Averages for Casino Airport notes mean daily maximum temperatures ranging from 21.1°C in July to 31.3°C in January. Mean daily minimum temperatures range from 6.6°C in July to 18.8°C in January. Casino Airport is located 40km to the north-east and, as the closest weather station listed on the Bureau of Meteorology's Internet site (www.bom.gov.au), is considered to be satisfactorily representative of the site.

The project area experiences summer rainfall, with a mean of 1097mm per annum.

An indication of the climatic characteristics of the project area is shown in Table 2.1.

Prevailing winds in the locality are generally south-east in the warmer months between November and May, and north-west in the cooler months with morning to afternoon variance contributing to the overlap involving the months from April through to December (APP 2007 EIS for Six Mile Swamp Creek).

Table 2.1 Climatic Characteristics

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Temperature (°C) – Casino Airport													
Mean Daily Max	31.3	30.3	29.1	26.8	23.7	21.4	21.1	22.8	25.6	27.9	29.8	31.1	26.8
Mean Daily Min	18.8	18.8	17.3	13.9	10.6	7.9	6.6	7.3	10.1	13.1	15.8	17.7	13.1
Rainfall (mm) – Casino Airport													
Mean Monthly	135	159	150	96	80	66	58	42	42	70	86	115	1098
Rain Days/Month	11	12	13	10	9	7	6	6	6	8	9	10	108

Source: Bureau of Meteorology

2.2.6 Acid Sulphate Soils

There are no acid sulphate soils in the study area because it is too high to have been subject to tidal influence during the Holocene period which is an essential prerequisite for the formation of sedimentary pyrite which oxidises to produce sulphuric acid and iron oxides (Erskine 1996 – EIS for Six Mile Swamp Creek).

2.2.7 Groundwater

Groundwater depth fluctuates in response to variations in seasonal and annual rainfall. Site inspections in 2008 in periods of no rain indicate a dry river-bed and dry sand. Site inspections shortly after heavy rainfall revealed surface flow within the channel. The groundwater is generally unpolluted. **Section 4.2** addresses water quality aspects of the project, including groundwater and water quality.

2.2.8 Flora and Fauna

Conacher Travers prepared a Flora and Fauna Assessment for the subject land in 2007 **(Appendix E).** This assessment confirmed the following:

- the vegetation within the subject site consists of two separate stands of remnant vegetation comprising of Riparian Open Forest and Disturbed Swamp Woodland and two disturbed regrowth communities comprising Regrowth Scrub and Grassland
- four threatened fauna species, the Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Little Bentwing-bat (*Miniopterus australis*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*) were observed within the subject site.
- two endangered ecological communities, Subtropical Coastal Floodplain Forest and Swamp Sclerophyll Forest on Coastal Floodplains were observed within the subject site. These communities will be wholly retained as part of the proposal.
- no threatened flora species or endangered populations were observed within the subject site during surveys
- the proposed development is not likely to have a significant effect on threatened species, populations, endangered ecological communities or their habitats

DPI Fisheries in a letter dated 21 May 2007 (**Appendix C3**) advised that *"..There are unlikely to be any threatened species or threatened species listed under Part 7A of the Fisheries Management Act 1994."*

Section 4.8 and **Appendix E** of this report provides additional details and assesses potential impacts to flora and fauna at the site.

2.2.9 Agricultural Suitability

The proposed extraction activities will take place on the flood-out within the bed of Cabbage Tree Creek. The flood-out as described in **Section 2.2.2** and **Appendix D** does not constitute a viable growth medium or environment for purposeful agriculture as it consists of unconsolidated alluvial sand with a minimal amount of organic material. The extractive site is therefore not considered to be suitable for agriculture. Small stockpiles of extracted sand will be situated within the unimproved grazing pasture located along the channel.

Wilkie (2007) advised that the land uses currently undertaken within the site are a combination of low intensity cattle grazing and uncleared scrub. The land is comprised of a combination of Class 4 and Class 5 land. A higher agricultural land classification is totally restricted due to inherent soil types that are highly erodible and naturally infertile and this is in addition to the sloping nature of much of the land which further exacerbates the risk of soil erosion. Wilkie (2007) considers that the existing grazing operation is considered to be the highest and best agricultural use that the site is capable of sustaining.

Wilkie (2007) advised that the land within the site has very limited agricultural value and that removal of a very small amount of this land for non-agricultural purposes is not considered to pose any threat to either the site's future agricultural production potential or the continued operation of the existing grazing enterprise.

2.2.10 Flooding

Erskine (1996) cites a review of the Department of Land and Water Conservation's flow duration data for State Forest's Casino Management Area, finding that the neighbouring Battens Bight Creek has a median daily flow of only 2.3 ML/d (0.0266m³/s) and had poor base flow persistence (90% flow of 0ML/d). Highest run-off occurs during late summer and the smaller creeks, like Cabbage Tree Creek, are ephemeral, drying up during protracted low rainfall periods.

The largest historical flood in the Richmond River catchment occurred in February 1954. While no hydrological records of this flood exist for Cabbage Tree Creek and neighbouring systems, local residents testify to its large magnitude and its destructive effects. This flood was responsible for initiating large scale erosion in the adjacent Six Mile Swamp Creek (Erskine 1996).

Potential flooding impacts are further addressed in **Section 4.3** of this report.

2.2.11 Visual Context

The main landform pattern throughout the site is described as being low hills with associated landform elements being hill-slopes, drainage depressions, stream bed (Cabbage Tree Creek) and valley flat. The adjoining lands comprise unused scrub/woodland, Nature Reserve and State Forest.

The creek line is vegetated apart from the access tracks to the creek bed and screening area. Large sandstone boulders are exposed intermittently along the creek banks. The creek valley is surrounded by forested hills with exposed weathered sandstone.

The creek bed and banks are not highly visible in the local context due to local topography and vegetation.

The visual impacts of the proposed development are detailed in **Section 4.10** of this report.

2.2.12 Extractive Operations in Project Vicinity

Ardill Payne & Partners consulted with Mr Jeff Brownlow of the Department of Primary Industries (DPI) to determine the extent and scale of similar activities within a 10km radius of the site.

The DPI's INDMIN database identified 15 construction material sites (including the subject site) within 10km of the subject site.

Of the 15 quarries only one (Brenners Quarry) was identified as being operational. Two of the quarries listed are those that have recently been approved by Richmond Valley Council, viz:

- DA 2006.0215 – endorsement date of consent 26 June 2006 – Lots 13 & 15 DP 755608 – No. 1600 Old Tenterfield Road, Rappville (Six Mile Swamp Creek) – 25,000m^3 per annum for 25 years

- DA 2007.0099 – endorsement date of consent 20 February 2007 – Lot 35 DP 755608 – No. 1380 Old Tenterfield Road, Rappville (Six Mile Swamp Creek) – 5,000m^3 per annum for 30 years

2.3 Adjoining and Surrounding Land Uses

Land uses adjoining and surrounding Lot 35 DP 755608 were determined by aerial photographs, 1:25,000 topographic map review and site inspections. The existing land uses are listed below:

North – Uncleared scrub/forest.

South – Mount Neville Nature Reserve.

West – Mount Neville Nature Reserve.

East – Uncleared scrub/forest and Fullers State Forest.

There are several residential dwellings located near the site and along Brewers Road (including one residence on the subject land). The closest affected dwelling is 700m north-east from the excavation site on Lot 150 DP 811460. The location of these dwellings is identified on the map in Appendix F at **Appendix I**.

3 DESCRIPTION OF PROPOSAL

This section describes the proposed sand extraction operations and ancillary activities, and identifies specific environmental and development objectives that will be adopted in conjunction with the project.

3.1 Overview of Operations

The proposed operation involves the progressive extraction of coarse dry river sand from the bed of the Cabbage Tree Creek. The flood-out area proposed for extraction operations on the subject site is approximately 800m in length and 20m in width (average), which amounts to approximately 1.6ha. Given that the extraction site consists of fluvial deposits within the confines of the creek bed, it is generally unsuitable for other uses.

Consent is sought for a maximum annual extraction of 20,000m^3 (during peak periods) for a period of 30 years. The proponent has advised that the average annual extraction rates would be typically 5,000-10,000m^3 per annum.

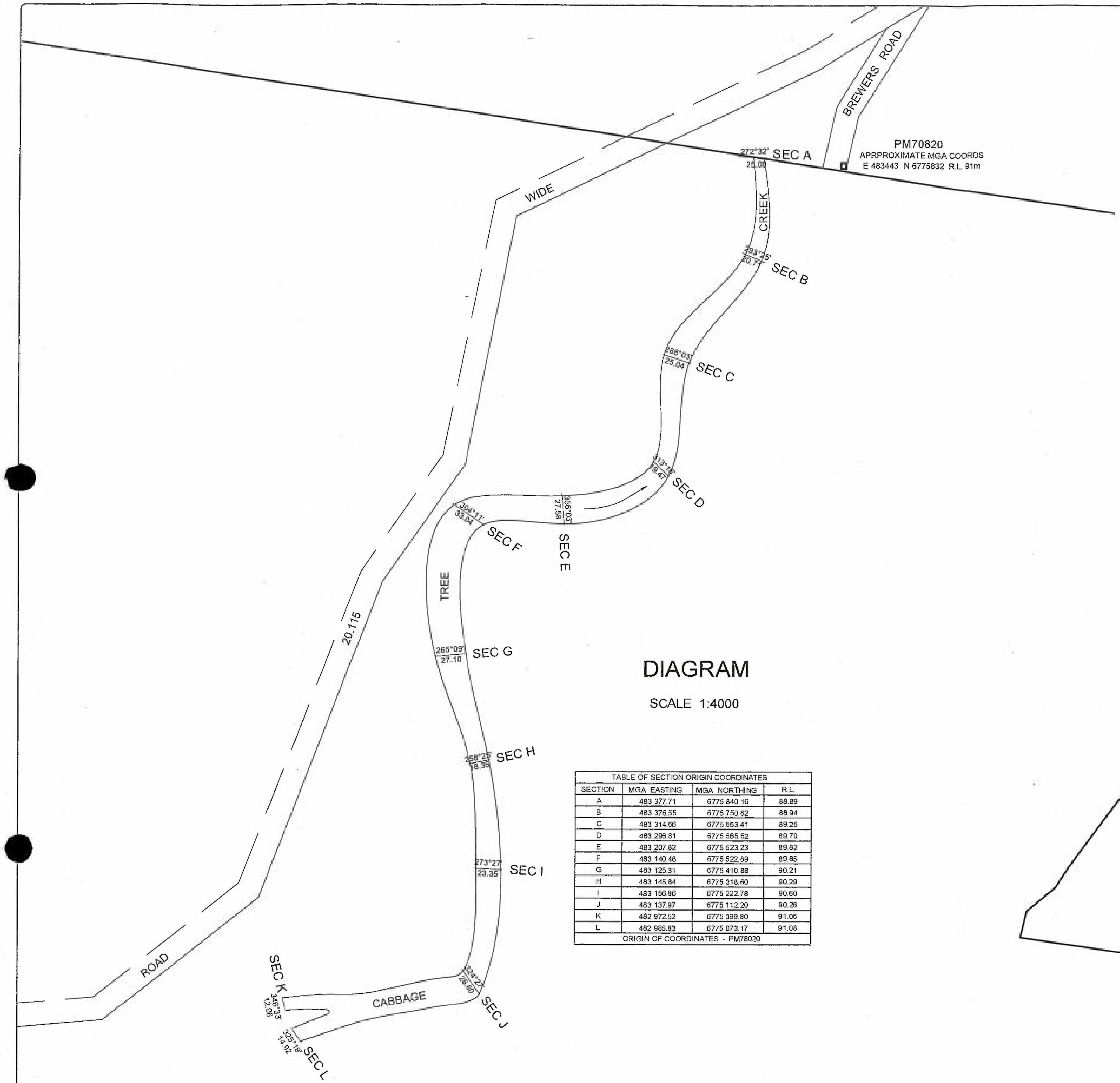
In summary, the proposed extraction involves the following:

- removal of unconsolidated sand via mechanical means (eg excavator)
- screening of the sand to separate organic matter via a dry sieve screen
- stockpiling the sand
- loading the sand into haulage trucks by an excavator or front end loader for dispatch to surrounding markets

Access to the channel will be via existing breaks between the trees along the bank. The access points will be located and maintained so as to minimise erosion and destabilization of the creek banks.

Figures 4.1 and **4.2** comprise a site survey and cross sections of the existing creek.

Figure 5 is a site layout plan indicating the extraction area, staging areas, screening and stockpiling sites and access tracks.



DIAGRAM

SCALE 1:4000

TABLE OF SECTION ORIGIN COORDINATES			
SECTION	MGA EASTING	MGA NORTHING	R.L.
A	483 377.71	6775 840.16	88.89
B	483 376.55	6775 750.62	88.94
C	483 314.66	6775 663.41	89.26
D	483 296.81	6775 565.52	89.70
E	483 207.82	6775 523.23	89.82
F	483 140.48	6775 522.89	89.85
G	483 125.31	6775 410.88	90.21
H	483 145.84	6775 318.60	90.29
I	483 156.86	6775 222.78	90.60
J	483 137.97	6775 112.20	90.26
K	482 972.52	6775 099.80	91.06
L	482 985.83	6775 073.17	91.08
ORIGIN OF COORDINATES - PM78020			

PLAN

SCALE 1:20000

Do not scale drawing. Use written dimensions only

Issue	Date	Amendment	App'd

Client: KINGSBRAE SAND QUARRY

Project: LOT 38 DP755635 BREWERS ROAD KIPPENDUFF

Title: PLAN

ARDILL PAYNE & PARTNERS
CONSULTING CIVIL AND STRUCTURAL ENGINEERS
PROJECT MANAGERS AND TOWN PLANNERS
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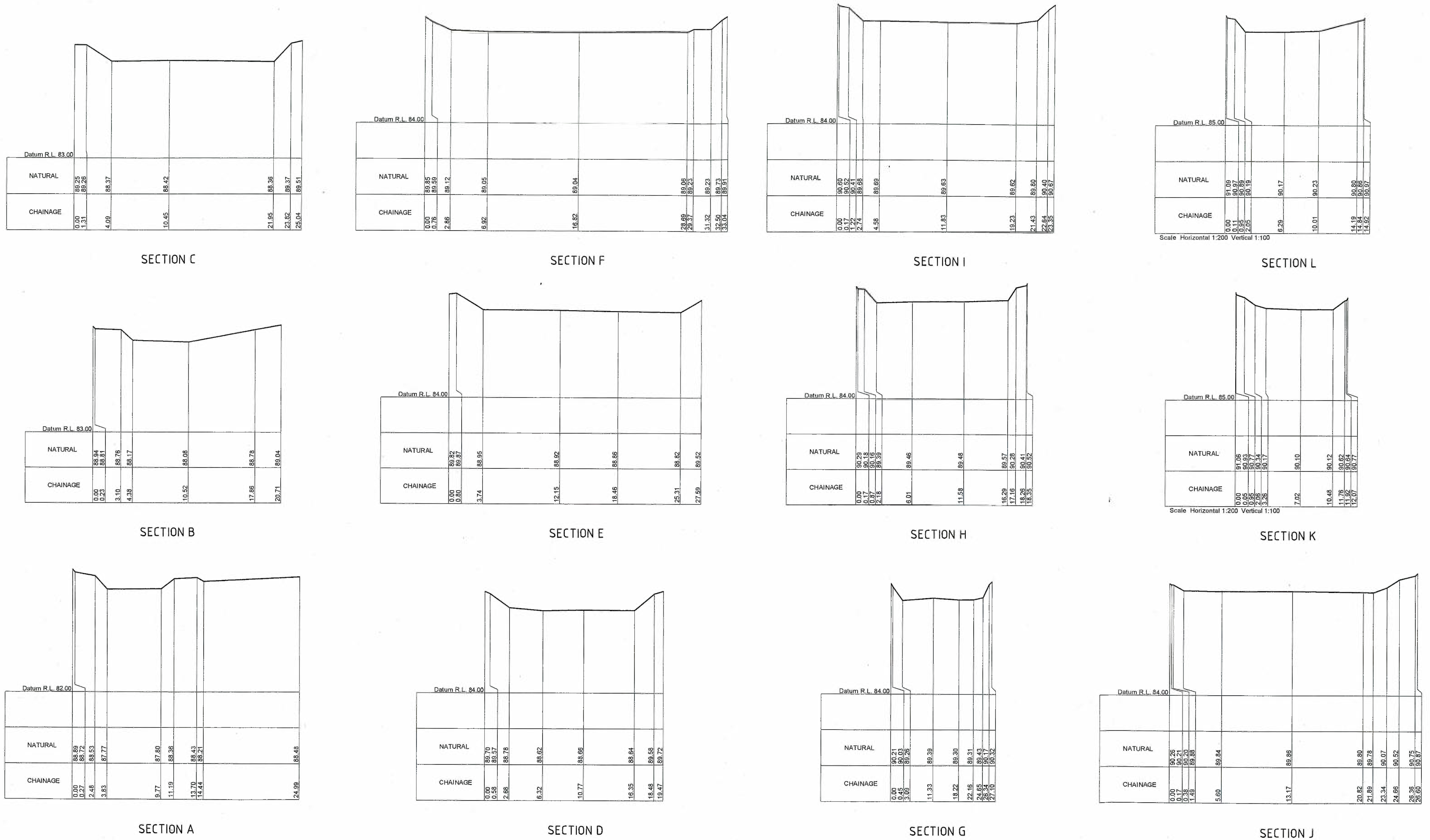
e-mail:info@ardillpayne.com.au

Surveyed	JS	Scale at A3	SEE ABOVE
Drawn	GGC	Datum	A.H.D. (APPROX)
Date	JULY 2007	Filename	6518XS
Checked		Approved	
Job No.	07/6518	Dwg. No. / Issue	Sv.01

FIGURE 4.1



Scale Horizontal 1:400 Vertical 1:200

Do not scale drawing. Use written dimensions only

Issue	Date	Amendment	App'd

Client: KINGSBRAE SAND QUARRY

Project: LOT 38 DP755635 BREWERS ROAD KIPPENDUFF

Title: CROSS SECTIONS

ARDILL PAYNE & PARTNERS
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PROJECT MANAGERS AND TOWN PLANNERS
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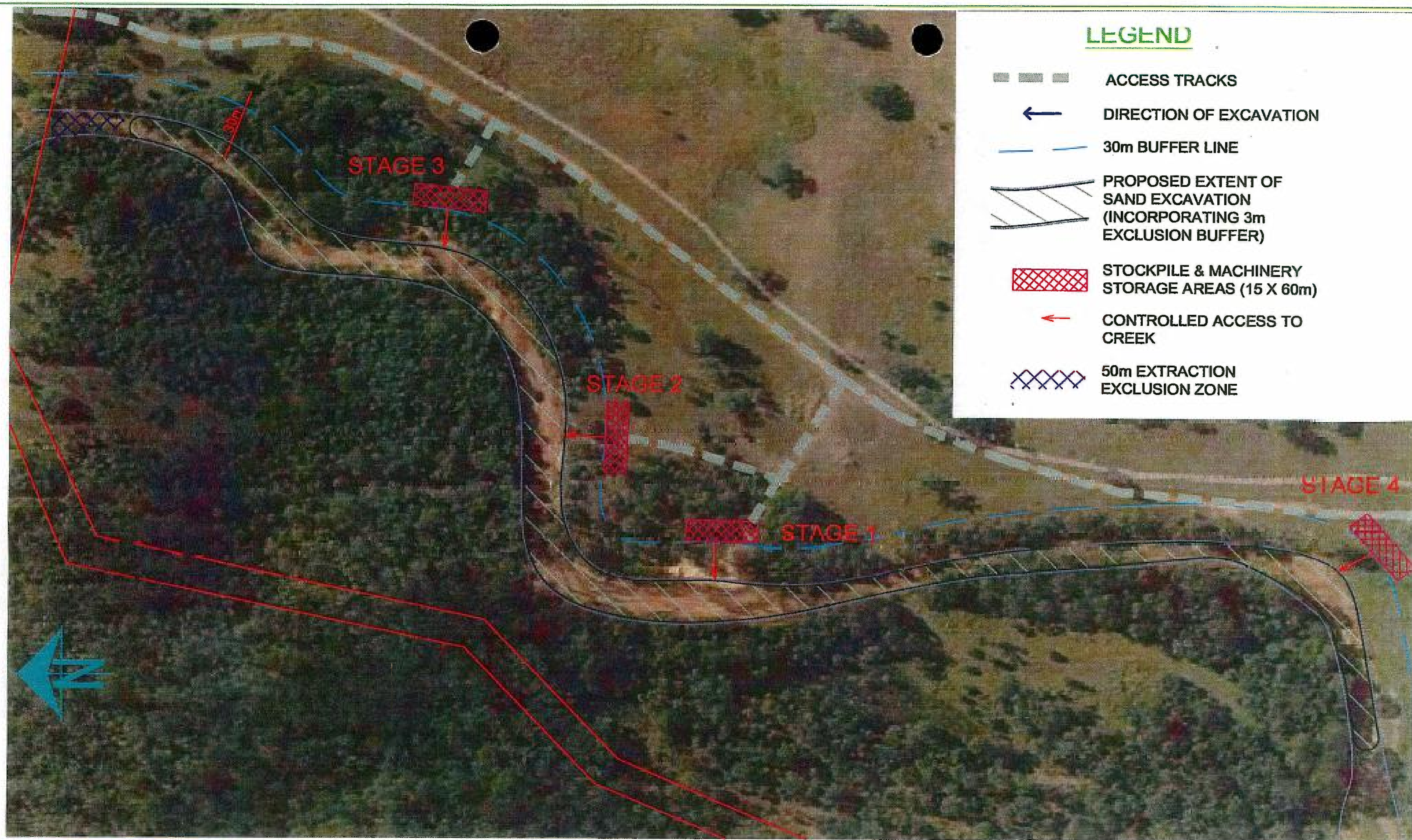
Surveyed	JS	Scale at A3	SEE ABOVE
Drawn	GGC	Datum	A.H.D. (APPROX)
Date	JULY 2007	Filename	6518XS
Checked		Approved	
Job No.	07/6518	Dwg. No.	Sv.02
		Issue	

FIGURE 4.2



LEGEND

ACCESS TRACKS
DIRECTION OF EXCAVATION
30m BUFFER LINE
PROPOSED EXTENT OF SAND EXCAVATION (INCORPORATING 3m EXCLUSION BUFFER)
STOCKPILE & MACHINERY STORAGE AREAS (15 X 60m)
CONTROLLED ACCESS TO CREEK
50m EXTRACTION EXCLUSION ZONE

Do not scale drawing. Use written dimensions only

PROJECT:
LOT 38 DP755635
BREWERS ROAD
KIPPENDUFF

TITLE:
SITE PLAN

CLIENT:
KINGSBRAE SAND QUARRY

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Scale at A4	NTS	Datum	N/A
Design	PS	Date	MAR 08
Drawn	RB	File	6518XS_3
Dwg No.	FIG5	Job No.	6518

Drawings 1-3 of Appendix A to **Appendix D** identify the proposed maximum width and depth of the creek bed excavation.

3.2 Project Objectives

The following is a statement of objectives that will govern the sand extraction operations:

- to ensure that the resource is extracted in an efficient and environmentally responsible manner
- to control and manage the sand extraction to facilitate the recovery of the surveyed section of the creek to a specified predicted recovery potential
- to protect the existing water quality at and downstream of the site
- to develop and implement controls that minimise creek degradation
- to develop and implement controls that minimise air pollution with respect to potential dust generated by earthmoving equipment and vehicles
- to ensure that adequate provision has been made with respect to traffic generation and access
- to identify and protect site flora and flora
- to maintain the visual integrity of the site and locality
- to ensure that waste generated by the proposal is minimised and managed in an environmentally acceptable manner
- to ensure that the proposal does not create adverse impacts on surrounding land uses
- to facilitate economic and sustainable extraction of sand material from the site
- to facilitate the reliable supply of high quality medium river sand to local and regional development industries
- to ensure that the proposal implements the principles of Ecologically Sustainable Development (ESD)

3.3 Resource Characteristics

The sand resource within the flood-out has been deposited during prior flood events with significant deposition occurring during and subsequent to the 1954 flood. An extremely large rainfall event occurred in the catchment in February 1954 which was reported to have caused catastrophic bed and bank erosion in the adjacent Six Mile Swamp Creek catchment (Erskine 2005, 1996). It is likely that Cabbage Tree Creek experienced catastrophic morphogenesis (channel change) during this rainfall event (Dilworth 2008). **Section 2.2.2** and **Appendix D** detail the geomorphic characteristics of the site.

The Department of Urban Affairs and Planning (now DoP) 'EIS Guideline for Extractive Industries' states that "construction sand, soil, gravel or similar materials (which are not within the meaning of the *Mining Act 1992*) are defined as 'extractive materials". Extractive materials are used principally as construction material in pre-mixed and bituminous concrete, road base, foreshore protection, land formation and landfill material."

Field analysis of sediment grain size from samples collected by Dilworth (2008) throughout the surveyed section of the creek indicated a heterogenous mix of fine to coarse sands. Laboratory results of particle analysis report a D^{50} particle size of 0.699mm which corresponds to a coarse sand classification.

The project proponent describes the sand as clean and well suited for purposes such as ready mix concrete and landscaping.

3.4 Quantity of Sand Available and Sustainable Extraction Rates

Sustainable extraction is usually interpreted to mean that extraction rates of construction materials from rivers and estuaries do not greatly exceed natural replenishment rates by bed-load transport of sand and/or gravel. Extraction rates, replenishment rates and sand storage volumes for Cabbage Tree Creek were investigated by Dilworth (2008).

3.4.1 Extraction Rate

The proposed maximum annual extraction rate is 20,000m^3 with typical rates of between 5,000-10,000m^3 per annum. The proposed term of the operation is 30 years.

3.4.2 Site Survey

Deposited bed-load sediment stratigraphy samples were undertaken by Riparian Engineering Pty Ltd in November 2007 (refer **Appendix D**). An excavator with a 4m auger attachment was used to drill into the deposited bed-load sediment to a maximum depth of 3.6m. Drilling was ceased if bedrock was hit.

Three to four sediment depth samples were taken for each surveyed cross section. The surveyed cross sections of the creek are provided at **Figure 4**.

At each sediment depth sample, the surface of the deposited sediment and the maximum depth was recorded by APP's Registered Surveyor. The data was calculated to determine the volume of the deposited bed-load sediment.

After every metre drilled into the deposited bed-load sediment, the stratigraphy of the extracted core was inspected to detect if there was changes in the particle size and colour in the sediment, which would indicate that the original creek bed had been reached. Black sandy loam was evident when the creek bed bottom was found using this method.

In most cases the auger could not reach the bottom of the creek and a note of "no bottom @ 3.6m" was recorded. This meant that the bottom of the creek was not found and that the deposited bed-load was greater than 3.6m in depth.

3.4.3 Storage Volume

In order to ensure that extraction during dry periods does not deplete sand storage from Cabbage Tree Creek it is important to establish that there is sufficient sand stored in the channel to permit short-term extraction of stored sand.

Dilworth (2008) advises that there is approximately 24,881m^3 of sandy bed-load sediment available for extraction based on certain constraints. Approximately 69,750m^3 of additional sandy bed-load sediment is available and is stored in up-stream channel supplies as excessive sedimentation. As a consequence, there is approximately 95,000m^3 of sand available for extraction.

Dilworth (2008) has recommended that a geomorphic assessment of the sand extraction operation be undertaken after the removal of 99,750m^3. This assessment will establish if more sediment can be extracted from the creek.

3.5 Environmental Benefits of Sand Extraction

Dilworth 2008 reported that the *"The proposed sand extraction will not have a detrimental impact on riparian vegetation and will provide new recruitment and revegetation sites on lower streams that are currently smothered with sediment ..... The proposed sand excavation operation can potentially facilitate the geomorphic recovery of Cabbage Tree Creek."*

Sand slugs are recommended as possible extraction sites due to the fact that the sand can cause a number of detrimental environmental impacts, such as:

- burial of ponds, water-holes and pools which form important aquatic habitat and refugia
- burial of the floodplain with thick, infertile deposits of quartz sand
- creation of a mobile featureless, sand substrate which drastically reduces macro invertebrate biodiversity and abundance
- the substantial raising of floodplain water tables with the consequent death of riparian trees
- elevated water temperatures and hence reduced dissolved oxygen concentrations
- rapid deposition and channel instability by repeated cycles of incision and avulsions
- the filling of waterholes used by stock and native fauna for drinking

Notwithstanding the above, extracted material is periodically replenished by natural processes.

3.6 Extractive Operations

3.6.1 Site Layout

With the exception of the movement of haulage trucks to and from the site, all other activities will be contained wholly within the site. Excavation, screening, stockpiling and loading onto haulage vehicles, will all take place on the creek bed and overbank areas adjacent to the flood-out. Fuel, lubricants will be trailer or ute mounted and will be kept in appropriately contained areas that are well clear of the creek bed and banks.

Figure 5 comprises a site layout plan depicting the various components of the proposed operations.

3.6.2 Sequence of Work

The location and alignment of the proposed extraction area is shown on the site layout plan (**Figure 5**) and the proposed works incorporates the project objectives, the Flora and Fauna Assessment's recommendations (**Appendix E** and **H**) and Dilworth's recommended extractive strategies (**Appendix D**).

The extraction area follows the channel alignment. The cross sections provided at Appendix A of **Appendix D** identify the maximum width and depth of the extraction for each section of the creek.

The extraction works are proposed to be undertaken in stages, working progressively from the up-stream to the down-stream end of the site. Quantities of sand extracted within each stage will vary according to the surface area and depth of each section. Areas not being worked will be restored with smooth batters leaving no mounds or holes likely to create turbulence or eddying, or which are likely to redirect flows.

Access to the channel area will be by way of existing gaps in the trees along the creek bank **(Photographs 5** and **6)**.

The screening plant and staging areas will be located at a site away from the creek bank as indicated on **Figure 5**.

The proposed sequence of work for the extraction operations is illustrated in **Figures 5** and involves the following:

1. Demarcation of a stockpile area, including an area for the storage of machinery and fuel and a loading area with a durable plastic containment fence.
2. Installation of bunding around the areas proposed for stockpiles and fuel storage.
3. Demarcation of the area proposed for extraction works with durable plastic demarcation fence.
4. Extract sand to finished levels as identified on the plans at Appendix A of **Appendix D**.

5. Sand will be transported directly to the dry sieve for screening or if necessary, will be stockpiled in a designated location to enable the material to dry out before screening.

6. Organic matter and other material separated during processing will be stockpiled in a designated location. The sand is generally "clean" with little organic content and as a result very little by-product will be generated. Any by-product will be stockpiled away from the creek banks and will be left to revegetate naturally.

3.6.3 Extraction Strategies

Dilworth 2008 (**Appendix D**) recommends a number of extraction strategies which will be incorporated into the extractive operation, viz:

- Ensure that original bed material underlying the deposited sandy bed-load sediment is not disturbed in any way.
- No excavation is to proceed into the pre-aggradation long term bed profile.
- No excavation is to proceed below the maximum excavation depth specified for each cross section in Appendix A of **Appendix D** until further investigation is undertaken.
- Existing riparian vegetation is to be protected during operations. If riparian vegetation is disturbed, it should be replaced with appropriate native riparian species.
- The operation is to be properly monitored by Kingsbrae based on the proposed monitoring strategy detailed in **Section 3.6.4** of this EIS.
- No abrupt transitions in channel width and depth should remain at the completion of extraction, particularly within up-stream sections.
- All access roads to the channel should be rehabilitated at the completion of operations.
- All stockpiles should be removed and all disturbed areas revegetated at the completion of operations.
- The optimum channel dimensions after extractive operations should closely resemble the maximum equilibrium excavation areas defined in each cross section in Appendix A of **Appendix D**.
- As bank toes that are covered in sediment become exposed, the bank toes are to be revegetated with suitable riparian vegetation.

3.6.4 Monitoring

Dilworth 2008 (**Appendix D**) recommends a number of monitoring strategies which will be incorporated into the extractive operation, viz:

- Undertake survey of changes to bed levels at existing cross sections. Signs of bed and bank instability should be noted and assessed if they are causing excessive bank erosion. Existing cross sections are to be surveyed after the extraction of 20,000m^3, 40,000m^3, 60,000m^3, 80,000m^3 and 99,750m^3.
- Undertake survey of changes to bed levels at the four up-stream and one down-stream monitoring cross sections. Signs of bed and bank instability should be noted and assessed at these locations is they are causing excessive bank erosion. Monitoring cross sections are to be surveyed after the extraction of 20,000m^3, 40,000m^3, 60,000m^3, 80,000m^3 and 99,750m^3.
- Undertake survey of changes at selected cross sections after major flood events (greater than 1:10 year ARI) in the creek once a minimum of 20,000m^3 has been removed to determine the sediment transport delivery to the site (sand replenishment rates) and if there are any negative impacts to the geomorphic stability of the creek.

Dilworth 2008 recommends that a detailed geomorphic assessment of the sand extraction operation is to be undertaken after the extraction of 99,750m^3 of bed-load sediment. This assessment is to be based on surveys, geomorphic assessment of channel stability and recovery processes and up-stream supplies of sediment. The assessment will determine the quantum of bed-load sediment that can be extracted from the creek.

3.6.5 Hours of Operation

Given the size of the proposed operation (maximum of 20,000m^3 per annum) the site will only be operated on an intermittent basis. Proposed hours of operation are limited to 7.00am to 6.00pm Monday to Friday and 8.00am to 12 noon Saturday.

3.6.6 Site Access

Site access will be by way of the existing gravel track identified on **Figure 5**. This is the same access that has been utilised by haulage vehicles in accordance with the prior approved sand extraction operations on the site.

The project operator will be responsible for maintaining the internal access track and implementing erosion control measures as appropriate.

3.7 Equipment and Personnel

Equipment to be utilised at the site includes:

- excavator
- front-end loader (7 tonne)
- portable screening plant operated by an auxiliary diesel motor
- haulage trucks (8-20 cubic metre capacity)

Only one on-site manager/operator will generally be employed at the site in conjunction with operations. Truck drivers will also be required depending upon the orders for the day.

Given the small scale of the project it is anticipated that it will operate on an intermittent basis.

3.8 Site Services

Given the small scale of the proposed operations, only limited personnel and equipment are required. The respective service requirements are as follows:

- Electricity – An electrical supply is not proposed to be provided to the extractive operations as no site office or services require electrical power. No lighting is required as operations will occur during daylight hours.

- Water – No specific water supply is required for any of the processes involved in the proposed extractive operations.

- Sewerage – A portable chemical toilet will be provided at the site for the site manager, contract drivers or any visitors to the site.

- Telecommunications – Mobile phones will provide telecommunication facilities.

3.9 Transportation

Sand extracted from the site will be screened and stockpiled at the designated locations and will be loaded onto haulage trucks that have a carrying capacity of 8-20 cubic metres.

The quarry will provide material to the operator's depot at Casino and/or work sites at a number of locations throughout the region including Lismore, Alstonville, Evans Head, Casino, Tabulam and Ballina.

The principle haulage route follows Brewers Road, Old Tenterfield Road and Wyan Road – Rappville Road via Rappville and the Summerland Way (Main Road No. 83) to Casino. A directional split will occur once the trucks reach Casino. Most of the trucks will travel east along the Bruxner Highway to the centres of Lismore, Alstonville and Ballina. Some haulage trucks may follow Old Tenterfield Road via Carter's Bridge to the Summerland Way at Whiporie, then south to Grafton.

Sections 3.11 and **4.7** further address transportation and potential traffic impacts. **Appendix F** is a Traffic Impact Study prepared for the operation.

3.10 Fuel

Diesel fuel will be required for the operation of the excavator, front-end loader and screening plant. Fuel will be available on the site in a mobile (trailer or ute) or skid-mounted tank.

No refuelling will be undertaken within the bed or on the banks of the creek. No haulage trucks will be refuelled at the subject site. They will be refuelled at appropriate fuelling facilities distant from the site.

3.11 Traffic Generation

3.11.1 Trip Generation

The maximum extraction rate is 20,000m³ per annum. It is envisaged by the proponent that annual extraction rates would more typically be in the order of 5,000-10,000m^3 per annum. Actual daily extraction will vary according to a number of factors including:

- weather
- resource supply
- fluctuations in demand

It is proposed to conduct work at the site six days per week, 52 weeks per year, however the above-referenced variations will likely reduce this to approximately 260 days per year, which equates to five working days per week.

Based on a typical annual extraction rate of 10,000m^3 and 260 works days per year, average daily extraction rates of approximately 40m^3 of sand would be transported from the site each day (ie 2 truck loads per day). Peak extraction days would generate up to 5 truck loads per day (ie extraction of 100m^3 per day).

Traffic generation has been estimated assuming the use of haulage trucks with a maximum capacity of 20m^3. This equates to 1250 truck loads per year (or 2500 truck trips per year) based on the maximum extraction rate of 20,000m^3. A return trip is counted as two trips.

Table 3.1 identifies indicative average truck rates that will be generated by the operations if the average daily extraction rate of 40m^3 is achieved.

Table 3.1 – Average Daily Truck Movements

Truck capacity	Loads/day	Truck movements/day	Average vehicle movements/hour
20m^3	2	4	<1

Table 3.2 identifies indicative peak truck rates that will be generated by the operations if the average daily extraction rate of 100m^3 is achieved.

Table 3.2 – Peak Traffic Generation Rates

Truck capacity	Loads/day	Truck movements/day	Average vehicle movements/hour
20m^3	5	10	1

The site will be operated generally by one on-site manager who will generate an additional two traffic movements per day.

Section 4.7 further addresses transportation and potential traffic impacts. **Appendix F** is a Traffic Impact Study that has been prepared for the site.

3.12 Rehabilitation and Final land Use

The progressive extraction of sand from the site will include redefinition of the river banks and site remediation. Site rehabilitation and final land use is fully discussed in **Section 5** and **Appendix H**.

4 ENVIRONMENTAL INTERACTIONS

This section expands on the contextual description of the physical environment provided in Section 2.0 and provides an analysis of the environmental interactions applicable to the proposed development with specific reference to the site planning objectives specified in Section 3.0 of the report.

4.1 Potential Geomorphic Impacts

Sections 2 and **3** and **Appendix D** identify the fluvial characteristics of Cabbage Tree Creek. The environmental benefits of removing sand from a flood-out are detailed in **Section 3.5**.

Erskine (1996 and 2005) notes that extraction from a creek bed may potentially give rise to potential environmental impacts, as follows:

- bed degradation
- bank erosion
- channel enlargement
- reduced flow velocities in enlarged sections
- increased flow velocities in drawdown zone immediately upstream of excavations
- bed armouring induced by degradation
- accelerated bed-load transport at upstream end of bed-load reach
- reduced bed-load transport through channel enlarged by excavation

These potential impacts are fully discussed in the fluvial geomorphic assessment at **Appendix D**.

In regard to potential impacts the following measures are recommended:

a. *Confine excavation to the excavation area shown on the plans at Appendix A of* ***Appendix D****.*

Confining extraction to a defined channel in accordance with the cross section plans is expected to generally restore and maintain bed gradients, enhance stream hydraulics, ensure the flow of water to downstream ecosystems and will not impact the underlying creek bed.

b. *Restrict extraction to the more recent deposits and do not disturb any original bed or bank material.*

Sand extraction shall be limited to the depths shown on the plans at Appendix A to **Appendix D**. This measure is recommended to minimise bed and stream bank erosion and protect water quality. Confining extraction to the "clean" sand with minimal fines within the channel will further protect water quality.

c. *Carry out progressive extraction working down-stream in a consistent manner.*

Extraction that is undertaken in an irregular manner may result in the turbulence and the redirection of flows in the event of flooding.

d. *Restrict the entry and exit of machinery to specific limited points along the creek bed. Constantly maintain and rehabilitate points of entry and exit at the completion of works at each section.*

This measure is intended to minimise disturbance of the creek banks.

e. *Site screening plant at nominated locations as extraction moves in a downstream direction to minimise haulage distances.*

Siting the screening plant appropriately will reduce the need to move extracted sand to the plant. The proposed progressive locations of the plant are identified on **Figure 5**.

f. *Erect bunding at each point of relocation of the screening plant.*

Bunding around the screening plant and resource stockpiles will minimise the potential for erosion and sedimentation.

g. *Establish and maintain stream bank alignment consistent with the upstream reach and the plans at Appendix A of* ***Appendix D****.*

Appropriate alignment avoids sudden channel expansions and contractions and will prevent stream bank erosion and failure.

h. *Locate all stockpiling away from the top of the bank. Rehabilitate and revegetate stockpile and equipment storage areas at the completion of operations.*

Vegetation will assist in stabilising the creek banks and in filtering run-off and stormwater entering the creek.

i. *As bank toes covered in sediment become exposed, revegetate bank toes with suitable riparian vegetation.*

Vegetation will assist in stabilising the banks of the creek and minimise the potential for erosion and bank failure.

Refer to **Section 3** for discussion of sustainable extraction and proposed extraction rates.

4.2 Water Quality

The protection and maintenance of water quality is a primary concern of the sand extraction operations. Potential causes of water pollution result from extraction and stockpiling and associated erosion and sedimentation risks and ancillary activities such as fuel storage and handling.

4.2.1 Excavation Impacts on Water Quality

Extraction will be confined to the areas and depths indicated on the plans at Appendix A of **Appendix D**. No excavation will occur within 3m of the creek bank. These buffers will assist in preventing erosion of the creek banks. Extraction will thus be limited to the "clean" sand within the channel area.

Extraction will be limited to periods of low or no rainfall, when groundwater within the channel will be low, to avoid disturbance to groundwater.

4.2.2 Water Quality Impacts of Ancillary Activities

Ancillary activities associated with excavation that have the potential to impact water quality and appropriate ameliorative measures are included below:

a. *Stockpiling of sand*

Bunding will be installed around any stockpiling area prior to any stockpiling. This bunding will ensure that there is no pollution of the creek or downstream environments from erosion and sedimentation from run-off or stormwater.

b. *Management of organic material*

Organic material such as leaves and sticks will be separated from the sand during sieving. This material will be placed in low mounds near the edge of the flood-out and vegetated with native species to facilitate stability. Given the clean characteristics of the sand only a small amount of organic material will be produced.

c. *Access to the flood-out*

Restrict the entry and exit of machinery to the specified points along the creek bed with appropriate relocation of any screening plant. Constantly monitor, maintain and rehabilitate points of entry and exit as each section is completed. Plant with native endemic vegetation at the completion of extractive operations.

d. *Fuel Storage*

Fuel will be stored in sealed containers in accordance with industry standards and kept on a ute or trailer. In the event of any spillage, all polluted material will be disposed of at an approved facility. Refuelling will only occur within designated fuel storage areas.

4.3 Flooding

Section 2.2.10 addresses flooding in the project area. Erskine (2005) notes that sand excavations of this nature will slightly increase channel capacity over current conditions. This is an important part of the extraction strategy and will result in the storage of sand in the extracted area due to a decrease in mean flow velocity. When sand replenishment rates decrease due to reduced upstream sand supply, channel capacity will increase and hence the frequency of overbank floods and the amount of overbank sand deposition will decrease.

4.3.1 Flood Management Plan

A significant flood may have the potential to damage equipment and the stockpile areas as these will be located adjacent to the creek. The following practices will be implemented by the proponent:

- the operator will maintain awareness of inclement weather, including monitoring of weather forecasts
- in the event that substantial flooding appears imminent the operator will immediately cease work
- the excavator, front end loader, fuel storage and toilet will be relocated to higher ground

4.4 Air Quality

Particulate matter in the atmosphere, which includes dust, consists of solid or liquid particles ranging in size from 0.1 to 50 micrometres. Even without human activity, the atmosphere contains particles from natural sources such as wind blown dust, forest fires, sea salt, plant pollens and bacteria.

The larger particles in the air either settle to the ground or are scrubbed out by rainfall, while the smaller particles may remain suspended in the air for considerable periods. If other materials such as lead contaminate particles are in the air, health can be affected. This is not anticipated to be significant on the subject site and the main concerns about course materials would be generally more in terms of nuisance such as damage or soiling of materials.

The smaller particles, less than 10 micrometres in diameter, are inhaled and may cause respiratory problems or are absorbed into the bloodstream. Particles less than 2.5 micrometres are also responsible for reducing visibility (EPA 1996 as cited by Geolink in 2000).

Air emissions can be classified as either point source emissions (ie emissions from a stack or vent) or fugitive emissions (ie wind erosion, leakages or spillages associated with loading, conveyors, storage facilities, plant operation, vehicle movements, etc).

Sand excavation activities such as that proposed have the potential to generate fugitive dust during:

- excavation activities
- processing (sieving) and loading onto vehicles
- vehicle movements on the internal tracks and on the unsealed road

Exhaust emissions from machinery operating at the site has the potential impact upon air quality.

The resource within the channel consists of river sand. The project proponent describes the sand as "clean" with minimal fines and organic material. It is therefore considered that extraction activities will not result in the generation of significant amounts of fugitive dust.

The plant and machinery to be used at the site is an excavator, a front-end loader and a dry sieve screening plant. It is likely that only one or two pieces of equipment will be operated at any one time as the project is proposed to be managed by only one person, which will limit the potential for air pollution.

The operator will implement a range of control measures to minimise the potential for air pollution during project operations. These measures include:

- restriction of speed on unsealed roads on the site
- securely covering all loads prior to leaving the site
- limiting the size stockpiles to no more than two weeks supply
- erect silt fencing or similar measures around stockpiles under extreme wind conditions
- covering stockpiles under extreme wind conditions

Measures to limit exhaust emissions that will be implemented include:

- all mechanical plant, machinery and trucks will be fitted with appropriate exhaust controls
- all engines including trucks will be maintained and tuned to manufacturer's specifications so as to minimise exhaust emissions

Passive measures to reduce possible wind erosion include the planting of native vegetation on the realigned banks and vegetating the organic material mounds separated from the sand during processing.

4.4.1 Potential Air quality Impact on Dwellings in the Locality

In assessing air quality it is necessary to consider potential impacts on sensitive receivers.

The impacts on adjacent residences is low having regard to the fact that the nearest affected dwelling is situated in excess of 700m from the extraction area.

Prevailing winds in this locality are described in **Section 2.2.5**.

Due to the small scale of operations and to the surrounding sparsely settled rural environment, an on-going dust monitoring program is not considered warranted and is therefore not proposed.

However, should there be a local issue with respect to dust nuisance, it will be reported and addressed in accordance with the complaints procedures in the plan of management.

4.5 Noise

An acoustic assessment was conducted by Ambience Audio Services (**Appendix I**) to assess the noise impact of sand extraction activities and associated haulage on residential dwellings.

The potential sources of noise associated with the proposed extractive operations are the operation of equipment at the site (excavation and loading of trucks) and the movement of haulage trucks along the road network.

Section 3.7 lists the equipment that will be operated at the site. It is likely that only one or two pieces of equipment will be operated at any one time as the project is proposed to be managed by only one person, which will limit the potential for noise generation.

Section 4.7 and **Appendix F** detail the truck movements that will be generated by the project. The haulage of material using trucks will not result in significant noise impacts given the relative small number of truck loads/movements.

Limiting the hours of operation will further prevent potential noise impacts resulting from truck movements.

The closest affected dwelling is located approximately 700m to the north-east of the site. Having regard to the existing stands of vegetation and separation distance to the nearest residences, it is highly unlikely that sand extraction activities at the site will result in any noise nuisance.

The operator will implement a range of control measures to minimise the potential for noise. These measures include:

- the fitting of mufflers to all machinery and trucks in accordance with manufacturer's specifications
- enclosing the motor and installing a muffler on the exhaust of the sand screener
- locating the sand stockpiles at the site in the direction of the closest affected residential dwelling (north-east) to act as barriers
- the maintenance of all equipment to manufacturer's specifications to ensure that no undue noise is emitted at the site or during transportation to and from the site
- limiting the hours of operation to 7.00am to 6.00pm Monday to Friday and 8.00am to 12 noon Saturday
- the operator will instruct truck drivers on responsible driving techniques in the vicinity of residences

- any noise complaints will be directed to the operator who will then implement appropriate measures to reduce noise

The acoustic assessment concluded that:

- the proposed sand extraction operation will be in compliance with the NSW Industrial Noise Policy (Jan 2000) subject to the implementation of the recommended noise control measures in the report
- road traffic noise levels generated by the trucks on the haulage routes to and from the site are below the NSW EPA Environmental Criteria for Road Traffic Noise recommended maximum levels.

4.6 Waste Management

The proposed extraction operation has the potential to result in two distinct forms of waste, being:

a Non-production wastes such as general waste and plant maintenance products that would be generated by on-site personnel (anticipated to be 1 part-time employee). An appropriately contained waste receptacle will be provided within the operations area to accommodate such waste. This waste will be collected and regularly removed from the site and deposited at an appropriate waste disposal facility. Given the small scale of the project a minimal amount of waste would be generated.

b Production wastes such as organic material that is a by-product of processing/dry sieving of the sand resource. This organic by-product has been used successfully in the past and will continue to be mounded along the edges of the flood-out and allowed to revegetate.

The proponent is familiar with the prior sand extraction activities at the site, and has indicated that very little organic by-product is generated by the screening process.

4.7 Traffic and Transport

The sand has historically and will continue to be used in "ready-mix" concrete, nursery supplies and other construction related purposes. The markets have historically and will continue to include the larger regional centres and towns including Lismore, Grafton, Casino, Ballina, Evans Head and the surrounding districts.

Appendix F is a Traffic Impact Statement prepared for the project that details the standard of the local road network and the traffic that will be generated by the development.

The principle haulage route follows Brewers Road, Old Tenterfield Road and Wyan Road – Rappville Road via Rappville and the Summerland Way (Main Road No. 83) to Casino. A directional split will occur once the trucks reach Casino. The majority of the truck movements will be east along the Bruxner Highway to the centres of Lismore, Casino and Ballina.

Some haulage may follow Old Tenterfield Road via Carter's Bridge to the Summerland Way at Whiporie, then south to Grafton.

Sand extracted from the creek will be stockpiled at the designated locations and loaded onto trucks for haulage.

Daily extraction will vary in accordance with a number of factors including:

- weather
- resource supply
- fluctuations in demand

It is proposed to haul sand from the site six days per week, 52 weeks per year. However the above-referenced variations will likely reduce this to a maximum of 260 days per year, which equates to five working days per week. Based on a typical annual extraction rate of 10,000m^3 and 260 working days per year, an average of 40m^3 of sand would be transported from the site each day.

Traffic generation has been estimated assuming the use of haulage trucks with a maximum capacity of 20m^3. This equates to 1250 truck loads per year or 2500 truck trips per year, based on the maximum yearly extraction rate of 20,000m^3 (a return trip counts as two trips).

Table 4.1 is indicative of the average daily traffic volumes that will be generated by the operations if the maximum yearly extraction rate ($100m^3$) is achieved.

Table 4.1 – Average Daily Truck Generation

Truck Capacity	Loads/day	Truck Movements/day	Additional Vehicles/hour
$20m^3$	5	10	1

The site will be generally operated by one on-site manager, who will generate an additional two traffic movements per day.

The total traffic generated by the development is therefore approximately 12 movements per day. This figure may fluctuate depending on frequency of activities, demand etc.

The project will generate a minor increase in heavy vehicle movements on local rural roads. Such increases will not be excessive nor exceed the carrying capacity and capabilities of these roads. The level of impact on the Summerland Way and Bruxner Highway is contended to be such that would be imperceptible.

An additional 12 traffic movements per day are unlikely to raise any adverse safety issues for local transport and users of the local and regional road network.

The RTA's "Guide to Traffic Generating Developments" provides acceptable ranges of peak vehicle flows for various "levels of service" experienced on rural roads. The intention is to at least maintain the existing "level of service" for the roads adjacent to the site.

Road capacity "levels of service" are defined by the RTA for rural roads as shown in **Table 4.2**, with the highest level of service being Level A (free flow), with service deteriorating to Level F (forced flow). **Table 4.2** is relevant to the "levels of service" for rural roads.

Table 4.2. Two-way Peak Hour Flows on Two Lane Rural Roads (Design speed 100km/hr)

Terrain	Level of Service	15% Heavy Vehicles (veh/hr) – 100km/hr	15% Heavy Vehicles (veh/hr) – 80km/hr
Level	B	530	477
	C	870	783
	D	1410	1269
	E	2290	2061

The following performance standards are recommended:

Weekday Peak Hour Flows

Major Roads:	Level of service C
Minor Roads:	Level of service C (desirable)

Recreational Peak Hours (weekends)

Major Roads:	Level of service D
Minor Roads:	Level of service D (desirable)

The anticipated additional peak traffic movements of 1-2 vehicles/hr will not alter the "level of service" currently experienced, nor impose any major social or physical detriment upon the local residents and road users. The additional traffic generated by the proposed development is relatively insignificant when compared to the existing traffic volumes. Further the traffic levels are still well within the prescribed RTA service guides. The level of impact on the Summerland Way and Bruxner Highway will be imperceptible.

It is also noted that extractive operations, including the haulage of sand from the site, were conduced at the site from 1995 to 2000.

4.8 Flora and Fauna

A detailed flora and fauna assessment was undertaken at the site by Conacher Travers (September 2007). A copy of the report is provided as **Appendix E**.

The report concluded that:

i. *The subject site contains habitats for a number of threatened species and endangered ecological communities. The area to be impacted however is generally of low value for threatened species. The higher quality habitats and vegetation types will be retained as part of the proposal.*

ii. *Four threatened species, the Glossy Black-Cockatoo, Grey-headed Flying-fox, Little Bentwing-bat and Greater Broad-nosed bat were observed within the subject site.*

iii. *Two endangered ecological communities, Subtropical Coastal Floodplain Forest and Swamp Sclerophyll Forest on Coastal*

Floodplains were observed within the subject site. These will be wholly retained as part of the proposal.

iv. *No threatened flora species or endangered populations were observed within the subject site during surveys.*

v. *The proposed development is not likely to have a significant effect on threatened species, populations, endangered ecological communities or their habitats.*

vi. *A Species Impact Statement should not be required for the proposed development.*

vii. *It is considered that a referral of this project to Environment Australia is not required.*

4.8.1 Flora

Conacher Travers (2007) reports that the vegetation within the subject site consists of two separate stands of remnant vegetation comprising Riparian Open Forest and Disturbed Swamp Woodland and two disturbed regrowth communities comprising Regrowth Scrub and Grassland, details of which are as follows:

Riparian Tall Open Forest (*Eucalyptus grandis, Lophostemon suaveolens & Eucalyptus terticornis*)

Location and distribution – occurs on sandy alluvial soils adjoining the creek line

Disturbance – disturbed by edge effects and minor weed invasion in the shrub and ground layers, selective clearing and low levels of grazing

Disturbed Swamp Lowland Woodland (*Melaleuca alternifolia*)

Location and distribution – occurs on poorly drained alluvial floodplain and low-lying depressions on the site

Disturbance – extensively disturbed by significant weed invasion in the ground layers, a history of rural activities, vehicle tracks, moderate grazing, selective clearing and continual slashing

Disturbed Regrowth Scrub (*Acacia fimbriata and Banksia integrifolia subsp. Integrifolia*)

Location and distribution – occurs as a small disturbed remnant in the south of the site associated with the sandy alluvial soils adjoining the creek line

Disturbance – extensively disturbed by moderate weed invasion in the shrub and ground layers, a history of rural activities, massive earth movement, vehicle tracks and selective clearing and slashing

Grassland with scattered trees

Location and distribution – occurs throughout the subject site associated with highly disturbed areas

Disturbance – highly disturbed by extensive weed invasion, clearing, grazing, earth movement and alterations to the natural drainage

4.8.2 Fauna

Conacher Travers (2007) identified a number of fauna habitats on the site comprising:

- riparian bushland
- flower, nectar and seed producing tree and shrub species
- sparse to dense groundcover
- leaf litter layer
- hollow trees
- ephemeral aquatic/sand substrate habitats within creek bed
- dam
- cleared areas adjacent to creek

Four threatened fauna species were identified within the site during surveys being Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Little Bentwing-bat (*Miniopterus australis*) and Greater Broad-nosed bat (*Scoteanax rueppellii*).

An assessment pursuant to Section 5A of the Environmental Planning & Assessment Act 1979 was undertaken and concluded that the development would not likely significantly affect threatened species, populations or ecological communities or their habitats.

A Koala habitat assessment was undertaken pursuant to State Environmental Planning Policy No. 44 (refer Section 6 of **Appendix E**). This assessment advised that the site does not contain Potential Koala Habitat and that there was no evidence of Koala habitation in the area (such as scats, suitable scratch marks on trees) and that no Koalas were observed during the fauna survey of the site and surrounding area.

DPI Fisheries in a letter dated 21 May 2007 advised that there are unlikely to be any threatened species or threatened species listed under Part 7A of the Fisheries Management Act 1994.

4.9 Heritage

4.9.1 European Heritage

No buildings or other items of European heritage are evident on the site. The proposed development will not result in any impacts to items of European heritage value.

4.9.2 Aboriginal Heritage

The 1995 EIS (Jelliffe) advised that *"No sacred sites or relics have been found at the site (pers comm. Boolangle Local Aboriginal Land Council 11/8/95). The site was inspected by sites officers from the Boolangle Aboriginal Land Council. No other cultural or heritage values have been identified for the site."*

In view of the deposition of a substantial amount of sand within Cabbage Tree Creek prior to, during and subsequent to the 1954 flood it is expected that if any relics did exist on the site they would have been covered. Due to the fact that proposed operations will only extract recently deposited sand and not disturb the underlying swamp deposits, no impacts are expected.

Ardill Payne & Partners notified the Boolangle LALC and the Junbung Elders of the proposed development in letters dated 14 May 2007 and 24 October 2007 respectively. These letters included a brief description of the project and requested the provision of any relevant comments that they may have had in respect of the proposed development. No correspondence was received from the LALC or Junbung at the date of writing this EIS.

Notwithstanding the above, if any articles or items of indigenous and/or European heritage significance are uncovered during site activities, work will immediately cease and Richmond Valley Shire Council, the Boolangle

LALC and DEC will be contacted to develop and implement an appropriate management strategy.

4.10 Visual Impacts

Sand extraction activities can by their characteristics result in visual impacts. The extraction site is visible only from the residence on the subject property. The other nearest local residences are located more than 700m from the site. The visual context of the site is described in **Section 2.2.11**. Adjoining and surrounding land uses are listed in **Section 2.3**.

The nearest public road to the site is Brewers Road, located approximately 250m to the east. The extraction site is generally not readily visible from Brewers Road by virtue of intervening vegetation and topography. Trees are located both along Brewers Road and along Cabbage Tree Creek. The project site and proposed extraction operations will not be readily visible from surrounding properties or roads in the vicinity.

As stated previously, sand extraction operations were conducted on the site from 1995 to around 2000.

Notwithstanding these prior extractive operations, no evidence or visual impacts such as erosion or degradation of vegetation has occurred. In fact, with the exception of small vegetated mounds (previous stockpiles), there is no visual evidence that sand extraction ever occurred at the site as a result of natural replenishment processes that have occurred since previous extraction activities were undertaken.

Notwithstanding the above, the following measures will be implemented to protect and enhance the sites aesthetic attributes:

- stockpiles will be limited to a minimum of two weeks supply
- the material separated from the sand during screening will be used to create low mounds, which will be vegetated with appropriate endemic native species

4.11 Social and Public Health Issues

As discussed in this report the subject site is relatively remote in terms of proximity to human settlements (including dwelling houses) and is relatively small in scale. The potential for the project to result in social or public health impacts is therefore not considered to be significant.

Potential impacts to the local amenity are primarily associated with visual impacts, traffic and noise issues. **Section 4.10** assesses the visual context of the project. Given the site's relatively isolated location, the presence of vegetation between the site and Old Tenterfield Road and the small scale of the project, no significant adverse visual impacts will likely occur.

Traffic generation is assessed in **Section 4.7** and **Appendix F**. In summary, the proposed operations will generate, on average, 4 truck and 2 car movements per day. This small number of vehicle movements will not significantly adversely impact the road network servicing the site.

Potential public health impacts arising from the proposal are associated with impacts to the local air quality and noise. Air quality impacts would arise primarily from dust generation during dry windy conditions. As discussed in **Section 4.4**, the anticipated impacts would be minimal due to the small scale of the operations, lack of fines, the implementation of appropriate management measures and the spatial separation distance between the nearest affected residence.

Noise impact is assessed in **Section 4.5** and **Appendix I**. In summary, the assessment concluded that the sand extraction operation will be in compliance with the NSW Industrial Noise Policy subject to the implementation of the recommended noise controls issues in **Appendix I** and the road traffic noise levels generated by the trucks on the haulage routs are below the recommended maximum levels of the NSW EPA Environmental Criteria for Road Traffic Noise.

No known impacts to social or public health were experienced during prior extractive operations at the site.

4.12 Economic Considerations

4.12.1 Generation of Employment

Given the relatively small scale of the project, there will be no significant direct generation of employment. The project will result in one part-time position at the site. Additionally, the project will create a demand for truck drivers and various administrative tasks.

The project will benefit and improve the viability of ready-mix, construction and landscaping businesses in the region by providing a reliable and good quality source of sand, thereby enhancing the opportunities for these businesses to provide employment.

Broader economic benefits will include the provision of a source of good quality, clean coarse grained sand that will be available for use in the region. Materials produced from the raw material are used in the construction of public infrastructure such as roads as well as for private developments such as subdivisions. Providing additional sources of such material is likely to result in more competitive pricing of such a resource in the local market.

4.13 Cumulative Impacts

Cumulative impacts may result from various activities with similar impacts interacting with the environment in a region over both space and time (DIPNR 1996).

As indicated in this report, sand extraction activities occurred at the site prior to and between 1995 and 2000. With the exception of several small mounds (less than 2m in height) of previously stockpiled material (which have now become vegetated) and farm tracks, no visible signs of the prior extraction operations exist at the site. This is because sand that has been extracted from the site has replenished by natural processes. There is no evidence of erosion or degradation on the site.

Ardill Payne & Partners consulted with Mr Jeff Brownlow of the Department of Primary Industries (DPI) to determine the extent and scale of similar activities within a 10km radius of the site.

The DPI's INDMIN database identified 15 construction material sites (including the subject site) within 10km of the subject site.

Of the 15 quarries only one (Brenner's Quarry) was identified as being operational. Two of the quarries listed are those that have recently been approved by Richmond Valley Council, viz:

- DA 2006.0215 – endorsement date of consent 26 June 2006 – Lots 13 & 15 DP 755608 – No. 1600 Old Tenterfield Road, Rappville (Six Mile Swamp Creek) – 25,000m^3 per annum for 25 years
- DA 2007.0099 – endorsement date of consent 20 February 2007 – Lot 35 DP 755608 – No. 1380 Old Tenterfield Road, Rappville (Six Mile Swamp Creek) – 5,000m^3 per annum for 30 years

5 ENVIRONMENTAL MONITORING & MANAGEMENT

This section provides a compilation of potential environmental impacts as well as associated amelioration methods and monitoring/management strategies.

5.1 Compilation of Potential Environmental Impacts and Amelioration Methods

Table 5.1 – Amelioration Measures and Monitoring/Management Requirements

Issue	Amelioration Measure	Monitoring/Management
Fluvial/ Geomorphic Refer Section 4.1.	• Confine excavation and depth and width of excavation to the excavation area shown on Appendix A to **Appendix D**. • Do not disturb any original bed or bank material. • Maintain a minimum 3m buffer to creek banks and vegetation. • Carry out progressive extraction working downstream in a consistent manner. • Restrict the entry and exit of machinery to specific limited points along the creek bed with relocation of the screening plant. Constantly maintain and rehabilitate points of entry and exit as each section is completed. • Relocate screening plant to nominated locations as extraction moves in a downstream direction to minimise haulage distances. • Erect bunding at each point of relocation of the dry sieve plant. • Establish and maintain stream bank alignment consistent with the upstream reach and the plans at Appendix A to **Appendix D**. Avoid sudden channel expansions and contractions. • Locate all stockpiles away from the top of the bank. Rehabilitate and revegetate stockpile and equipment storage areas at the completion of operations. • Survey the cross sections after the extraction of 20,000, 40,000, 60,000, 80,000 and 99,750m^3 to determine sand replenishment rates in comparison to extraction volumes.	The site operator will demarcate extraction areas using stakes and construction tape prior to extraction activities. The operator will be responsible for ensuring that extraction does not encroach beyond the demarcated area. The operator will be responsible for complying with the listed amelioration measures, a plan of management for the project and conditions of consent.
Water Quality	• Confine excavation to the area shown on Appendix A at	The operator will be responsible for complying with the listed

Refer Section 4.2.	**Appendix D**. • Maintain minimum 3m buffers to creek banks and vegetation. • Install bunding around stockpiles. • Revegetate any mounds of separated organic material. • Fuel will be stored in appropriate containers. • Fuel storage will be spatially removed from the creek. • Entry to the creek will be limited to demarcated points. • Operations will be confined to periods of low or no rainfall. • Restrict the entry and exit of machinery to the specified limited points along the creek bed with relocation of the screening plant. • Constantly monitor, maintain and rehabilitate points of entry and exit as each section is completed. Plant with native vegetation.	amelioration measures, a plan of management for the project and conditions of consent.
Flooding Refer Section 4.3.	• The operator will maintain awareness of inclement weather, including monitoring of weather forecasts. • In the event of imminent flooding work shall cease and equipment relocated to higher ground.	The operator will maintain awareness of inclement weather, including monitoring of weather forecasts. In the event of imminent flooding work shall cease and equipment relocated to higher ground.
Air Quality Refer Section 4.4.	• Restrict speed on unsealed roads. • Securely cover all loads prior to leaving the site. • Limit the size of stockpiles to no more than 2 weeks supply. • Erect silt fences around stockpiles. • Cover stockpiles under extreme windy conditions. • Revegetate any mounds of organic materials. • Fit all machinery with exhaust controls to manufacturer's specifications. • All engines, including trucks, will be maintained and tuned to manufacturer's specifications.	The operator will be responsible for complying with the listed amelioration measures, a plan of management for the project and conditions of consent. The operator will be responsible for visually monitoring the operation and implementing measures to contain dust. These measures include covering stockpiles with tarpaulins if necessary. The operator will be responsible for addressing any complaints regarding dust.
Noise Refer Section 4.5.	• All machinery will be fitted with mufflers in accordance with manufacturer's specifications. • The motor on the sand screener is to be enclosed and a muffler installed on the exhaust. • All machinery will be maintained to manufacturer's specifications to ensure that no undue noise is emitted at the site or during transportation to and from the site. • Hours of operation will be limited to 7.00am to 6.00pm Monday to	The operator will be responsible for complying with the listed amelioration measures, a plan of management for the project and conditions of consent. The operator will induct truck drivers and advise on proper driving technique in the vicinity of residences. The operator will be responsible for addressing any noise

	Friday and 8.00am to 12 noon Saturday. • Any noise complaints will be directed to the operator who will then implement appropriate measures to reduce noise	complaints received regarding the operations.
Waste Management Refer Section 4.6.	• An appropriate waste receptacle will be located within the operations area to contain non-production waste. • Production waste (primarily organic material – leaves and sticks) will be mounded along the edges of the flood-out and allowed to revegetate.	The operator will regularly remove collected waste for disposal at an approved facility. The operator will be responsible for picking up and disposing of any litter. The operator will be responsible for mounding organic by-product along the edges of the flood-out for revegetation.
Transportation Refer Section 4.7.	• The Traffic Impact Study prepared for the site concluded that the project would not result in significant impacts to the local road network. • Extraction will be limited to a maximum of 20,000m³ of sand per annum, which will result in an average of 5 loads or 10 truck movements per day.	The operator will maintain detailed records of the volume of sand extracted and will submit an annual report to Council. The operator will ensure than no more than 20,000m³ of sand will be extracted per annum.
Flora and Fauna Refer Section 4.8.	• A minimum buffer of three (3) metres will be retained between any extraction area and the creek banks.	The site operator will demarcate extraction areas using stakes and construction tape prior to extraction activities. The site operator will be responsible for ensuring that extraction does not encroach beyond the demarcated area.
Cultural Heritage Refer Section 4.9.	• If any articles or items of indigenous and/or European heritage significance are uncovered during site activities, work will immediately cease and Richmond Valley Shire Council, the Boolangle LALC and DECC will be contacted to develop and implement an appropriate management strategy.	The operator will be responsible for ceasing work and contacting Richmond Valley Shire Council if any articles or items of indigenous and/or European heritage significance are uncovered during site activities. The Boolangle LALC and DECC will also be contacted to develop and implement an appropriate management strategy.
Visual Environment Refer Section 4.10.	• Stockpiles will be limited to a minimum of two weeks supply and 2.5m in height. • Organic material (leaves and sticks) separated from the sand during screening will be used to create low mounds, which will be vegetated with appropriate endemic native species.	The operator will be responsible for ensuring that stockpiles do not exceed 2.5m in height and two weeks supply. The operator will be responsible for placing organic materials in mounds along the edge of the flood-out for revegetation.
Social and Public Health Refer to Section 4 and this Table	• Air Quality – Refer Section 4.4 and this Table • Noise – Refer Section 4.5 and this Table	The operator will be responsible for complying with the listed amelioration measures, a plan of management for the project and

	• Traffic – Refer Section 4.7 and this Table • Visual Impacts – Refer Section 4.7 and this Table	conditions of consent.

5.2 Rehabilitation Measures to be Implemented after the Completion of Extraction

A site rehabilitation plan has been prepared by Conacher Travers and is provided at **Appendix H**.

The objectives of the site rehabilitation plan are to:

- Identify key site characteristics and potential impacts of the sand extraction operation
- Provide details for the minimisation of impacts during works
- Protect, and where possible, regenerate riparian vegetation
- Maintain bank stability and minimise bank erosion
- Manage and control the extent of weeds within riparian areas
- Provide a program for the completion of rehabilitation works
- Provide a framework for the monitoring and reporting of the long term results of the weed removal and vegetation management program

The site rehabilitation strategy and proposed works program are detailed in Sections 2 and 3 respectively of **Appendix H**.

5.3 Plan of Management

A detailed plan of management will be prepared and provided to Council for approval prior to the commencement of operations on the site. The plan of management will incorporate the ameliorative measures listed in this report, comments from Government Agencies and Council issued during the EIS assessment process and conditions of consent. More specifically, the plan of management will include, but not be limited to the following:

1. Operational details including:

(i) hours of operation
(ii) numbers, type and location (if fixed plant) of plant and machinery
(iii) expected life of extractive operations
(iv) numbers of employees on site
(v) employee facilities
(vi) operational procedures (specifically for the control of noxious weeds and the disposal of pollutants, such as oils, broken machinery, effluent etc)

2. A scaled site plan of the entire quarry site containing the following details:

(i) contours over the proposed extraction areas
(ii) dimensions where necessary (ie distances to nearest dwelling houses, lot boundaries, creeks etc)
(iii) existing disturbed land
(iv) proposed land for future expansion for the first year of operations (until the first annual report)
(v) stockpile and overburden storage areas
(vi) internal access tracks
(vii) vehicle storage and refuelling areas
(viii) fuel storage area

3. An erosion and sediment control plan showing:

(i) details of erosion and sediment control practices and structures that will be implemented during operations involving:
    (a) site clearing
    (b) overburden removal and protection
    (c) extraction
    (d) stockpiling
    (e) creation of access tracks
    (f) rehabilitation
    (g) removal of sediment controls and access tracks after rehabilitated land is stabilised
(ii) diagrams of erosion and sediment control structures to be used (ie the creek bed control structure etc)
(iii) site plan showing the location of the proposed erosion controls to be installed in the first year of operations (until the first annual report)
(iv) all batters and banks at a 1 in 4 slope or less

4. A rehabilitation plan showing details of:

   (i) grass and seed fertiliser application rates
   (ii) tree re-stocking rates per hectare (if necessary)
   (iii) topsoil re-instatement procedures (if necessary)
   (iv) any rehabilitation proposed for the first year of operation (until the first annual report)
   (v) rehabilitation maintenance details (ie inspections of old rehabilitation areas for erosion, poor revegetation areas, infestation with noxious weeds etc, measures used for controlling such matters)

5. Maps showing the access from the quarry to a main road including the haulage routes used.

5.4 Annual Report

An annual report will be prepared and provided to Council on the anniversary of commencement of extractive operations. This report will include, but not be limited to the following:

1. A site plan showing:

   (i) the extraction area that is being worked at the time of the report
   (ii) the area(s) intended for extraction in the next 12 months
   (iii) the area(s) that have been rehabilitated
   (iv) areas intended for rehabilitation in the next 12 months
   (v) stockpile sites
   (vi) overburden storage sites
   (vii) erosion controls in place at the time of the report

2. Written details addressing:

   (i) state of compliance with each condition of consent at the time of the report
   (ii) any problems encountered in the management of the site
   (iii) differences between the situation as at the time of the report compared with what was intended by the previous annual report (or the initial report)
   (iv) summary of amount of material extracted
   (v) revision of the expected life of the quarry
   (vi) an estimate of the resource currently available

(vii) the source and subject of any complaints reported to the quarry operator or any other person involved in the operation of the quarry (including the drivers of haulage vehicles)

6 STATUTORY AND POLICY PLANNING

This section of the report identifies and addresses the applicable environmental planning instruments (EPIs) and policy planning documents that must be considered by Council and relevant State Government Authorities in the consideration of this application.

Section 6.1 identifies the applicable EPI's and describes the effects of these instruments on the proposed development. .

Section 6.2 identifies other policy adopted by Council or other State Government Authorities and details the effect of these policies on the proposed development.

6.1 Environmental Planning Instruments (EPIs)

This section identifies and provides comment on the EPIs and EP & A 1979 provisions that are of relevance to the proposed development.

6.1.1 Deemed Environmental Planning Instruments (Deemed EPIs)

There are no deemed EPIs applying to the subject land or proposed development (as defined in Section 4 of the EP & A Act 1979).

6.1.2 Local Environmental Plans (LEPs)

The Companhurst Local Environmental Plan 1990 (CLEP) is the only LEP applying to the subject land. The following comments are made in respect of the relevant provisions of the CLEP:

Part 1 – Preliminary

The relevant aims and objectives of the CLEP are:

"(c) to facilitate growth and development of the Shire of Copmanhurst in a manner which:

(i) *encourages the efficient and effective delivery of services; and*
(ii) *protects the agricultural assets of the Shire; and*
(iii) *protects the natural and cultural resource of the Shire."*

Part 2 – General Restrictions on Development of Land

The subject land is zoned 1(a)(Rural(General) Zone) under the provisions of the CLEP.

Extractive industries are permissible developments with consent within the zone. The objectives of the zone are:

1. *Objectives of zone*

The objectives of this zone are:

(a) *to enable development for purposes that are:*

i. *appropriate in a rural location; and*

ii. *sympathetic to the environmental characteristics of the land and the costs of providing public services and amenities; and*

(b) *to promote efficient, sustainable, agricultural utilisation of agricultural land, particularly prime crop and pasture land; and*

(c) *to control development that may restrict the function of, or create traffic hazards along, arterial roads in rural localities; and*

(d) *to encourage the protection and conservation of:*

i. *soil stability (by controlling development in accordance with soil capability); and*

ii. *forests of commercial value for timber production; and*

iii. *valuable deposits of minerals, coal, petroleum and extractive materials by controlling the location of development to enable the efficient extraction of those deposits; and*

iv. *water resources.*

As detailed in **Section 3** the proposed development comprises an extractive industry involving the extraction of sand from within a flood-out in Cabbage Tree Creek. The flood-out contains a substantial, valuable and self-replenishing sand deposit that can be extracted in an efficient and environmentally sound manner. The subject land has been subject of a prior approved sand extraction operation (circa 1995-2000) and prior sand extraction.

Due to the rural character of the locality (generally lower quality agricultural lands) with dispersed rural settlement, it is considered that this use is appropriate in this rural location.

The resource exists as a consequence of the environmental characteristics of Cabbage Tree Creek in this location. As is detailed in **Sections 4** and **Appendix D** and as evidenced by past extractive operations from the subject site, the extraction of sand can and will be undertaken in a manner that is sympathetic to the environment.

The proposal does not require the provision or extension of public services and amenities.

There are very limited agricultural opportunities or pursuits that could be conducted within the flood-out. Further, the subject land does not comprise nor adjoin prime crop or pasture land. Under the circumstances, the proposal will not compromise the efficient, sustainable and agricultural utilisation of any agricultural land.

As has been evidenced by past operational history and due to the fact that the expected traffic generation is not substantial, it is not likely that the development will restrict the function of, or create traffic hazards along arterial roads in the locality.

Approval of the application will enable the extraction and use of an existing valuable sand resource, which can be extracted in an efficient and environmentally sound manner.

Part 3 - Special Provisions

Clause 16 – Matters to be Considered (includes Schedule 4) stipulates certain heads of consideration that Council must consider in granting consent to development on land zoned 1(a). These considerations have been adequately addressed in **Section 4** of this EIS.

Clause 30 – Flood Prone Land provides that prior consent is required from Council for any purpose (other than agriculture) on land zoned 1(a) shown by firm hatching on the map.

Flood issues are detailed in **Sections 2.2.10** and **4.3**.

6.1.3 Environmental Planning and Assessment Model Provisions 1980

Clause 6 (Part 1 – Preliminary) of the CLEP adopts clauses 5(1)-(3), 13-17, 19-23, 26, 28, 29 and 32 of the EP & A Model Provisions 1980. These provisions are identified and addressed below:

Clause 5 – Consideration of certain application

Clause 5(2) – This clause relates to applications that are likely to cause increased vehicular traffic on any road in the locality and provides certain matters that the consent authority must consider relating to the adequacy of vehicular access to and from the site, the sufficiency of on-site parking, any representations made by the RTA and whether appropriate space exists for the loading/unloading and fuelling of vehicles.

These matters are all detailed and addressed in **Section 4.7** and **Appendix F** of this EIS.

Clause 5(4) – This clause relates specifically to applications for extractive industries and mines and provides that the consent authority should consider imposing conditions relating to reinstating the land, removing waste materials or refuse, securing public safety in and protecting the amenity of the neighbourhood.

The matters are all detailed and addressed in **Section 4** of this EIS.

Clause 32 – Extractive industry, transport terminal

This clause applies to extractive industries within a rural zone that are within 400m of a main or arterial road and provides that the work or land is more 90m of the alignment of the main or arterial road and there is no direct access to such road.

The subject land is not within 400m of a main or arterial road.

Clause 34 – Flood prone land

This clause applies to land within a flood prone area and provides that works may not be carried out on such land without the consent of the consent authority.

Flooding is dealt with in **Section 4.3** of this EIS.

6.1.4 Regional Environmental Plans (REPs)

The North Coast Regional Environmental 1988 (NCREP) is the only REP applying to the subject land. The following clauses are relevant to the proposed development.

Clause 12 – Development control – impact of development on agricultural activities (Part 2, Division 1)

This clause provides that Council shall not consent to an application to carry out development on rural land unless it has first considered the likely impact of the proposed development on the use of adjoining or adjacent agricultural land and whether or not the development will cause a loss of prime crop or pasture land.

As detailed in **Section 2.2.9** and **Appendix G** of this EIS, the subject land does not comprise nor adjoin prime crop or pasture land. The sand resource is situated within a flood-out that has little to no agricultural worth or potential.

Clause 15 – Development control – wetlands or fishery habitats (Part 2, Division 2)

This clause provides that Council shall not consent to a development application for any purpose within, adjoining or upstream of a river or stream unless it has considered the following specific matters:

(a) *the need to maintain or improve the quality or quantity of flows of water to the wetland or habitat* – As is detailed in **Section 5**, an operational management plan will be implemented that will address water quality impacts.

The proposed sand extraction will remove an existing blockage and flow impediment and will thus potentially improve the quantity of flows downstream.

(b) *the need to conserve the existing amateur and commercial fisheries* – There are no amateur or commercial fisheries within close proximity to the site that would be impacted by the proposed development.

(c) *any loss of habitat which will or is likely to be caused by the carrying out of the development* – As is detailed in **Section 4.8** and **Appendix E**, the proposal will not result in the loss of any habitat. The terrestrial habitat of the site will likely be improved as a consequence of the proposed works detailed in **Section 3**.

(d) *whether an adequate public foreshore reserve is available and whether there is adequate public access to that reserve* – There are no public foreshore reserves on or adjoining the site and as such, this consideration is not applicable to this application.

(e) *whether the development would result in pollution of the wetland or estuary and any measures to eliminate pollution* – As is detailed in **Sections 3** and **4** of this EIS, the development is not likely to result in any pollution of the environment (particularly the downstream environment).

(f) *the proximity of aquatic reserves dedicated under the Fisheries Management Act 1994 and the effect the development will have on these reserves* – There are no such aquatic reserves within close proximity to the site. This consideration is not applicable to this application.

(g) *whether the watercourse is an area of protected land as defined in Section 21AB of the Soil Conservation Act 1938 and any measures to prevent soil erosion* – The watercourse has not been identified by the DNR as being an area of protected land.

(h) *the need to ensure that native vegetation surrounding the wetland or fishery habitat area is conserved* – As is detailed in **Section 4.8**

and **Appendix E**, native riparian vegetation will be conserved and embellished.

(i) *the recommendations of any environmental audit or water quality study prepared by the Department of Water Resources or the Environment Protection Authority and relating to the river, stream, wetland, area or catchment* – There are no such audits or studies prepared by the DNR or the DECC applicable to the subject land or to this application.

Clause 18 – Development control – extractive industry (Part 2, Division 3)

This clause provides that Council shall not consent to a development application for an extractive industry unless it includes necessary consent conditions to require implementation (both during and after extractive operations) of an erosion and sediment control plan and rehabilitation plan.

These matters are dealt with in **Sections 4** of this EIS and will be addressed in the Plan of Management.

6.1.5 State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33)

SEPP 33 provides a mechanism for the consideration of applications for hazardous and offensive industries, by ensuring that the consent authority has sufficient information to assess any such applications, to impose conditions to reduce or minimise any adverse impacts and to require advertising of applications for such development.

Extractive industries are by their nature and the operations involved, potentially hazardous and/or offensive. Under the circumstances, Council must have regard to the heads of consideration contained in Clause 13, viz:

(a) *current circulars or guidelines published by the Department of Planning relating to hazardous or offensive development; and*
(b) *whether any public authority should be consulted concerning any environmental and land use safety requirements with which the development should comply; and*

(c) *in the case of development for the purpose of a potentially hazardous industry – a preliminary hazard analysis prepared by or on behalf of the applicant; and*

(d) *any feasible alternatives to the carrying out of the development and the reasons for choosing the development the subject of the application (including any feasible alternatives for the location of the development and the reasons for choosing the location of the subject of the application); and*

(e) *any likely future use of the land surrounding the development."*

Having regard to the size, location, nature of operations and to past operational and environmental performance of the prior extractive operations, it is contended that it is not strictly such that would actually be defined as a potentially hazardous or offensive operation.

Notwithstanding this contention, all of these matters have been addressed within the various sections of this EIS. Further, the advertising requirement of Clause 14 of SEPP 33 is the same as that required of this application (in accordance with Division 5 of the EP & A Regulation 2000).

6.1.6 State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44)

The subject site was assessed for activity by Koalas by Conacher Travers (2007) (**Appendix E**) using the following methods:

i. A search of the Atlas of NSW Wildlife (DECC, 2007)]
ii. Foot survey of site with inspection of Koala food tree species
iii. Target of Koalas during spotlight surveys

One preferred Koala food trees species (*Eucalyptus tereticornis)* was observed within the subject site. This species did not constitute greater than 15% of the trees species within the subject site in the vegetation communities they occurred in.

This investigation concluded that "*.. the site does not contain Potential Koala Habitat. No evidence of Koala habituation of the area, such as scats, suitable scratch marks on trees or Koalas were observed during the fauna survey of the site and surrounding area."* (refer **Appendix E**).

6.1.7 State Environmental Planning Policy No. 55 – Remediation of Land

SEPP 55 aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment. The Policy ensures that remediation is permissible development and is always carried out to a high standard. It specifies when consent is required for remediation and lists considerations that are relevant when rezoning land and determining development applications.

The *Managing Land Contamination, Planning Guidelines, SEPP 55 – Remediation of Land (1998)* provides that where the history of a site is relatively well documented and no existing or prior potential contaminating activities are evident, no further investigations are required.

Section 1.3 provides details of the site history. The extraction activities that occurred between 1995 and 2000 involved the removal of clean river sand from the flood-out using an excavator. No chemicals or other potentially contaminating activities are known to have been utilised during these operations.

The sand resource that has been and is proposed to be excavated was likely deposited at the site during and subsequent to the 1954 flood. No known commercial or industrial land uses are located upstream of the site with the potential to contaminate the sand resource.

Surrounding lands generally consist of low intensity cattle grazing pastures and woodlands. No commercial or industrial land uses are located within the vicinity of the lands.

Having regard to the current and historic uses of the subject site as detailed in **Section 1** and the adjoining and up-stream land uses, there is little to no potential for the site to be contaminated as a consequence of past or current land uses. Under the circumstances, it is contended that there is no detailed investigation required pursuant to SEPP 55.

6.1.8 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

This policy provides for the proper management and development of mineral, petroleum production and extractive material resources to promote the social and economic welfare of the State; and to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive materials resource. The policy ensures that appropriate planning controls are implemented to encourage ecologically sustainable development through the environmental assessment and sustainable management of mineral, petroleum and extractive material resources.

This applicant seeks consent to re-commence extractive operations from the site to which a prior consent for extraction existed.

The proposed development is permissible pursuant to Clause 7(3) on the basis that agriculture is a permissible use within the zone and the waterway is not in an environmental conservation zone.

Clauses 12-18 of the SEPP are of particular relevance to this application and are addressed below:

12 – Compatibility of proposed mine, petroleum production or extractive industry with other land uses

(a)(i) The existing land uses in the vicinity of the development have been identified in **Section 2.3** of this report.

(a)(ii) A quarry has previously operated on the site prior to and during the period 1995-2000 without any apparent adverse impacts on adjoining land uses. The proposed re-commencement of extractive operations is not considered to be such that any further adverse effects will occur, as the area is generally remote and sparsely populated.

(a)(iii) The land has an operational history of a prior sand extraction. The use is considered to be such that is compatible with the rural locality and adjacent uses and will enable the extraction of a replenishable sand resource that is adversely impacting the environment of the creek.

(b) Public benefits of the quarry are such that will result from the provision of a valuable extractable resource which in turn will boost the local economy and provide employment opportunities.

(c) As detailed in **Section 5** of this report, measures to reduce the incompatibility of the development will be implemented.

13 – Compatibility of proposed development with mining, petroleum production or extractive industry

(1)(a) There are currently no existing extractive industries operating in the immediate vicinity of the existing quarry, as identified in **Section 2.2.12** of this report. Surrounding land uses are characterised by grazing land and bushland/woodland.

(1)(b) The quarry is not identified on a map as being of State or Regionally significant resources of mineral, petroleum or extractive materials.

(1)(c) The land is not identified by an environmental planning instrument as being the location of significant resources of minerals, petroleum or extractive materials.

(2)(a)(i)A quarry previously operated on the site prior to and during the period 1995-2000. During that time there were no apparent conflicts of use, and it is not anticipated that any significant issues will arise.

(2)(a)(ii)The proposed quarry is appropriately situated in a rural locality and will not adversely impact the existing and future uses in the vicinity of the development.

(2)(a)(iii)The proposed quarry will facilitate the extraction of a known replenishable sand resource. A number of other riverine sand extraction operations exist in the broader locality which are comparable to the proposed operation.

(2)(b) The public benefits mentioned above in 12(b) are not considered likely to significantly impact on the extraction of the resource or deem the land to be incompatible with surrounding land use.

(2)(c) An extractive operation has previously operated at the same time as a number of other extractive industries in the broader locality, without any apparent inconvenience to either surrounding extractive operations or the quarry itself.

14 Natural Resource management and Environmental Management

(1)(a) Impacts on water resources, including surface water and ground water have been addressed in **Section 4** and **Appendix D** of this report. During the operational life of the prior quarry there were no apparent issue relating to contamination of ground or surface water.

(1)(b) As detailed in **Section 4.8** and **Appendix E** of this report, the subject site contains habitats for a number of threatened species and endangered ecological communities and also four threatened fauna species. The extraction area is generally of low value to threatened species, and higher quality habitats and vegetation will be retained as part of the proposed extraction operations.

(1)(c) It is considered that the current method of extraction on the land is the most efficient with respect to Greenhouse Gas emissions, and that the extractive operations will continue in the most efficient manner.

15 Resource Recovery

(1) Prior to development consent being granted in 1995, the efficiency of resource recovery was considered in Jelliffe's 1995 EIS. The quarry would have obtained a share of the market for the extractive resource in the area at that time. The proposed method of extraction is considered to be the most practical and efficient in terms of resource recovery.

(2) The prior quarry operated under the terms of 14 consent conditions by Copmanhurst Shire Council, inclusive of environmental management and rehabilitation. **Section 8.1.6** of Jelliffe 1995 EIS makes note of rehabilitation methods for the site at the end of the quarry life. A Site Rehabilitation Plan **(Appendix H)** has been prepared for this current proposal by Conacher Travers (2007) which specifies that the operation of extractive activities will be limited to the creek bed, and that the recycling of materials will take place when appropriate.

(3) Copmanhurst Shire Council issued conditions of consent in 1995 to permit the prior extractive operations. As has been articulated in this EIS, it is submitted that extractive operations are able to be conducted in a very efficient and practical manner with a minimal generation of waste.

16 Transport

(1)(a) All loading and unloading of materials will be undertaken wholly within the quarry site and not in the public roads system. In regards to the limiting of transport of material on public roads, road transport is the only option available to the quarry site.

(1)(b) The primary haulage routes closest to the quarry do not traverse residential areas or on roads near to schools.

(1)(c) The requirement of a code of conduct is a matter for Council; however, driver protocols will be implemented in respect of transport of materials on public roads from the site.

(2)(a) The appropriate road authorities are the Richmond Valley Council and the RTA.

(2)(b) It is assumed that Richmond Valley Council will duly refer the application to the RTA.

(3)(a) It is assumed that Richmond Valley Council will advertise the development application, and deal with appropriately any submissions it receives.

(3)(b) It is assumed that Richmond Valley Council will provide the RTA with a copy of the determination of the development application.

17 Rehabilitation

(1) The site will be subject to rehabilitated in accordance with the Site Rehabilitation Plan completed by Conacher Travers (2007), included as **Attachment H**.

(2)(a) Final intended use of the land will be grazing land, as per the Site Rehabilitation Plan prepared by Conacher Travers (2007). This plan details revegetation of the area, and the removal of any access tracks and stockpile areas. A copy of this report has been included as **Attachment H**.

(2)(b) There is no waste generated from the extracted material (other than a small amount of vegetative matter), and there is unlikely to be any waste generated from rehabilitation activities on the site. Waste receptacles will be provided for waste materials such as general refuse generated by on-site personnel and will be regularly removed and disposed of at the local garbage depot.

(2)(c) A prior EIS investigation undertaken as part of the previous EIS relating to the site indicated that there was no evidence of contaminated soil on the site. There has not been any activity on the site post this EIS which would have led to soil contamination.

(2)(d) The site is classified as private property, and therefore the public would not have access to any part of the site during excavation operations or during rehabilitation activities.

18 Receipt and disposal of waste

The disposal of off-site waste on the quarry land is not permitted under this clause of the SEPP

6.1.9 State Environmental Planning Policy (Major Projects)

The intended development proposes to extract 20,000m^3 per annum from a total resource of approximately 95,000m^3. As this development will be operating well under the minimum extraction threshold of a Major Project for an extractive industry under item 7 of the SEPP, it does not apply to this particular project.

6.1.10 Deemed Environmental Planning Instruments

There are no deemed environmental planning instruments applying to the subject land or proposed development.

6.1.11 Specific EP & A Act 1979 requirements

The proposed development comprises an "extractive industry" as described in Schedule 3 of the EP & A Regulation 2000. The development is thus designated development pursuant to Section 77A of the EP & A Act. Under the circumstances, this EIS has been prepared in accordance with Section 78A(8) of the Act.

6.1.12 Integrated Development

The development comprises integrated development pursuant to Section 91 of the EP & A Act 1979 due to the fact that certain approvals will be required in addition to development consent before the development may be carried out. The required approvals are:

- A Controlled Activity approval under Part 3, Chapter 3 of the Water Management Act 2000 – Issued by Department of Natural Resources.
- A permit under the Fisheries Management Act 1994 – Issued by the Department of Primary Industries (Fisheries).

Schedule 1 of the Protection of the Environment Operations Act 1997 (POEO) provides that extractive industries that:

(1) obtain extractive materials by methods including excavating, dredging, blasting, tunnelling or quarrying or that store, stockpile or process extractive materials, and

(2) that obtain, process or store for sale or re-use an intended quantity of more than 30,000m^3/year of extractive material

are DECC (EPA) licensed activities.

As the project is not a scheduled activity based on the proposed extraction rate, no licenses from the DECC are required.

6.2 Other Planning Policy and Related Statutes

This section identifies and provides comment on the EPIs and EP & A 1979 provisions that are of relevance to the proposed development.

6.2.1 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

An assessment of the site was undertaken by Conacher Travers (2007) having regard to the EPBC Act (refer **Appendix E**). This assessment concluded that:

"No endangered ecological communities or threatened flora listed in EP&BC Act (1999) were identified on or near the site.

It is considered that a referral of this project to Department of Environment and Water Resources is not required as it is not likely to impact on a significant population of nationally listed threatened species or on any nationally listed endangered ecological community."

6.2.2 Threatened Species Conservation Act 1995 (TSC Act)

An assessment of the site was undertaken by Conacher Travers (2007) having regard to the TSC Act (refer **Appendix E**). This assessment concluded that:

"The removal of sand from the site as part of the extraction process does not constitute part of any key threatening process within the meaning of the Threatened Species Conservation Act (1995)."

6.2.3 Section 94 Plans

Section 94 contributions are payable to Council on a per cubic metre rate of material hauled. The payment of such would be made on a progressive basis in accordance with a consent condition.

6.2.4 NSW Coastal Policy

The subject land is not situated within the coastal zone as defined in the NSW Coastal Policy 1997.

6.2.5 North Coast Urban Planning Strategy 1995 (NCUPS)

NCUPS acknowledges that the North Coast contains many of the fastest growing urban areas in NSW, with an expectant 2016 population of some 605,000 persons (from 378,460 in 1991).

The Strategy acknowledges that the demand for extractive materials will increase with continued population growth and states that *"All these resources need to be protected from encroachment by incompatible land uses and not unnecessarily sterilised for future generations."*

Several of the Strategy Actions require the State and Local Government to undertake studies to identify and protect all significant existing and potential extractive and mineral resources in the region and options so as to:

- *conserve significant existing and potential extractive material and mineral sites;*
- *establish suitable non-urban buffers around existing and potential extractive material and mineral sites;*
- *reduce conflict over resource haulage routes.*

6.2.6 Far North Coast Regional Strategy 2006-31

The Strategy acknowledges the importance of identifying and protecting existing operations and potential future extractive resources that are of regional and sub-regional importance.

7 CONCLUSION

This section of the report is the conclusion of the EIS. This section identifies any feasible alternatives to carrying out the development and the consequences of not carrying out the development and provides the basis of the Operational and Environmental Plan of Management for the sand quarry.

7.1 Analysis of Feasible Alternatives

Having regard to the circumstances of this case, it is contended that there are no feasible alternatives to not conducting sand extraction from the subject site in the manner detailed in this EIS. Should this resource not be exploited, similar sand will have to be sourced from other locations, leaving the flood-out to expand in size with subsequent flood events with resultant detrimental impacts to the flood characteristics of the locality, the agricultural potential of the land and on the downstream creek environment. The property will continue to be used for low intensity cattle grazing.

The relevant circumstances of this case are:

- the site is proximate to regional towns and markets where a substantial demand exists for such a resource
- the site is in a sparsely settled rural environment that is relatively isolated from any conflicting land uses (i.e. urban areas, rural dwellings, prime agricultural land, intensive agricultural pursuits)
- the substantial existing resource and the potential for the resource to be replenished during subsequent flood events
- the environmental implications of leaving the growing and advancing sand slug in the creek
- the limited availability of sand resources in other locations in the region
- the ability for the sand to be extracted economically and efficiently
- the fact that sand has been extracted from this site for a number of years in a manner that has does not appear to have had any substantial tangible negative environmental impacts or consequences

7.2 Consequences of Not Carrying out the Development

Adopting the "do nothing" or "no development" option would result in the following negative impacts:

- continued long-term degradation of the creek and related riparian environments
- sustained channel blockage and increased growth of the flood-out with consequential potential destruction of existing riparian vegetation
- increased potential for up-stream flooding due to obstruction to the flow path of the creek
- reduction in environmental flows to downstream environments from a "damming" of the creek
- waste of a substantial important and valuable building industry resource
- the necessity for such material to be sourced from other sites that may be more environmentally sensitive or not as well situated with respect to the built environment

7.3 Project Justification

The following sections provide the reasons justifying the carrying out of the proposed development in the manner proposed having regard to the biophysical, economic and social considerations and ecologically sustainable development principles.

7.3.1 Biophysical Considerations

The impacts of the proposed development on the natural and man-made environments are detailed in **Section 4** of this EIS. The proposed operational controls and mitigation measures that are detailed in **Sections 3** and **4** of this EIS are considered to be such that will ensure that there are no substantial negative impacts upon such environments.

Continued extraction will further remove sand from the flood-out. The extraction site is a major sediment storage zone due to the passage of the sand slug down Cabbage Tree Creek following substantial erosion during and after the 1954 flood. Such sand slugs are recommended as extraction sites due to the fact that the sand can cause a number of detrimental environmental impacts. Extraction will result in less sand being transported downstream to bury/infill the chain of ponds (**Section 3**).

The proposed extractive operation is sustainable on the basis that the resource is replenished during flood events. A significant amount of material exists in-stream and up-stream to enable the quarry to operate for up to 5 years based on a maximum extraction of 20,000m^3 per annum or up to 20 years based on an extraction of $5{,}000m^3$. The extractive operation is to be subject to periodic monitoring to ensure that there is sufficient sediment supply and transport to the creek.

7.3.2 Economic and Social Considerations

Approval of the application will result in a supply of a valuable sand resource for use in the locality and sub-region. There exists a strong demand for such material to facilitate the development requirements of a rapidly growing region.

The continued supply of construction related materials is critical to the sustained long-term well-being and sustainability of a broad spectrum of development and related industries that are fundamental to the strength and well-being of the local and regional economies.

The development is consistent with the relevant planning and strategic policies of the State and local government, particularly those that promote the orderly and efficient use of land in a manner that will not have significant detrimental impacts upon the natural and man-made environments.

The proposal will re-activate sand extraction operations that have been undertaken previously on the site for a period of 5 years. These activities appear to have been conducted in a manner that did not have unreasonable impacts upon the character and amenity of the area and that did not compromise the agricultural or other use of any adjoining or adjacent land.

7.3.3 Ecologically Sustainable Development (ESD)

The proposed development attains the four principles of ESD as contained in the Intergovernmental Agreement on the Environment (IGEA) signed in 1992. These principles are detailed below with comments provided immediately after each one:

- *The* precautionary *principle – namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. Decisions should be guided by careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment and an assessment of the risk-weighted consequences of various options.*

This EIS has thoroughly identified and assessed the potential environmental impacts of the proposed development. It is concluded that with the adoption and implementation of the mitigation strategies and management measures that there will not be any serious or irreversible damage to the environment.

- *Inter-generational equity – namely, that the present generation should* ensure *that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.*

This EIS has demonstrated that the health, diversity and productivity of the environment will not be compromised by the proposed development. It is contended that the removal of the sand slug will improve the flooding characteristics of the upstream properties and the environmental flows to the downstream receiving environment and the possible geomorphic recovery of Cabbage Tree Creek.

Further, the extraction of this valuable resource is a productive use of a resource that is currently not being utilised to its economic potential. The use of this material will assist in the continued development and prosperity of the region, having positive benefits on the regional economy with resultant social benefits from employment, growth and economic well-being.

- *Conservation of biological diversity and ecological integrity – namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.*

That part of the flood-out that is proposed to be subject of extraction is devoid of substantial vegetation and provides limited habitat value. Subject to extractive operations being undertaken strictly in accordance with an adopted plan of management, the biological diversity and ecological integrity of the locality will not be compromised.

Extraction will remove the sand slug in the flood-out so that less sand is deposited in the flood-out and so that less sand is transported downstream to bury/infill the chain of ponds. Extraction will result in less sand being transported downstream to bury/infill the chain of ponds.

- *Improved valuation, pricing and incentive mechanisms – namely, that environmental factors should be included in the valuation of assets and services, such as:*

    - *polluter pays – that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,*

    - *the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including he use of natural resources and assets and the ultimate disposal of any waste,*

    - *environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.*

The proposed extractive operations are not likely to be the source of any substantial pollution or waste. The proposal will enable the use of a valuable naturally occurring sand resource that has been deposited by natural flood events. The extraction of the sand resource as proposed is a viable and economic use of the resource that is of substantial benefit the continued growth and development of the region.

Extraction and use of the resource will provide substantially higher social and economic returns and benefits to the broader community than the current land use allows.

The proponent has first hand operational experience and is well aware of the issues involved in extracting the sand in an environmentally sensitive and responsible manner.

7.4 Final Conclusion

The proposed development is permissible with consent within, and is consistent with the objectives of the 1(a) zone under the Copmanhurst LEP 1990. The proposal is also consistent with the North Coast REP 1988 and other relevant legislation and planning policy.

This EIS has vigorously assessed the proposed development under a raft of environmental planning instruments having regard to all relevant environmental, social and economic considerations.

The development will provide a ready supply of material that is used in the building and landscaping industry. The resource is well situated to supply the local market and is a reasonable use of the land having regard to the land uses and character of the local area.

The extractive operations can be conducted and managed in a way that will not have significant detrimental impacts upon either the natural or man-made environments. The re-commencement of extractive operations will, however, remove sand from the flood-out, which is a major sediment storage zone due to the passage of the sand slug down Cabbage Tree Creek following substantial erosion during and after the 1954 flood.

The proposed extraction operation is sustainable because the proposed annual extraction rate will not exceed the annual sand replenishment rate and because there is sufficient sand stored in the flood-out to permit short-medium term extraction without any replenishment.

Extraction will remove the sand slug in the flood-out so that less sand is deposited in the flood-out and so that less sand is transported downstream to bury/infill the chain of ponds.

In conclusion and having regard to the particular circumstances of this case, it is respectfully requested that Council grant consent to this development application.

REFERENCES

Erskine, WD. – Geomorphological Aspects of Continued and Expanded Sand Extraction from Six Mile Swamp Creek on Portions 13 and 15, Parish of Dobie, County of Richmond (June 1996)

Erskine, WD – Geomorpholigical Report on Sand Extraction from Six Mile Swamp Creek Near Clearfield, NSW (November 2005)

Geolink – A Development Application and Environmental Impact Statement with respect to a proposal by R & C Watson to carry out extractive industry and minor filling works on Lot 3 in a subdivision of Lot 8 DP 734573, Newrybar Swamp Road, Lennox Head (2000)

Jelliffe, PA – Environmental Impact Statement for the Proposed Extractive Industry Cabbage Tree Creek (August 1995)

Department of Urban Affairs and Planning and Environmental Protection Authority – Managing Land Contamination Planning Guidelines, SEPP 55 - Remediation of Land (1998)

Department of Urban Affairs and Planning – EIS Guideline. Extractive Industries, Dredging and Other Extraction in Riparian and Coastal Areas (1996)

Northern Rivers Regional Strategy (www.nrrs.org.au)

Peter Parker Environmental Consultants Pty Ltd – Balls Pit: Sand Extraction Proposal – Flora and Fauna Survey (1998)

NOTE FOR USERS

This report has been prepared for the purpose and exclusive use of Mr Robert King of Kingsbrae Partnership Pty Ltd as operator of the proposed sand quarry. The report is not to be used for any other purpose or by any other person or corporation.

Ardill Payne & Partners accepts no responsibility for any loss or damage suffered, however so arising, to any person or corporation who may use or rely on this report for a purpose other than that described above.

The maps, development plans and other figures contained in this report are suitable only for the purposes of this report. No reliance should be placed upon this information for any purpose other than for the purposes of this report.

Appendix A
DA form and EIS certification form

Submission of
Environmental Impact Statement (EIS)
prepared under the *Environmental Planning and Assessment Act 1979*
Section 78A (8)

Development Application

applicant name	Ardill Payne and Partners
applicant address	79 Tamar Street PO Box 20 BALLINA NSW 2478
land to be developed	Lot 38 DP 755635 Cabbage Tree Creek, Wyandah

EIS prepared by

name	Paul M Snellgrove
qualifications	Bachelor of Town Planning (UNSW)
address	79 Tamar Street PO Box 20 BALLINA NSW 2478
in respect of	Extractive Industry (sand quarry) - Refer attached EIS

Environmental Impact Statement

An environmental impact statement (EIS) is attached

Certificate

I certify that I have prepared the contents of this Statement and to the best of my knowledge:

- it is in accordance with Clauses 72 and 73 of the *Environmental Planning and Assessment Regulation 1994*, and
- it is true in all material particulars and does not, by its presentation or omission of information, materially mislead

signature	PSnellgrove
name	Paul M Snellgrove
date	29 JULY 2008

RICHMOND VALLEY COUNCIL

Offices: Cnr Walker Street & Graham Place, Casino
19-25 Woodburn Street, Evans Head
Postal Address: Locked Bag 10, CASINO NSW 2470
Email Address: Council@richmondvalley.nsw.gov.au
Casino Telephone: (02) 6660 0300 – EDS Fax: (02) 6662 1342
Evans Head Telephone: (02) 6682 4392 - Fax: (02) 6682 4252

DA No ____________
Date ___/___/___
Amt $ ____________
Receipt No ____________
Prop No ____________
Ass. No ____________

Development Application and Supplement

(Section 81(1)(a) of Environmental Planning and Assessment Act 1979)

Use this form to apply for **consent to carry out development**. The **DA Supplement** that accompanies this form will help you complete the application. To complete this form, please place a cross in the tick boxes ☐ and fill out the text boxes as appropriate. To minimise delay in receiving a decision about your application, please ensure you submit all relevant information. You need to apply to the relevant consent authority (usually the Council). Once the consent authority has assessed your application, you will receive a notice of determination.

1. Details of the applicant

Mr ☑ Ms ☐ Mrs ☐ Dr ☐ Other: PAUL SNELLGROVE

First name:

Family name / Company name: ARDILL PAYNE & PARTNERS

Flat/street no.: 79

Street name: TAMAR STREET

Suburb or town: BALLINA

State: NSW

Postcode: 2478

Daytime telephone: 66863280

Fax: 66867920

Mobile:

Email: pauls@ardillpayne.com.au

2. Identify the land you propose to develop

Flat/Street no.: 543

Street name: BREWERS ROAD, KIPPENDUFF

Suburb or town: VIA RAPPVILLE

Lot no.: 38

Section no.:

DP no.: 755635

You can find the lot no., section, DP/MPS no. and volume/folio details on a map of the land or on the title documents for the land. If you need additional room, please attach a schedule and/or a map with these details.

3. Details of Ownership

Owner name	Owner name
MARGARET SMITH	
Address	**Address**
PO BOX 12	
Town/postcode	**Town/postcode**
RAPPVILLE 2469	
Telephone Number	**Telephone Number**

4. Describe what you propose to do

Describe the use of the building and /or the land and its use:

SAND EXTRACTION ~ CABBAGE TREE CREEK

4. continued

Will this development involve:

☐ erecting, altering or adding to a building or structure

- ➢ Is it a temporary building or structure? Yes ☐ No ☒

☐ subdividing land

☐ subdividing a building into strata units

☐ demolition

☐ changing the use of land or a building or the classification of a building under the Building Code of Australia (without building, subdividing or demolishing)

☒ other work (without building, subdividing or demolishing)?

5. Staged development

You can apply for development consent for only part of your proposal now, and for the remaining part(s) at a later stage.

Are you applying for development consent in stages?

No ☒

Yes ☐ ➢ Please attach:

- information which describes the stages of your development
- a copy of any consents you already have for part of your development.

6. Plans of the land and development

You need to provide a number of plans that show what you intend to do. Section 2 of the **DA Supplement** sets out which plans to provide and the details to include.

Please attach:

- a site plan of the land, drawn to scale
- plans or drawings of the proposal, drawn to scale

and, where relevant:

- an A4 size plan of the proposed building and other structures on the site
- a plan of the existing building, drawn to scale.

7. Environmental effects of your development

To assess your proposal, the consent authority needs to understand the impacts it will have. Depending upon the nature and scale of your proposal, you need to provide one or more of the statements listed below to explain the environmental effects of your proposal. See section 3 of the **DA Supplement**.

Is your proposal **designated development**?

Yes ☒ ➢ Please attach an environmental impact statement.

No ☐ ➢ Please attach a statement of environmental effects.

Is your proposal likely to significantly impact on **threatened species**, populations, ecological communities or their habitats?

Yes ☐ ➢ Please attach a species impact statement.

No ☒

Note: It is a legal requirement that all Development Applications must be accompanied by a Statement of Environmental Effects

8. Section 68 approval

Approvals under Section 68 of the Local Government Act 1993 *(see note 1)*

Does this application seek approval to one or more of the matters listed in Section 78(a)(3) of the Act?

- ☐ Carry out water supply work
- ☐ Carry out stormwater drainage work
- ☐ Carry out sewerage work
- ☐ Connect a private sewer with a public sewer
- ☐ Use a building as a place of public entertainment
- ☐ Connect a private drain with a public drain
- ☐ Install a sewage management facility & ancillary drainage
- ☐ Alter a sewage management facility & ancillary drainage
- ☐ Place a waste storage container in a public place
- ☐ Other

9. Other approvals from Council

To carry out your proposal, you may need other approvals from the Council. See section 4 of the **DA Supplement**.

Do you want Council to approve any other activity at the same time as this application?

No ☒

Yes ☐ ➢ Please fill out **Attachment A** of the **DA Supplement** and submit it with your application, along with any of the supporting documents, or application forms, as required.

10. Concurrences from State agencies

Do you need the concurrence of a State agency to carry out the development? See section 5 of the **DA Supplement**.

No ☒

Yes ☐ ➢ Please list any agencies whose concurrence you need.

Please attach sufficient information for the agency(s) to assess your application.

11. Approvals from State agencies

If you need a development consent and one or more of the approvals listed in **Attachment B** of the **DA Supplement**, your development is known as integrated development. The relevant state agency will be involved in the assessment of your proposal. See section 6 of the **DA Supplement**.

Is your application for integrated development?

No ☐

Yes ☒ ➢ Please submit **Attachment B** of the **DA Supplement** with your application and attach:

- sufficient information for the approval body(s) to assess your application
- additional copies of your application for each agency. *The consent authority can tell you the number that will be needed.*

12. Supporting information

You can support your application with additional material, such as photographs, including aerial photographs, slides and models to illustrate your proposal. Please list what you have attached:

PLANS, DIAGRAMS, PHOTOGRAPHS, SUPPLEMENTARY REPORTS CONTAINED IN EIS

13. Cost of development

Estimated Total Cost of Work: $ NIL – NO ESTABLISHMENT COSTS

14. Application fee

For development that involves a building or other work, the fee for your application is based upon the estimated cost of the development. If your application is for integrated development, you need to include $250 for each agency that will look at your proposal. If your development needs to be advertised to the public you may also need to include an advertising fee. The consent authority will help you calculate the fee for your application. (Advertising fees attract GST, all other fees do not).

15. Signatures

The owner(s) of the land to be developed must sign the application.
If you are not the owner of the land, you must have all the owners sign the application.
If the land is Crown land, an authorised officer of the Department of Lands must sign the application.

As the owner(s) of the above property, I/we consent to this application:

Owner signature	Owner signature
M G L Smith	
Name	**Name**
MARGARET SMITH	
Date	**Date**
29 JULY 2008	

This owner's consent also authorises access to the subject premises by an authorised person for the purposes of carrying out inspection(s) under the provisions of Section 118C(3) of the Act.

The applicant, or the applicant's agent, must sign the application.

Signature	In what capacity are you signing if you are not the applicant
PSeeye	
Name, if you are not the applicant	**Date**
	29 JULY 2008

16. Privacy policy

The information you provide in this application will enable your application to be assessed by the consent authority and any relevant state agency. If the information is not provided, your application may not be accepted. Your application will be advertised to the public for comment if the development is designated development, advertised development or is required to be advertised by a development control plan. The application will also be kept in a register by the Council that can be viewed by the public at any time. Please contact the Council if the information you have provided in your application is incorrect or changes.

17. Lodgement

Before submitting your application, please ensure you have attached all the information the consent authority needs to assess your proposal. You can use the following checklist. Please place a cross in the box ☐ next to any items you have attached:

Land details

☒ A map that sets out the lot, DP/MPS and volume/folio numbers

☒ A schedule that sets out the lot, DP/MPS and volume/folio numbers

Staged development

☐ Information which describes the stages of the development

☐ A copy of any consents already granted for part of the development

Plans

☒ A site plan of the land — **required for all applications**

☒ Plans or drawings of the proposal — **required for all applications**

☐ An A4 size plan of the proposed building and other structures on the site

☐ A plan, drawn to scale, of the existing building

Environmental effects

☒ An environmental impact statement for a designated development proposal

☐ A statement of environmental effects — **required for all applications** that are not designated development

☐ A species impact statement

Other approvals from Council

☐ Attachment A of the DA Supplement

☐ Supporting document(s) identified in Attachment A of the DA Supplement

☐ Application form to install an On-site Sewage Management System (OSMS) & 6 copies of Engineering Plans & Reports (Only applicable if installing or upgrading an OSMS)

State agency concurrences and approvals

☐ Additional information required by the agencies from which you need concurrence

☒ Attachment B of the DA Supplement

☒ Additional information required by the agencies you have identified in Attachment B of the DA Supplement

☒ Additional copies of your application for each of those agencies

Supporting information

☒ Other material to support your application, such as photos, slides and models.

Application fee

☒ Your application fee — **required for all applications.**

Attachment B Integrated development - approvals from State agencies

Some proposals, because of their nature, need other kinds of approvals (eg licences, permits). Your proposal is known as integrated development if you need development consent and one or more of the approvals that have been set out in this attachment. Follow through each group of questions to decide whether you need any of these approvals. If you have identified you need one or more approvals, please include this attachment with your application. (Section 6)

Aquaculture

Do you want to carry out aquaculture?

No ☒

Yes ☐➢ You need a permit under section 144 of the *Fisheries Management Act 1994* from NSW Fisheries.

Dredging or reclamation

Do you want to carry out dredging or reclamation work in a waterway (a stream, river, lake, lagoon, estuary or marine waters)?

No ☐

Yes ☒➢ You need a permit under section 201 of the *Fisheries Management Act 1994* from NSW Fisheries.

Marine vegetation

Do you want to harm any mangroves or seagrasses in a public waterway or on the shore of a public waterway?

No ☒

Yes ☐➢ You need a permit under section 205 of the *Fisheries Management Act 1994* from NSW Fisheries.

Do you want to take sea lettuce or blackfish weed to use as bait from a public waterway or the shore of a public waterway?

No ☒

Yes ☐➢ You need a permit under section 205 of the *Fisheries Management Act 1994* from NSW Fisheries.

Heritage

Does your development involve a building, a place or land that has a permanent conservation order, an interim conservation order or an interim heritage order protecting it, or which is listed on the State Heritage Register?

No ☒

Yes ☐➢ You need an approval under section 57 of the *Heritage Act 1977* from the NSW Heritage Office.

If the Council can give this consent, however, the development is not integrated development.

Mine subsidence

Do you want to build, subdivide, make roads, paths or driveways, or put in any pipelines, water, sewage, telephones, gas or other service mains in a mine subsidence district, or alter any of these types of development in a mine subsidence district?

No ☒

Yes ☐ ➢ You need an approval under section 15 of the *Mine Subsidence Compensation Act 1961* from the Mine Subsidence Board.

Aboriginal relics and places

Do you want to destroy, damage or otherwise harm an Aboriginal relic that is known to exist on the land you want to develop?

No ☒

Yes ☐ ➢ Are you going to do so in accordance with Aboriginal tradition?

Yes ☐

No ☐ ➢ You need an approval under section 90 of the *National Parks and Wildlife Act 1974* from the National Parks and Wildlife Service

Do you want to destroy, damage or otherwise harm land that has been declared to be an Aboriginal place?

No ☒

Yes ☐ ➢ You need an approval under section 90 of the *National Parks and Wildlife Act 1974* from the National Parks and Wildlife Service.

Pollution

Is your development designated development? YES - NOT SCHEDULED PREMISES

No ☐ ➢ Will the development cause the pollution of water?

No ☐

Yes ☐ ➢ You can apply for a licence under section 43(d) of the *Protection of the Environment Operations Act 1997* from the Environment Protection Authority so that you cannot be convicted of an offence of polluting water.

Yes ☐ ➢ You are likely to need a licence from the Environment Protection Authority. Is your land already designed to carry out the activity?

No ☐ ➢ You need a licence under section 47 of *the Protection of the Environment Operations Act 1997* from the Environment Protection Authority.

Yes ☐ ➢ You need a licence under section 48 of the *Protection of the Environment Operations Act 1997* from the Environment Protection Authority.

Rivers and lakes

Is your development within 40 metres of a stream, river, lake or lagoon?

No ☐

Yes ☒ ➢ Are you going to excavate the land, remove material from the land or do anything which will obstruct or detrimentally affect the water flowing in a stream, river, lake or lagoon?

No ☐

Yes ☒ ➢ You need a permit under Part 3A of the *Rivers and Foreshores Improvement Act 1948* from the Waterways Authority if the development will affect Sydney Harbour or its tributaries, Botany Bay (east of Captain Cook Bridge) or the Ports of Newcastle, Kembla, Eden or Yamba, and from the Department of Land and Water Conservation in any other case.

Roads

Will your development affect a public road, a Crown road, a highway, a main road, a freeway or a tollway?

No ☒

Yes ☐ ➢ You need a consent under section 138 of the *Roads Act 1993* from the Roads and Traffic Authority, the Department of Lands or the Council. *If the Council can give this consent, however, the development is not integrated development.*

Using water

NB: The following approvals are taken from the 1912 Water Act. It is proposed that the review of the Water Act, which is currently taking place, will consolidate and reduce the number of these approvals.

➢ *Licences and permits for occupiers of land*

Is your development going to be used for conserving water, irrigation, water supply, drainage or changing the course of a river?

No ☒

Yes ☐ ➢ Will your development affect the quantity or use of water in a river, lake or swamp, or water flowing into or from a river, lake or swamp?

No ☐

Yes ☐ ➢ If you occupy the land on which you propose to build the development, you need a licence under section 10 of the *Water Act 1912* from the Department of Land and Water Conservation to build and use your development, and take, use and dispose of the water for any purpose.

➢ If you own or occupy the land on which you propose to build the development, and you will be irrigating less than 4 hectares of land, you can apply for a permit under section 18F of the *Water Act 1912* from the Department of Land and Water Conservation to build and use your development and take, use and dispose of the water for anything other than irrigation.

➢ *Licence for non-occupiers of land*

1. Do you propose to build pumps (or the like) to obtain water, or build pipes (or the like) to carry water?

   No ☒

   Yes ☐➢ Is your development going to be used for conserving water, irrigation, water supply, drainage, changing the course of a river, or preventing the course of a river from changing?

   No ☐

   Yes ☐➢Go on to question 2

2. Will your development affect the quantity or use of water in a river, lake or swamp, or water flowing into or from a river, lake or swamp?

   No ☒

   Yes ☐➢ Do you propose to use the water for household use, stock use or irrigation?

   No ☐

   Yes ☐➢Go on to question 3

3. Do you occupy the land on which you propose to build the pumps (or the like)?

   Yes ☐➢ Go on to question 4

   No ☐➢ Can you obtain occupation of the land?

   No ☐➢ You need a licence under section 13A of the *Water Act 1912* from the Department of Land and Water Conservation to build the pumps and take and use the water.

   Yes ☐➢ Go on to question 4

4. Do you occupy all the land on which you propose to build pipes (or the like) to carry the water from the pumps to the land where you will use the water?

   Yes ☐

   No ☐➢ Can you obtain occupation of the land?

   Yes ☐

   No ☐➢ You need a licence under section 13A of the *Water Act 1912* from the Department of Land and Water Conservation to build the pumps and take and use the water.

➢ *Joint water supply scheme*

1. Is your development going to be used for conserving water, irrigation, water supply, drainage, changing the course of a river or preventing the course of a river from changing?

   No ☒

   Yes ☐➢ Will your development affect the quantity or use of water in a river, lake or swamp, or water flowing into or from a river, lake or swamp?

   No ☐

   Yes ☐➢ Go on to question 2

2. Is the development going to be used by two or more occupiers of land to supply water to their lands?

   No ☐

   Yes ☐ ➢ Go on to question 3

   Is the development going to supply water to irrigate land(s) other than the land on which the development is built?

   No ☐

   Yes ☐ ➢ Go on to question 3

   Will the development involve pipes (or the like) to carry water to irrigate your land and the land of other occupiers?

   No ☐

   Yes ☐ ➢ Go on to question 3

3. Will the development be built on land that is occupied by those who will use the water?

   Yes ☐ ➢ Go on to question 4

   No ☐ ➢ You need an authority under section 20B of the *Water Act 1912* from the Department of Land and Water Conservation to build and use the development and take and use the water.

4. Do the occupiers of land who will use the water want to build and use the development to supply water for household use, stock water use or irrigation?

   No ☐

   Yes ☐ ➢ Do they occupy all of the land on which the development will be built, and the land on which the pipes ((or the like)) will be built?

   Yes ☐

   No ☐ ➢ Can they obtain occupation of the land?

   Yes ☐

   No ☐ ➢ You need an authority under section 20CA of the *Water Act 1912* from the Department of Land and Water Conservation to build the development and take and use the water.

➢ *Group licences*

Are you a Board of Management elected under the *Private Irrigation Districts Act 1973*?

No ☒

Yes ☐ ➢ Do you want to build and use the development to take water from a river or lake for occupiers of land in a private district to use?

No ☐

Yes ☐ ➢ *You need a group licence under section 20L of the* Water Act 1912 *from the Department of Land and Water Conservation.*

➢ *Bores*

Do you want to sink a bore or enlarge, deepen or alter a bore?

No ☒

Yes ☐➢ Is the work to be carried out by the Crown?

Yes ☐

No ☐➢ You need a licence under section 116 of the *Water Act 1912* from the Department of Land and Water Conservation.

➢ *River banks and floodplains*

1. Do you want to build an earthwork, embankment or levee, or a road, railway or bridge?

No ☒

Yes ☐➢ Go on to question 2

2. Will the development be on land that is the bank of a river or lake, forms part of a bank of a river or lake or is within a floodplain?

No ☐➢ Go on to question 3

Yes ☐➢ Do you have a licence, authority, permit or consent under the *Water Act* 1912?

Yes ☐

No ☐➢ You need an authority under Part 8 of the *Water Act 1912* from the Department of Land and Water Conservation.

3. Will the development affect the flow of water to or from a river or lake and prevent land being flooded by water?

No ☐

Yes ☐➢ Do you have a licence, authority, permit or consent under the *Water Act* 1912?

Yes ☐

No ☐➢ *You need an authority under Part 8 of the* Water Act 1912 *from the Department of Land and Water Conservation.*

➢ *Bushfire Protection – Authorisation under Section 100B of the Rural Fires Act*

1. Are you proposing a subdivision of land that could lawfully be used for residential or rural residential purposes or development of land for special fire protection purposes?

No ☒

Yes ☐➢ You need authorisation under Section 100B of the Rural Fires Act.

RICHMOND VALLEY COUNCIL
Development Application Checklist

The checklist below identifies the information that may be required and will need to be submitted with your application.

Please tick all relevant boxes and attach information.

- [x] True Market Value of work & Council fees
- [x] Consent of all owners
- [ ] 6 Copies of plans/ 2 specifications - see DA Guide
- [x] Detailed Site Plan showing all trees & structures - drawn to scale
- [ ] 2 Copies of Rural Fire Service Bushfire Management Plan
- [ ] 3 Copies of BASIX Certificate – available at www.basix.nsw.gov.au
- [ ] 6 Copies Statement of Environmental Effects – see Fact Sheet EDA 009
- [ ] Water Sensitive Urban Design (WSUD) details – DCP 9 and Fact Sheet EDA 19
- [ ] Floor and Ground Levels in Flood Prone Land
- [ ] 6 Copies of On Site Sewage Management Application - Engineer's Report
- [x] Completed Development Application Form

NOTE: Failure to supply all the information will result in delay of your application for which Council cannot accept responsibility and may result in a refusal of the application.

The assessment may identify other issues that may require clarification or further submissions.

DEVELOPMENT APPLICATIONS MUST BE LODGED WITH COUNCIL
PRIOR TO 3.30PM MONDAY TO FRIDAY

TO BE COMPLETED BY APPLICANT

I have read all the information attached to this development application and have completed the checklist above. I acknowledge that the failure to supply all of the information requested by Council will result in the processing of this application being delayed.

PAUL SNELLGROVE	P Snellgrove	29 JULY 2008
Print Name	**Signature**	**Date**

Appendix B
Copy of DA 55/95

FFS:JKG
165/34-189-5.700

Please direct enquiries to: Mr F Smith
Director of Environmental Services

6 December 1995

Mr B E Martin
Coraki Road
GREENRIDGE
via CASINO 2470

Dear Mr Martin

DEVELOPMENT APPLICATION NO. 55/95

Seeking development consent to extract up to 12 000 m^3/year of river sand from Cabbage Tree Creek. The proposal is a designated development under Schedule 3 of the Environmental Planning and Assessment Act, being within forty (40) metres of a natural waterbody. The land is zoned Rural General 1(a).

Pursuant to Section 92 of the Environmental Planning and Assessment Act, 1979, notice is hereby given of the determination by the Council of Development Application No. 55/95 relating to the above.

The application has been determined by granting of consent subject to the following conditions:

1. This approval is for a period of five (5) years. Council may grant extensions of development consent beyond this period after an assessment of the effects of extraction and haulage contributions.
(Reason: To enable a review of operations.)

2. No vegetation to be removed or destroyed. Sand extraction and vehicle movements be limited to week days only, with working hours 7am - 6pm.
(Reason: To limit impact on amenity of the area.)

3. Should any Aboriginal sites, stone artefacts, bone or other cultural material be disturbed during operations, the development is to cease immediately and contact be made with the Lismore District Office of National Parks & Wildlife Service and the Boolangle Local Aboriginal Land Council.
(Reason: To safeguard Aboriginal heritage.)

../2

4. No excavation shall occur until a permit has been issued by the Department of Land and Water Conservation. Within six (6) months of date of this consent the provision of a Plan and Management for the sand extraction to fully address matters including:
   - identification of sand storage area and precautions to prevent washout during flooding
   - water control measures

   (Reason: To comply with Department of Land and Water Conservation requirements.)

5. An annual report addressing operations for the preceding twelve (12) months and identifying all rehabilitation activities, and stating operations proposed for the forthcoming twelve (12) months, shall be submitted to Council by 1 December each year while extraction continues.

   The first annual report to identify information on historical "high flow" events in Cabbage Tree Creek, and quantitative data on the water levels and amount of sand that can be expected to be transported into the extraction area during such events.
   (Reason: To enable environmental management.)

6. The excavation be limited to the active bed channel maximum width twenty-two (22) metres extending from chainage 050 to 1000.
   (Reason: To prevent damage to creek bed.)

7. Where the excavation is below low flow water level the maximum depth of excavation below the toe of the bank shall not exceed a depth of 1/6th of the distance from the toe of the nearest bank at any point.
   (Reason: To maintain integrity of creek bed.)

   The site must be re-surveyed every two (2) years and copies of the cross-sectional profile plans for the area worked is to be submitted to Council in the annual report.
   (Reason: To monitor excavations.)

8. A levy under Section 94(1)(b) of the Act amounting to 85c per cubic metre is to be paid to the Council to upgrade roads and expended in accordance with the Section 94 Contributions Plan - Roads and Bridges (Table 15 Road No. 182).
   (Reason: To upgrade roads and bridges to meet increased demands from development.)

9. Within three months of commencing operations, complete upgrading of Brewer's Road to a Class "B" standard at the localities identified below:

   (i) 0.3km from Old Tenterfield Road, the sandy section of approximately 100m to 200m long.

(ii) 2.6km from Old Tenterfield Road, two sections either side of a horizontal curve, one approximately 30m long, the other approx 40m long, consisting of sandy loose surface.

(iii) 3.0km from Old Tenterfield Road, a section 20m long, comprising possibly an old tree stump hole.

(iv) 3.5km from Old Tenterfield Road, a loose sandy section of approx 30m long.

(v) 3.7km from Old Tenterfield Road, remove a large tree on the northern side of the roadway.

(vi) 4.3km from Old Tenterfield Road, a sandy corner
(Reason: To enable continued access.)

10. The Junction of Brewer's and Old Tenterfield Roads be improved to an AUSTROADS "minimum treatment" (Fig. 5.16 - Intersections at Grade).
(Reason: To reduce traffic conflict.)

11. Extend seal in Brewer's Road to 30 m from Old Tenterfield Road.
(Reason: To reduce traffic conflict.)

12. Erect a hinged "Truck Entering" warning sign on Old Tenterfield Road each side of Brewer's Road, and to be displayed during operations.
(Reason: To reduce traffic conflict.)

13. Compliance with content and detail contained within the Environmental Impact Statement prepared for Mr Barry Martin by Peter A Jelliffe and dated August 1995.
(Reason: To ensure adherence to EIS.)

14. The operator to maintain a current school bus schedule and times in each truck operating from this site.
(Reason: To reduce traffic conflict.)

Note to Applicant:

(i) The excavation area is in excess of 20,000 m^2 and needs to be scheduled by the EPA under the Noise Control Act 1975.

(ii) Richmond River Shire Council has advised the need for a Development Application for the Yorklea site and requested all routes within that Shire be restricted to Ellangowan Road.

Endorsement of date of consent:	23 November 1995
Date from which approval operates:	22 December 1995

Yours faithfully

G Cowan

G B COWAN
GENERAL MANAGER

NOTES:

(1) To ascertain the date upon which the consent becomes effective refer to section 93 of the Act.

(2) To ascertain the extent to which the consent is liable to lapse refer to section 99 of the Act.

(3) Section 97 of the Act confers on an applicant who is dissatisfied with the determination of a consent authority a right of appeal to the Land and Environment Court exercisable within 12 months after receipt of this notice.

Appendix C
Consultations undertaken in preparation of EIS

Appendix C1
Director-General's requirements

NSW GOVERNMENT
Department of Planning

Contact: Michael Young
Phone: 02 9228 6437
Fax: 02 9228 6466
Email: michael.young@planning.nsw.gov.au
Our ref: G94/00135

Mr Paul Snellgrove
Ardill Payne & Partners
PO Box 20
BALLINA NSW 2478

RECEIVED
DATE 19.07.07 | BY PS 6518

Dear Mr Snellgrove

Director-General's Requirements – Proposed Sand Extraction, Cabbage Tree Creek

I refer to your request for the Director-General's requirements for the preparation of an Environmental Impact Statement (EIS) for the proposed extraction of sand from Cabbage Tree Creek, 543 Brewers Road, Kippenduff (Lot 38 DP 755635) in the Richmond Valley local government area.

These requirements have been prepared in consultation with the relevant Government authorities and are based on the information your company has provided to date.

Statutory Issues

Attachment No. 1 outlines the statutory matters that must be included in any EIS under clauses 71 and 72 of the *Environmental Planning and Assessment Regulation 2000* (the EP&A Regulation).

Specific Issues

Under clause 73(1) of the EP&A Regulation, the Director-General requires the EIS to address the following specific issues:

- **Description of the Proposal:** The EIS must include a full description of the proposal, clearly identifying the resource, the site, the proposed works (including any rehabilitation works) and the duration and intensity of extraction operations, and likely inter-relationship between the proposed operations and the existing/previous operations.
- **Justification for the Proposal:** The EIS must include a detailed justification of the proposal.
- **Environmental Planning Instruments:** The EIS must assess the proposal against the relevant provisions of *State Environmental Planning Policy No. 33 – Hazardous and Offensive Developments; State Environmental Planning Policy No. 44 – Koala Habitat Protection; State Environmental Planning Policy No. 55 – Remediation of Land; State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007; North Coast Regional Environmental Plan; Copmanhurst Local Environment Plan 1990;* and relevant development control plans and section 94 plans.
- **Strategic Documents:** The EIS must assess the proposal against the draft *Mid North Coast Regional Strategy.*

- **Key Issues***:* The EIS must assess the following potential impacts of the proposal during construction and operation, and describe what measures would be implemented to avoid, minimise, mitigate, offset, manage and/or monitor these potential impacts:
  - noise;
  - water (including surface and ground water);
  - hydrology and fluvial geomorphology (including flooding and bank/channel stability);
  - air quality;
  - traffic and transport;
  - flora and fauna (particularly critical habitats; threatened species, populations or ecological communities, or their habitats);
  - soils and land use;
  - heritage (both Aboriginal and non-Aboriginal);
  - waste management;
  - hazards;
  - utilities and services; and
  - social and economic.
- **Rehabilitation and Final Land Use:** The EIS must:
  - justify the final land use in relation to the strategic land use objectives for the area;
  - describe in detail how the site would be progressively rehabilitated; and
  - describe what measures would be put in place for the ongoing management of the site following cessation of extraction activities, including consideration of the most appropriate mechanisms for securing sufficient financial resources for the implementation of these measures in the long term.
- **Environmental Monitoring and Management:** The EIS must describe in detail how the environmental performance of the proposal would be monitored and managed over time.

Guidelines

During the preparation of the EIS, you must consult the Department's EIS Guideline - *Extractive Industries – Dredging and Other Extraction in Riparian and Coastal Areas* and the *NSW Sand and Gravel Extraction Policy for Non-Tidal Rivers* – a component of the *State Rivers and Estuaries Policy* (1992).

The guidelines are available for purchase from the Department's Information Centre, 23-33 Bridge Street, Sydney or by calling 1300 305 695.

Integrated Development

Under section 91 of the *Environmental Planning and Assessment Act 1979* the development is "integrated development" if it requires certain approvals in addition to development consent before it may be carried out.

In your Form A, you indicated that your proposal will require an approval under the *Fisheries Management Act 1994* and *Rivers and Foreshores Improvement Act 1948*. The detailed requirements for these approvals are included in Attachment No. 2 and these must be addressed in the EIS.

If further integrated approvals are identified before the Development Application (DA) is lodged, you must conduct your own consultation with the relevant agencies, and address their requirements in the EIS.

When you lodge your DA for the proposal, you must include:

- One copy of the EIS for each of the integrated approval authorities; and
- A cheque for $250 made payable to each integrated approval authority, to offset costs involved in the review of the DA and EIS.

Consultation

During the preparation of the EIS, you must consult the relevant local, State and Commonwealth government authorities, service providers and community groups, and address any issues they may raise in the EIS. In particular, you should consult the surrounding landowners and occupiers that are likely to be impacted by the proposal. Details of the consultations carried out and issues raised must be included in the EIS.

The Department of Environment and Climate Change have provided their requirements for the proposal (see Attachment No. 3) and you must address these in the EIS.

The Commonwealth Environment Protection and Biodiversity Conservation Act

If your proposal contains any actions that could have a significant impact on matters of National Environmental Significance, then it will require an additional approval under the *Commonwealth Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). This approval is in addition to any approvals required under NSW legislation. It is your responsibility to contact the Department of Environment and Water Resources in Canberra ((02) 6274 1111 or *http://www.environment.gov.au*) to determine if the proposal is likely to significant impact on matters of National Environmental Significance, and would require an approval under the EPBC Act. The Commonwealth Government has accredited the NSW environmental assessment process for assessing any impacts on matters of National Environmental Significance. As a result, if it is determined that an approval is required under the EPBC Act, please contact the Department immediately, as supplementary Director General's requirements will need to be issued.

Administration

You should note that if the DA to which these requirements relate is not made within two years of the date of this letter, you must re-consult with the Director-General prior to lodging the application in order that these requirements may be revised if necessary.

Enquiries

If you have any enquiries about the above, please contact Michael Young on (02) 9228 6437.

Yours sincerely

Howard Reed

Howard Reed 16.7.07
A/Manager
Mining and Extractive Industries

As delegate of the Director-General

ATTACHMENT NO. 1

ATTACHMENT NO. 1

STATUTORY REQUIREMENTS FOR THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT UNDER PART 4 OF THE ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

In accordance with the *Environmental Planning and Assessment Act 1979* (the Act), an environmental impact statement (EIS) must meet the following requirements.

Content of EIS

Pursuant to Schedule 2 and clause 72 of the *Environmental Planning and Assessment Regulation 2000* (the Regulation), an EIS must include:

1. A summary of the environmental impact statement.
2. A statement of the objectives of the development or activity.
3. An analysis of any feasible alternatives to the carrying out of the development or activity, having regard to its objectives, including the consequences of not carrying out the development or activity.
4. An analysis of the development or activity, including:
   (a) a full description of the development or activity; and
   (b) a general description of the environment likely to be affected by the development or activity, together with a detailed description of those aspects of the environment that are likely to be significantly affected; and
   (c) the likely impact on the environment of the development or activity, and
   (d) a full description of the measures proposed to mitigate any adverse effects of the development or activity on the environment, and
   (e) a list of any approvals that must be obtained under any Act or law before the development or activity may be lawfully carried out.
5. A compilation, (in a single section of the environmental impact statement) of the measures referred to in item 4(d).
6. The reasons justifying the carrying out of the development or activity in the manner proposed, having regard to biophysical, economic and social considerations, including the following principles of ecologically sustainable development:
   (a) The precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
   In the application of the precautionary principle, public and private decisions should be guided by:
      (i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and
      (ii) an assessment of the risk-weighted consequences of various options,
   (b) Inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations,
   (c) Conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,
   (d) Improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:
      (i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,
      (ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,
      (iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

An environmental impact statement referred to in Section 78A(8) of the Act shall be prepared in written form. The prescribed form to accompany the environmental impact statement must comply with the requirements of clause 71 of the Regulation and be signed by the person who has prepared it.

Procedures for public exhibition of the EIS are set down in clauses 77 to 81 of the Regulation.

Attention is also drawn to clause 283 of the Regulation regarding false or misleading statements in EISs.

<u>Note</u>

If the development application to which the EIS relates is not made within 2 years from the date of issue of the Director-General's requirements, under clause 73(6) of the Regulation the proponent is required to re-consult with the Director-General.

– ✧ –

ATTACHMENT NO. 2

NSW Government
DEPARTMENT OF NATURAL RESOURCES

Contact: David Hart
Phone: (02) 6641 6530
Fax: (02) 6641 6601
Email: David.Hart@dnr.nsw.gov.au

Our ref: GRA6128169 EA370
Your ref: DGR ID: 303

Mr David Kitto
Director, Major Development Assessment
Department of Planning
GPO Box 39 SYDNEY NSW 2001

Attention: Michael Young

Received
06 JUN 2007
Strategic Assessments

4 June 2007

Dear Mr Kitto

Re: Sand extraction proposal Cabbage Tree Creek (DGR ID No. 303)

I refer to your letter of 28 April 2007 in which you have requested advice regarding issues to be included in the Director-General's Requirements (DGRs) for the Environmental Impact Statement (EIS) for this development.

On 27 April 2007 the functions of the Department of Natural Resources (DNR) transferred to either the Department of Water and Energy, the Department of Environment and Climate Change, the Department of Primary Industries, or the Department of Lands. Arrangements are currently being finalised for the re-allocation of DNR's former staff and legislative responsibilities to these other Departments. Future inquiries should be directed to them separately, rather than to the former DNR. However, to assist you with your present inquiry during this transition period, the following advice is provided in DNR's former capacity, as it applied to the matters relating to this development.

A permit under Part3A of the *Rivers and Foreshores Improvement Act, 1948* from the Department of Water and Energy is required for any excavation or removal of material within, or within 40 metres of, a non-tidal stream as proposed by the proponent.

The EIS for the proposal is to cover the extraction site and associated processing and stockpiling areas. The EIS must contain a complete hydrological study, fluvial geomorphologic study, erosion and sediment control plan, rehabilitation plan and monitoring proposals.

In addition to the matters set out in the Department of Planning's EIS Guidelines ("Extractive Industries, Dredging and Other Extraction in Riparian and Coastal Areas"), the Department considers that the EIS needs to address the following details, as assessed by a suitably qualified person:

1. **Hydrology**
   - Effects of the proposal on floods, flooding and the passage of flood waters in the creek system.
   - Changes in flood levels and flows.
   - Likely impacts on upstream and downstream reaches, adjacent land and infrastructure.
   - Likely effect on the surface water quality, eg: if fine, erodible or dispersible soil will be disturbed or imported; if the removal of groundcover and riparian vegetation will allow nutrients and pollutants to be freely transported into the creek system.
   - Effects on the existing drainage system.

2. Fluvial geomorphology

This section must address the possible effect on creek stability and the present stability of the channel. It must be site specific and consist of:

- The relationship of the proposal to any river management plan for the local area.
- An assessment of stream stability.
- Cross sections of the creek at 50 metre intervals from 50 upstream to a point 50 metres downstream of the extraction site. The cross sections should be permanently marked for monitoring surveys in future.
- The effect of the operation on riparian vegetation.
- Proposed works to stabilise and their justification if the creek is not in equilibrium.
- The cumulative effect with other similar activities, with other stream management works and other development in the area. The report should address bed load transport rates and impact on the upstream operation.

3. Erosion and Sediment Control

A site specific plan is needed to address:

- Site preparation techniques.
- Run-off control before, during and after development activity.
- Extraction methods, their impacts and mitigation. This should include the staging of the extraction, the area to be disturbed at any time and the progressive rehabilitation of the site.
- Site amelioration techniques.
- Erosion control structures, design and location.
- Limitations (environmentally sensitive areas).

4. Rehabilitation Plan

Again the plan must be site specific and address:

- Existing contours and landscape.
- Final contours and landscape and links to flood hydraulics and fluvial geomorphology.
- Final land use
- Existing vegetation.
- Final vegetation composition including buffer zones.
- Sowing techniques, planting techniques and performance guarantees.
- Maintenance activities and commitment.
- Details of the final landform and vegetation cover and their effects on stability of the creek system.

5. Monitoring

Proposals for the following are required:

- Schedule for cross section survey.
- Vegetation assessment.
- Long term river stability assessment.

This development may also require approval under the *Water Management Act, 2000* if water is to be taken and used in the operation.

Should you have any further enquiries please contact Glen Poolman of the Department of Water and Energy on 02 66416521.

Yours sincerely

D Hart

David Hart
Senior Natural Resource Officer

Our Ref: 07-1477

Mr David Kitto
Director, Major Development Assessment
Department of Planning
PO Box 39
SYDNEY NSW 2001

URBAN ASSESSMENTS
RECEIVED
11 JUL 2007

Attention: Mr Mike Young

5 July 2007

Dear Mr Young

Re: Requirements for an EIS for sand extraction Cabbage Tree Creek

Thank you for your letter of 28 May 2007 requesting the Aquatic Habitat Protection Unit (AHPU) within NSW Department of Primary Industries (DPI) outline requirements for the above mentioned proposal. I apologise for the delay in my response.

DPI responsibility covers managing fish (including aquatic invertebrates), and fish habitat throughout NSW. In addition, the department works to provide quality commercial and recreational fishing, and aquaculture opportunities.

Information provided to this department in your letter and the supporting documentation indicates that the proposal may be an Integrated Development Assessment matter for DPI. Sections 198-202 of the *Fisheries Management Act* 1994 are triggered when dredge and reclamation is undertaken on land that is periodically inundated by water. Where another government approval is provided for the works, concurrence is required from DPI's Aquatic Habitat Protection Unit.

Sections 219 – 220 of the *Fisheries Management Act* 1994 are triggered when barriers to the movement of fish including weirs or property road crossings are to be constructed or modified. Often sand extraction activities involve the construction of a weir or other bed control structures to ensure that the site does not experience a head cut.

Assessment documentation for the site will, with specific reference to sections 219 and 220 of the *Fisheries Management Act* 1994 need to provide information that details:

1. **Aquatic environment**
   a) How often does the waterbody contain water? (If intermittent, estimate average annual frequency)
   b) Are there permanent waterholes upstream or downstream? Give details:
   c) Are there any natural or human-made obstructions to fish passage nearby (give details)? If so, how often are these obstructions 'drowned out'?
   d) Are fish migrations known to occur in the area. Give details of fish species and the time(s) of migrations:
2. **Reason for obstructing or blocking fish passage**
   (a) Why is it necessary to obstruct or block fish passage?
3. **Characteristics of obstruction or blockage**
   a) For how long do you propose to obstruct or block fish passage:
   3 months or less ☐, 3-6 months ☐, 7-12 months ☐, if longer please specify number of months or years:
   b) By how much will the proposed obstruction or blockage to fish passage reduce the cross-sectional area of the water course (tick appropriate box):
   5% or less ☐, 5-10% ☐, 10-20% ☐, 20-50% ☐, or more than 50% ☐.
   c) If the proposed obstruction or blockage to fish passage contains openable 'gates' or other structures (e.g. a regulator), how often and when will it be open and enable fish passage? Give details:
   d) What 'headloss' or 'afflux' is expected across the obstruction or blockage to fish passage under the following flow conditions:

Flow	Headloss/afflux (mm)	Water velocity (cm/s)
Average flow		
1:2 year flood		
1:5 year flood		
1:10 year flood		
1:20 year flood		

FISHERIES MANAGEMENT DIVISION
AQUATIC HABITAT PROTECTION BRANCH

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www.dpi.nsw.gov.au
Tel: 02 6626 1269
Fax: 02 6626 1377

4. Restoring fish passage

a) Describe measures proposed for maintaining fish passage during the proposed works/activities (e.g. fishways, bypass channels, trapping and manual relocation):

b) If works will be removed after a time, how will fish passage be restored?

c) Will restoration of fish passage restore similar conditions to the waterbody as existed before the blocking of fish passage: Yes ☐ or no ☐?

d) If not, please clearly describe any changes:

5. Environmental compensation

a) Describe environmental compensation measures for unavoidable and permanent blockage of fish passage (e.g. other improvement projects for the aquatic environment):

If appropriate the DPI will prepare General Terms of Approval, conditions that require appropriate mitigation strategies are undertaken and efforts are actively pursued to ensure minimal impacts on aquatic habitats. This may included the development and implementation of an aquatic habitat compensatory plan. Accordingly the extent and nature of riparian rehabilitation works to be undertaken will also need to be detailed.

When considering assessing environmental compensation it should be noted that some forms of 'river rehabilitation' can impact on fish passage. For instance establishing a 'dish shaped' channel may act as a 'behaviourable barrier' due to the absence of habitat diversity required by fish species for shelter and feeding. Alternatively, some instream structures constructed to prevent the migration of 'head cut' erosion points form physical barriers to the movement of fish. Accordingly the Aquatic Habitat Protection Unit within DPI will need to assess the rehabilitation plans developed for each stage sand extraction on the creek.

There are unlikely to be any threatened species or threatened species listed under Part 7A of the *Fisheries Management Act* 1994.

Finally, I have included as an attachment DPI Aquatic Habitat Protection's standard minimum information requirements for environmental assessment. Please ensure that the proponent address these requirements in the environmental studies. This will facilitate effective assessment of the proposal and reduce delays.

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If you have any further enquiries please contact me on (02) 6626 1397.

Yours sincerely

Patrick Dwyer
Fisheries Conservation Manager (North)

FISHERIES MANAGEMENT DIVISION
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GENERAL REQUIREMENTS

Describe the purpose of the proposal;

Describe the location and area of the proposal;

Detail the location of all component parts of the proposal, including any auxiliary infrastructure;

Provide a timetable for construction of the proposal with details of each phases of construction;

Detail likely or possible future needs arising from the proposal;

Provide a legible topographic map with scale, contours, north represented and the date the map/plan/air photo was prepared;

Specify zoning, present land use and whether special conditions (eg SEPP 14 wetlands) apply to the land proposed for development or adjacent land;

Describe the surrounding geomorphology;

Identify all water bodies including wetlands and floodplains;

Specify the direction of river flow and provide hydrological and stream morphological including depth contours and stream bed substrate information, water quality and if appropriate tidal characteristics;

Describe / map aquatic habitats (generally within 100 metres of the boundary of the proposal and sometimes further if downstream) that could be impacted upon either directly or indirectly by the proposal during its construction, life and decommissioning including:

- gravel beds
- rocky reefs
- wetlands and floodplains
- deep pools
- riparian vegetation and snags
- under cut banks
- aquatic vegetation (seagrass, algae, mangroves, saltmarsh & emergent vegetation such as reeds

Identify recreational and commercial fishing areas and aquaculture ventures that could be effected by the proposal or works during its construction;

A statement about the presence or absence of threatened species. Threatened species and key threatening processes are listed in Schedule 4 of the *Fisheries Management Act* and regularly updated on the Fisheries Scientific Committee website: www.fsc.nsw.gov.au

Detail the potential impacts of the various phases of the proposal;

Outline ongoing management activities to ensure impacts on aquatic biodiversity are minimised;

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REQUIREMENTS FOR ACTIVITIES THAT BLOCK FISH PASSAGE

Purpose and type of works requiring fish passage to be blocked;

Timing, duration and manner of proposed restriction / blockage to fish passage;

Methods to be used to avoid stranding fish and any remediation works.

REQUIREMENTS FOR DREDGING AND RECLAMATION WORKS

Purpose of works;

Type(s) of marine vegetation in the vicinity of the proposed works;

Distance of adjacent marine vegetation from the outer boundary of the proposed works;

Method of dredging or reclamation to be used;

Duration of dredging or reclamation works;

Time of dredging or reclamation works;

Dimension of area to be dredged or reclaimed;

Depth of dredging height of reclamation activities;

Nature of sediment to be dredged, including Acid Sulphate Soil and Potential Acid Sulphate Soils;

Method of marking area subject to works;

Environmental safeguards to be used during and after works;

Measures for minimising harm to fish habitat under the proposal;

Spoil type and source location for reclamation activities;

Method of disposal of dredge material;

Location and duration of spoil stockpiling, if planned;

Volume of material to be extracted or placed as fill.

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REQUIREMENTS FOR ACTIVITIES THAT DAMAGE MARINE VEGETATION

Type of marine vegetation to be harmed;

Amount of marine vegetation to be harmed, map distribution noting percentage densities of species of marine vegetation;

Reasons for harming marine vegetation;

Methods of harming marine vegetation;

Construction details, including proposed drainage;

Duration and timing of works/activities;

Measures for minimising harm to marine vegetation under the proposal;

Environmental measures to be employed;

Method and location of transplanting activities or disposal of marine vegetation.

REQUIREMENTS FOR ACTIVITIES THAT COULD IMPACT ON THREATENED SPECIES OR CONTRIBUTE TO KEY THREATENING PROCESSES

All assessments require a statement about the presence or absence of threatened species. Up to date listings are available on the Fisheries Scientific Committee website: www.fsc.nsw.gov.au

In determining the presence of threatened species, consideration must be given to the habitat types present within the study area, recent records of threatened species in the locality and the known distributions of these species;

The condition of the habitat within the area must be discussed noting habitat requirements of threatened species likely to occur and the effect of relevant historical events (including land clearing, agricultural activities, water abstraction/diversion, dredging, de-snagging, reclamation, siltation, commercial and recreational activities);

Assess potential impacts on threatened species via the 'Eight-Part Test' and upon completion, consultation with NSW DPI Aquatic Habitat Protection Unit prior to the EIS being finalised;

The proponent should note that where significant impact on threatened species is likely, a detailed Species Impact Statement must be prepared to assist in forming a determination.

The proponent should also note that the *Fisheries Management Act* 1994 contains provisions for strict penalties (up to $220,000 and 2 years imprisonment) to be imposed for individuals or companies that harm an endangered species, population or community or their habitat without proper authority carries.

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ASSESSMENT OF LIKELY IMPACTS

Investigate and report on an area extending downstream and/or upstream as far as is necessary to take all potential impacts into account;

Discussion possible indirect effects of the proposal on species/habitats in the area surrounding the subject site: for example, through altered hydrological regimes including stormwater runoff and drainage, soil erosion or pollution;

Outline the habitat requirements of threatened species and species important to commercial or recreational fishing likely to occur in the study area;

Discuss fish habitats within the study area and the nature and extent of habitat removal or modification which may result from the proposed action;

Discuss the potential impact of the modification or removal of habitat on fish species in the area;

For all species likely to have their lifecycle patterns disrupted by the proposal to the extent that individuals will cease to occupy any location within the subject site, the EIS must describe and discuss other locally occurring populations of such species;

The relative significance of this location for these species in the general locality must be discussed in terms of the extent, security and viability of remaining habitat in the locality;

Describe the potential contribution of the proposal to cumulative impacts on fish and fish habitat in the vicinity of the proposal.

AMELIORATIVE MEASURES

Discuss measures for minimising impacts on fish and fish habitat and other environmental safeguards to be employed such as how erosion and run off will be reduced and water quality maintained;

Specify the nature of any rehabilitation or environmental compensatory works to be undertaken and ongoing maintenance of these works to ensure their benefits are maintained;

Describe ongoing management actions within the proposal, both during construction and after completion, which relate to impact minimisation eg Environmental Management Plans;

Detail monitoring programs, including methodologies that assess Before and After, Control and Impact sites to determine the success of techniques used to ameliorate impacts on aquatic biodiversity level of impact of the development;

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Fax: 02 6626 1377

The EIS must consider how the proposal has been or may be modified and managed to conserve fisheries habitat on the subject site and in the study area.

In discussing alternatives to the proposal, and the measures proposed to mitigate any effects of the proposal, consideration must be given to developing long term management strategies to protect areas within the study area which are of particular importance for fish species. This may include proposals to restore or improve habitat.

Any proposed pre-construction monitoring plans or on-going monitoring of the effectiveness of the mitigation measures must be outlined in detail, including the objectives of the monitoring program, method of monitoring, reporting framework, duration and frequency.

Please Note: Persons undertaking aquatic surveys may be required to hold or obtain appropriate permits or licences under relevant legislation. It is recommend that, prior to any field survey activities taking place, those persons proposing to undertake those activities give consideration to their obligation to obtain appropriate permits or licences which may be required in the specific context of the proposed survey activities.

For example:

Fisheries Management Act 1994
Permit to take fish or marine vegetation for research or other authorised purposes (Section 37)

Licence to harm threatened (aquatic) species, and/or damage the habitat of a threatened species (Section 220ZW).

Animal Research Act 1985:
Animal Research Authority to undertake fauna surveys.

FISHERIES MANAGEMENT DIVISION
AQUATIC HABITAT PROTECTION BRANCH

1243 Bruxner Highway
WOLLONGBAR NSW 2477

ABN 51 734 124 190
www.dpi.nsw.gov.au
Tel: 02 6626 1269
Fax: 02 6626 1377

USEFUL DEFINITIONS

The definitions given below are relevant to these requirements:

Fish means any part of marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history (whether alive or dead). Fish include oysters and other aquatic molluscs, crustaceans, echinoderms and beachworms and other aquatic polychaetes.

Marine vegetation means any species of plant that at any time in its life must inhabit water (other than fresh water).

Waters refers to all waters including tidal waters to the Astronomical High Tide Level (AHTL) as well as flowing streams, irregularly flowing streams, gullies, rivers, lakes, coastal lagoons, wetlands and other forms of natural or man made water bodies on both private and public land.

Dredging work means:

(a) any work that involves excavating water land, or

(b) any work that involves the removal of material from water land that is prescribed by the regulations as being dredging work to which this Division applies.

Farm Dam means the backed up waters of any dam, or impoundment, located on land that is not public water land.

Reclamation Work means any work that involves:

(a) using any material (such as sand, soil, silt, gravel, concrete, oyster shells, tyres, timber or rocks) to fill in or reclaim water land, or

(b) depositing any such material on water land for the purpose of constructing anything over water land (such as a bridge), or

(c) draining water from water land for the purpose of its reclamation.

Water Land means land submerged by water:

a) whether permanently or intermittently, or

b) whether forming an artificial or natural body of water,

and includes wetlands and any other land prescribed by the regulations as water land to which this Division applies.

Wetlands includes marshes, mangroves, swamps, or other areas that form a shallow body of water when inundated intermittently or permanently with fresh, brackish or salt water, and where the inundation determines the type and productivity of the soils and the plant and animal communities.

Further Information

The DPI Policy and Guidelines series contains more detailed information on techniques and practices that satisfy DPI requirements to minimise impacts of developments on fish and fish habitat. The Guidelines are available at www.fisheries.nsw.gov.au. Considering the information in these documents prior to developing and submitting your proposal is strongly recommended.

Another document "*Guidelines for the Assessment of Aquatic Ecology in EIA*" (Draft 1998) produced by the Department for Urban Affairs and Planning (now Dept of Planning) may prove useful in outlining appropriate procedures and methodologies for conducting aquatic surveys required for the preparation of an EIS.

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ATTACHMENT NO. 3

Your reference	: DGR ID No: 303
Our reference	: DOC07/20980
Contact	: Ian Greenbank, 66402510
Attention	: Michael Young

David Kitto
Director
Major Development Assessment
Department of Planning
GPO Box 39
SYDNEY NSW 2001

Received
06 JUN 2007
Strategic Assessments

Dear Mr Kitto

PROPOSED SAND EXTRACTION FROM CABBAGE TREE CREEK – DGR ID No: 303

Thank you for your letter of 28 May 2007 concerning a proposal by Kingsbrae Partnership Pty Ltd to develop a sand extraction project at Lot 38, DP 755635, Kippenduff.

On the 14 May 2007 we also received a letter from Paul Snellgrove of Ardill Payne and Partners concerning what we believe to be the same proposal. Upon examining that proposal it was apparent that the site was not scheduled under the provisions of the Protection of the Environment Operations Act, 1997 as the annual volume of material to be removed is less than the limit of 30,000 cubic metres.

Please find attached a copy of the letter we sent to Ardill Payne and Partners.

We hope this has been helpful. If you have any further inquiries please contact our Ian Greenbank on 66402510.

Yours sincerely

GRAEME BUDD
Head Waters & Catchments Unit – North Coast
Climate Change & Environment Protection Group

The Department of Environment and Conservation NSW is now known as
the Department of Environment and Climate Change NSW

Department of **Environment and Conservation** NSW

Appendix C2
DECC (including Parks & Wildlife Division)

Your reference : Job 6518
Our reference : DOC07/19167
Contact : Ian Greenbank, 66402510

Paul Snellgrove
Ardill Payne & Partners
PO Box 20
BALLINA NSW 2478

RECEIVED
DATE 31-05-07 BY PS
6518

Dear Mr Snellgrove

ENVIRONMENTAL IMPACT STATEMENT FOR SAND EXTRACTION AT CABBAGE TREE CREEK, WYANDAH

Thank you for your letter of 14 May 2007 concerning a proposal by Kingsbrae Partnership Pty Ltd to prepare a development application and environmental impact statement for sand extraction from the bed of Cabbage Tree Creek adjacent to Brewers Road, Wyandah.

The proposed activity will not be scheduled under the Protection of the Environment Operations (POEO) Act, 1997 because it involves the removal of a quantity of sand below the threshold within that act. For this reason we will not be required to provide our Directors Requirements or General Terms of Approval and the proponent will not be required to hold an Environment Protection Licence.

Even so, this does not reduce the need for the proponent to comply with all Local Government and Department of Planning requirements. Nor does it protect them from breeching the POEO Act with regard to pollution. For this reason we ask that all efforts be taken to avoid the pollution of waters, the generation of dust on the site or access roads and the generation of excessive noise.

In general we would expect the following be reviewed during the process;-

- The proposal needs to be consistent with the provisions of the Protection of the Environment Operations Act 1997 (i.e. With respect to the control of air, noise and water pollution)
- Impacts on areas of native vegetation need to be assessed, with special reference to threatened or regionally significant flora and fauna species, populations and ecological communities.
- The proposed development needs to be consistent with the threatened species provisions of the Environment Planning and Assessment Act, 1979, State Planning Policy (SEPP) 44 – Koala Habitat Protection, SEPP 71 – Coastal Protection and the Native Vegetation Act, 2003.

- An appropriate level of Aboriginal cultural heritage assessment needs to be undertaken, to ensure that the proposal is not likely to impact on areas of cultural significance to the Aboriginal community. Also, it is important that the views of Aboriginal community groups be sought in regard to the proposed development.

We hope this information is helpful. If you have any further inquiries please contact our Ian Greenbank on 66402510.

Yours sincerely

GRAEME BUDD
Head Waters and Catchments Unit – North Coast
<u>Climate Change and Environment Protection Group</u>

Paul Snellgrove

From: Laurinda Teys
Sent: Monday, 25 June 2007 2:34 PM
To: Paul Snellgrove
Subject: FW: Proposed sand extraction - Cabbage Tree Creek[Scanned]
Attachments: brewers road.jpg

From: Keats Jon [mailto:Jon.Keats@environment.nsw.gov.au]
Sent: Monday, 25 June 2007 2:03 PM
To: Laurinda Teys
Cc: Williams Mark
Subject: FW: Proposed sand extraction - Cabbage Tree Creek[Scanned]

Attention: Paul Snellgrove

Paul,

On 30 May 2007 the Department of Environment and Climate Change (DECC) responded to your letter dated 14 May 2007 in relation to an EIS to be prepared for the above proposal.

The Parks and Wildlife Division of the DECC has recently identified a further issue that should be considered in the matter, as follows:

Our interest concerns the access road, Brewers Road, between the site and Brewers Road junction with the Old Tenterfield Road several kilometres to the east.

We manage the Mt Neville Nature Reserve situated at the western end of Brewers Road. We have a periodic need use Brewers Road to place heavy plant and equipment on the reserve to undertake essential fire trail maintenance. On occasion there is also a need to for fire agencies, including the Rural Fire Service to deploy heavy plant and fire fighting tankers in this locality to combat wildfire.

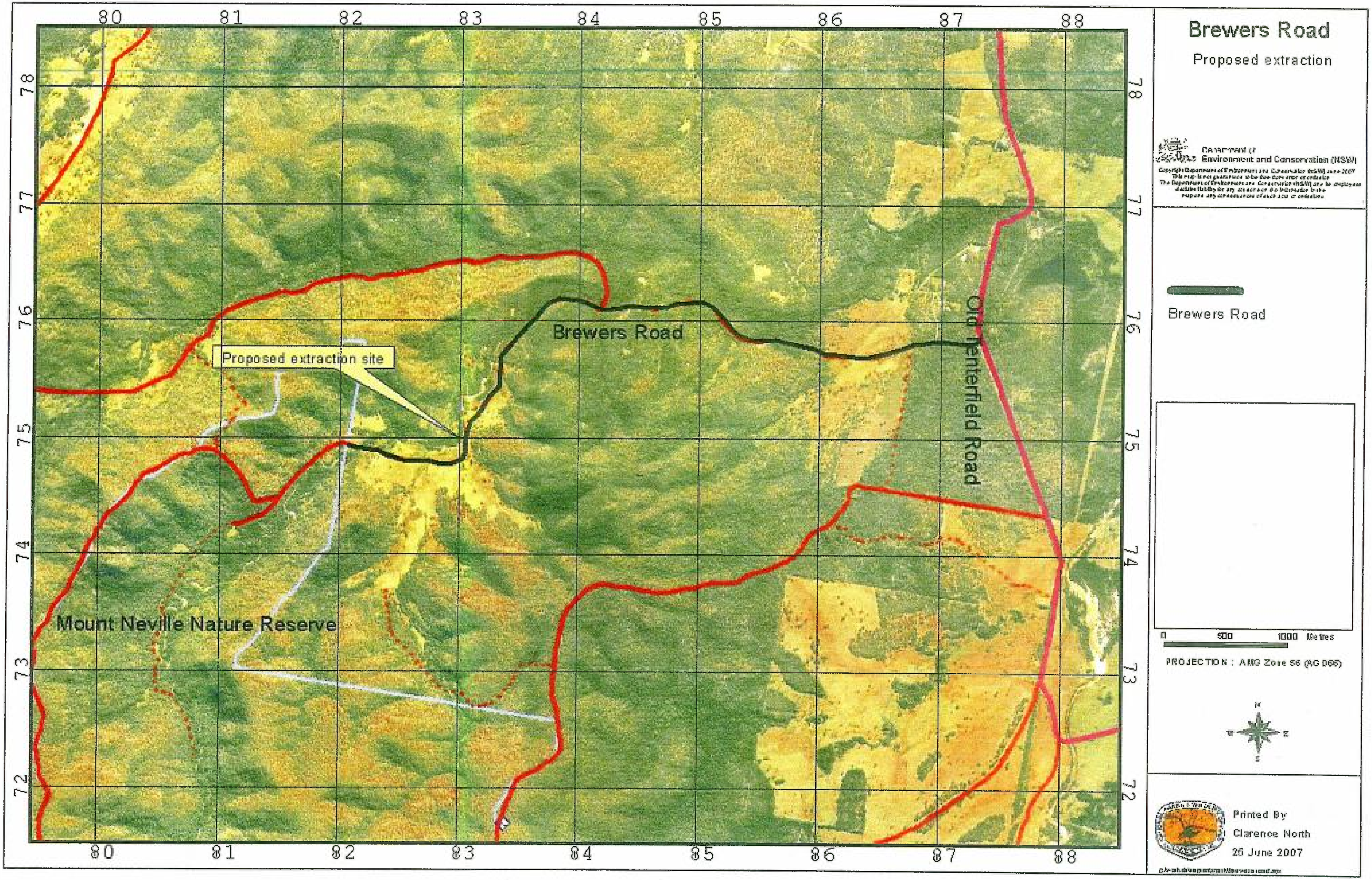
As can be seen from the attached diagram, the area is remote, contains extensive areas of steep terrain, heavily vegetated. There are no alternative equivalent access corridors nearby.

Our concern is that Brewers Road not become damaged or degraded due to the haulage associated with the sand extraction. There are some crossings of minor watercourses along Brewers Road which are potentially problem spots.

If you have any queries in relation to the above, please contact Mark Williams, Ranger Grafton, on 0428 965 525.

Regards

Jon Keats



Brewers Road
Proposed extraction
Environment and Conservation (NSW)
Brewers Road
0 500 1000 Metres
PROJECTION : AMG Zone 56 (AGD66)
N
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S
Printed By
Clarence North
25 June 2007
Proposed extraction site
Brewers Road
Old Tenterfield Road
Mount Neville Nature Reserve
80 81 82 83 84 85 86 87 88
78 77 76 75 74 73 72

Appendix C3
DPI Fisheries

NSW DEPARTMENT OF
PRIMARY INDUSTRIES

Now incorporating NSW Fisheries
ABN 51 734 124 190-002

Our Ref: 07-1477

Paul Snellgrove
Ardill Payne & Partners
PO Box 20
BALLINA NSW 2478

RECEIVED
DATE 24-05-07 BY PS 6518

21 May 2007

Dear Mr Snellgrove

Re: Requirements for an EIS for sand extraction Cabbage Tree Creek

Thank you for your letter of 14 May 2007 requesting the Aquatic Habitat Protection Unit (AHPU) within NSW Department of Primary Industries (DPI) outline requirements for the above mentioned proposal.

DPI responsibility covers managing fish (including aquatic invertebrates), and fish habitat throughout NSW. In addition, the department works to provide quality commercial and recreational fishing, and aquaculture opportunities.

Information provided to this department in your letter and the supporting documentation indicates that the proposal may be an Integrated Development Assessment matter for DPI. Sections 198-202 of the *Fisheries Management Act* 1994 are triggered when dredge and reclamation is undertaken on land that is periodically inundated by water. Where another government approval is provided for the works, concurrence is required from DPI's Aquatic Habitat Protection Unit. Sections 219 – 220 of the *Fisheries Management Act* 1994 are triggered when barriers to the movement of fish including weirs or property road crossings are to be constructed or modified.

If appropriate the DPI will prepare General Terms of Approval, conditions that require appropriate mitigation strategies are undertaken and efforts are actively pursued to ensure minimal impacts on aquatic habitats. This may included the development and implementation of an aquatic habitat compensatory plan. Accordingly the extent and nature of riparian rehabilitation works to be undertaken will also need to be detailed.

FISHERIES MANAGEMENT DIVISION
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Furthermore some forms of 'river rehabilitation' can impact on fish passage. For instance establishing a 'dish shaped' channel may act as a 'behaviourable barrier' due to the absence of habitat diversity required by fish species for shelter and feeding. Alternatively, some instream structures constructed to prevent the migration of 'head cut' erosion points form physical barriers to the movement of fish. Accordingly the Aquatic Habitat Protection Unit within DPI will need to assess the rehabilitation plans developed for each stage sand extraction on the creek.

There are unlikely to be any threatened species or threatened species listed under Part 7A of the *Fisheries Management Act* 1994.

Finally, I have included as an attachment DPI Aquatic Habitat Protection's standard minimum information requirements for environmental assessment. Please ensure that the proponent address these requirements in the environmental studies. This will facilitate effective assessment of the proposal and reduce delays.

If you have any further enquiries please contact me on (02) 6626 1397.

Yours sincerely

Patrick Dwyer
Fisheries Conservation Manager (North)

GENERAL REQUIREMENTS

Describe the purpose of the proposal;

Describe the location and area of the proposal;

Detail the location of all component parts of the proposal, including any auxiliary infrastructure;

Provide a timetable for construction of the proposal with details of each phases of construction;

Detail likely or possible future needs arising from the proposal;

Provide a legible topographic map with scale, contours, north represented and the date the map/plan/air photo was prepared;

Specify zoning, present land use and whether special conditions (eg SEPP 14 wetlands) apply to the land proposed for development or adjacent land;

Describe the surrounding geomorphology;

Identify all water bodies including wetlands and floodplains;

Specify the direction of river flow and provide hydrological and stream morphological including depth contours and stream bed substrate information, water quality and if appropriate tidal characteristics;

Describe / map aquatic habitats (generally within 100 metres of the boundary of the proposal and sometimes further if downstream) that could be impacted upon either directly or indirectly by the proposal during its construction, life and decommissioning including:

- gravel beds
- rocky reefs
- wetlands and floodplains
- deep pools
- riparian vegetation and snags
- under cut banks
- aquatic vegetation (seagrass, algae, mangroves, saltmarsh & emergent vegetation such as reeds

Identify recreational and commercial fishing areas and aquaculture ventures that could be effected by the proposal or works during its construction;

A statement about the presence or absence of threatened species. Threatened species and key threatening processes are listed in Schedule 4 of the *Fisheries Management Act* and regularly updated on the Fisheries Scientific Committee website: www.fsc.nsw.gov.au

Detail the potential impacts of the various phases of the proposal;

Outline ongoing management activities to ensure impacts on aquatic biodiversity are minimised;

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REQUIREMENTS FOR ACTIVITIES THAT BLOCK FISH PASSAGE

Purpose and type of works requiring fish passage to be blocked;

Timing, duration and manner of proposed restriction / blockage to fish passage;

Methods to be used to avoid stranding fish and any remediation works.

REQUIREMENTS FOR DREDGING AND RECLAMATION WORKS

Purpose of works;

Type(s) of marine vegetation in the vicinity of the proposed works;

Distance of adjacent marine vegetation from the outer boundary of the proposed works;

Method of dredging or reclamation to be used;

Duration of dredging or reclamation works;

Time of dredging or reclamation works;

Dimension of area to be dredged or reclaimed;

Depth of dredging height of reclamation activities;

Nature of sediment to be dredged, including Acid Sulphate Soil and Potential Acid Sulphate Soils;

Method of marking area subject to works;

Environmental safeguards to be used during and after works;

Measures for minimising harm to fish habitat under the proposal;

Spoil type and source location for reclamation activities;

Method of disposal of dredge material;

Location and duration of spoil stockpiling, if planned;

Volume of material to be extracted or placed as fill.

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REQUIREMENTS FOR ACTIVITIES THAT DAMAGE MARINE VEGETATION

Type of marine vegetation to be harmed;

Amount of marine vegetation to be harmed, map distribution noting percentage densities of species of marine vegetation;

Reasons for harming marine vegetation;

Methods of harming marine vegetation;

Construction details, including proposed drainage;

Duration and timing of works/activities;

Measures for minimising harm to marine vegetation under the proposal;

Environmental measures to be employed;

Method and location of transplanting activities or disposal of marine vegetation.

REQUIREMENTS FOR ACTIVITIES THAT COULD IMPACT ON THREATENED SPECIES OR CONTRIBUTE TO KEY THREATENING PROCESSES

All assessments require a statement about the presence or absence of threatened species. Up to date listings are available on the Fisheries Scientific Committee website: www.fsc.nsw.gov.au

In determining the presence of threatened species, consideration must be given to the habitat types present within the study area, recent records of threatened species in the locality and the known distributions of these species;

The condition of the habitat within the area must be discussed noting habitat requirements of threatened species likely to occur and the effect of relevant historical events (including land clearing, agricultural activities, water abstraction/diversion, dredging, de-snagging, reclamation, siltation, commercial and recreational activities);

Assess potential impacts on threatened species via the 'Eight-Part Test' and upon completion, consultation with NSW DPI Aquatic Habitat Protection Unit prior to the EIS being finalised;

The proponent should note that where significant impact on threatened species is likely, a detailed Species Impact Statement must be prepared to assist in forming a determination.

The proponent should also note that the *Fisheries Management Act* 1994 contains provisions for strict penalties (up to $220,000 and 2 years imprisonment) to be imposed for individuals or companies that harm an endangered species, population or community or their habitat without proper authority carries.

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ASSESSMENT OF LIKELY IMPACTS

Investigate and report on an area extending downstream and/or upstream as far as is necessary to take all potential impacts into account;

Discussion possible indirect effects of the proposal on species/habitats in the area surrounding the subject site: for example, through altered hydrological regimes including stormwater runoff and drainage, soil erosion or pollution;

Outline the habitat requirements of threatened species and species important to commercial or recreational fishing likely to occur in the study area;

Discuss fish habitats within the study area and the nature and extent of habitat removal or modification which may result from the proposed action;

Discuss the potential impact of the modification or removal of habitat on fish species in the area;

For all species likely to have their lifecycle patterns disrupted by the proposal to the extent that individuals will cease to occupy any location within the subject site, the EIS must describe and discuss other locally occurring populations of such species;

The relative significance of this location for these species in the general locality must be discussed in terms of the extent, security and viability of remaining habitat in the locality;

Describe the potential contribution of the proposal to cumulative impacts on fish and fish habitat in the vicinity of the proposal.

AMELIORATIVE MEASURES

Discuss measures for minimising impacts on fish and fish habitat and other environmental safeguards to be employed such as how erosion and run off will be reduced and water quality maintained;

Specify the nature of any rehabilitation or environmental compensatory works to be undertaken and ongoing maintenance of these works to ensure their benefits are maintained;

Describe ongoing management actions within the proposal, both during construction and after completion, which relate to impact minimisation eg Environmental Management Plans;

Detail monitoring programs, including methodologies that assess Before and After, Control and Impact sites to determine the success of techniques used to ameliorate impacts on aquatic biodiversity level of impact of the development;

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The EIS must consider how the proposal has been or may be modified and managed to conserve fisheries habitat on the subject site and in the study area.

In discussing alternatives to the proposal, and the measures proposed to mitigate any effects of the proposal, consideration must be given to developing long term management strategies to protect areas within the study area which are of particular importance for fish species. This may include proposals to restore or improve habitat.

Any proposed pre-construction monitoring plans or on-going monitoring of the effectiveness of the mitigation measures must be outlined in detail, including the objectives of the monitoring program, method of monitoring, reporting framework, duration and frequency.

Please Note: Persons undertaking aquatic surveys may be required to hold or obtain appropriate permits or licences under relevant legislation. It is recommend that, prior to any field survey activities taking place, those persons proposing to undertake those activities give consideration to their obligation to obtain appropriate permits or licences which may be required in the specific context of the proposed survey activities.

For example:

Fisheries Management Act 1994
Permit to take fish or marine vegetation for research or other authorised purposes (Section 37)

Licence to harm threatened (aquatic) species, and/or damage the habitat of a threatened species (Section 220ZW).

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(a) any work that involves excavating water land, or

(b) any work that involves the removal of material from water land that is prescribed by the regulations as being dredging work to which this Division applies.

Farm Dam means the backed up waters of any dam, or impoundment, located on land that is not public water land.

Reclamation Work means any work that involves:

(a) using any material (such as sand, soil, silt, gravel, concrete, oyster shells, tyres, timber or rocks) to fill in or reclaim water land, or

(b) depositing any such material on water land for the purpose of constructing anything over water land (such as a bridge), or

(c) draining water from water land for the purpose of its reclamation.

Water Land means land submerged by water:

a) whether permanently or intermittently, or

b) whether forming an artificial or natural body of water,

and includes wetlands and any other land prescribed by the regulations as water land to which this Division applies.

Wetlands includes marshes, mangroves, swamps, or other areas that form a shallow body of water when inundated intermittently or permanently with fresh, brackish or salt water, and where the inundation determines the type and productivity of the soils and the plant and animal communities.

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Further Information

The DPI Policy and Guidelines series contains more detailed information on techniques and practices that satisfy DPI requirements to minimise impacts of developments on fish and fish habitat. The Guidelines are available at www.fisheries.nsw.gov.au. Considering the information in these documents prior to developing and submitting your proposal is strongly recommended.

Another document "*Guidelines for the Assessment of Aquatic Ecology in EIA*" (Draft 1998) produced by the Department for Urban Affairs and Planning (now Dept of Planning) may prove useful in outlining appropriate procedures and methodologies for conducting aquatic surveys required for the preparation of an EIS.

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Appendix C4
DPI Agriculture, Fisheries, Forestry and Mineral Resources

NSW DEPARTMENT OF
PRIMARY INDUSTRIES

Now incorporating Department of Mineral Resources
ABN 51 734 124 190-003

Ardill Payne and Partners
PO Box 20
BALLINA NSW 2478

RECEIVED
DATE 19.06.07 BY PS 6518

Attn: Mr P Snellgrove

OUR REF: 07/3586
YOUR REF: 6518

14th June 2007

Dear Sir,

Re: EIS Requirements for sand extraction, Cabbage Tree Creek (Richmond Valley Shire)

Thank you for your letter of 14th May addressed to the Department in Orange.

The Department of Primary Industries has been formed by the merger of Forests NSW, Mineral Resources NSW, NSW Agriculture, and NSW Fisheries. This is a coordinated response from the Department of Primary Industries.

General Issues
The EIS Guideline for Extractive Industries (DUAP, 1996) should be followed in the preparation of the EIS.

Agricultural Issues
The agricultural suitability and classification of the subject and immediately adjoining land should be determined via a property level assessment by suitably qualified and/or experienced persons with due consideration to the features and criteria specified in Chapter 9 of the Rural Land Evaluation Manual (Dept. of Planning, 1988).

The proposed EA should also address the following key issues:

- the agricultural quality of the subject and adjoining lands,
- the agricultural use of the subject and adjoining lands,
- the location, extent, duration and purpose of the activity,
- consistency of the proposal with relevant policies and guidelines,
- the impact of the proposal on future agricultural production,
- the impact of the proposal on any existing or former cattle tick dip sites,
- any alternatives to the proposal,
- proposed rehabilitation measures and long term management/use of the subject lands,
- the compatibility of the operation with any adjoining and nearby agricultural enterprises,
- management of adverse impacts on water resources of use to agriculture
- impacts of the proposal on local flooding, in particular alterations to flood behaviour and surface water flows caused by the works and their impact on agricultural enterprises and farm access,

Geological Survey of NSW
Dept. Primary Industries
PO Box U86
University of New England
ARMIDALE NSW 2351

www.dpi.nsw.gov.au

Tel: 02 6738 8513
Fax: 02 6772 8664

- management of neighbourhood issues arising with such a project,
- quality of the material extracted and the proposed use this material.

Fisheries Issues
Please find attached the minimum assessment requirements as specified under the Fisheries Management Act, 1994 and the Department's "Policy and Guidelines for Aquatic Habitat Management and Conservation, 1999" (Attachment “F”). Specifically, the EIS should also assess the following areas to ascertain if additional approvals may be required.

Work to upgrade, repair or maintain watercourse crossings on internal (private) roads may trigger the need to obtain a permit under the *Fisheries Management Act* 1994, specifically sections 198-202 for dredge and reclamation activities and / or sections 218-220, impeding the free passage of fish. Accordingly if work to repair watercourse crossings forms part of the DA the matter would be an integrated matter for the Aquatic Habitat Protection Unit of DPI. Detail on the watercourse(s) and the proposed crossing(s) would therefore need to form a component of the EIS. To assist in the preparation of this information, guidelines for fish friendly crossings can be found on DPI website at:

http://www.fisheries.nsw.gov.au/__data/assets/pdf_file/5054/booklet-fish-passage.pdf

If work involving dredging (removing material from a watercourse) or reclamation (placing material into a watercourse) is required to repair, maintain or improve a crossing at any other time, a permit will still need to be obtained from DPI. A permit application form is available at:

http://www.fisheries.nsw.gov.au/__data/assets/pdf_file/5044/Fisheries-Manag-Act-Part-7.pdf

Forestry Issues
FNSW Northern Region have a harvesting plan in place in cooperation with NPWS/DEC to harvest remnant *Pinus* in the area. Harvested logs would have to be hauled along Brewers Road. Any EIS would need to consider log haulage traffic in addressing traffic impacts arising from the subject proposal.

Mineral Resource Issues
Mineral Resource issues are outlined in Attachment "M", and these should be addressed in the proposed EIS.

Should you have any further inquiries, please do not hesitate to contact:
- Mr Rik Whitehead in Wollongbar (Tel 6626 1349) for Agricultural issues.
- Mr Patrick Dwyer in Wollongbar (Tel 6626 1397), for Fisheries issues.
- Mr Nick Westman in Junction Hill (Tel 6640 1620) for Forestry issues.
- Mr Jeff Brownlow in Armidale (Tel 6738 8513) for Mineral Resource issues.

Yours faithfully,

for

C. Ricketts,
Chief Geoscientist,
Land Use

Encl. Attachment "F"
Attachment "M"

Attachment "F"

DPI – FISHERIES MANAGEMENT
MINIMUM REQUIREMENTS FOR ENVIRONMENTAL STUDIES

GENERAL REQUIREMENTS

- Describe the purpose of the proposal;
- Describe the location and area of the proposal;
- Detail the location of all component parts of the proposal, including any auxiliary infrastructure;
- Provide a timetable for construction of the proposal with details of each phases of construction;
- Detail likely or possible future needs arising from the proposal;
- Provide a legible topographic map with scale, contours, north represented and the date the map/plan/air photo was prepared;
- Specify zoning, present land use and whether special conditions (eg SEPP 14 wetlands) apply to the land proposed for development or adjacent land;
- Describe the surrounding geomorphology;
- Identify all water bodies including wetlands and floodplains;
- Specify the direction of river flow and provide hydrological and stream morphological including depth contours and stream bed substrate information, water quality and if appropriate tidal characteristics;
- Describe / map aquatic habitats (generally within 100 metres of the boundary of the proposal and sometimes further if downstream) that could be impacted upon either directly or indirectly by the proposal during its construction, life and decommissioning including:
  - gravel beds,
  - deep pools,
  - rocky reefs,
  - aquatic vegetation (seagrass, mangroves, saltmarsh and emergent vegetation such as reeds),
  - riparian vegetation and snags,
  - wetlands and floodplains, and
  - under cut banks.
- Identify recreational and commercial fishing areas and aquaculture ventures that could be effected by the proposal or works during its construction;
- A statement about the presence or absence of threatened species. Threatened species and key threatening processes are listed in Schedule 4 of the Fisheries Management Act and regularly updated on the Fisheries Scientific Committee website: www.fsc.nsw.gov.au
- Detail the potential impacts of the various phases of the proposal;
- Outline ongoing management activities to ensure impacts on aquatic biodiversity are minimised;

DPI – FISHERIES MANAGEMENT
MINIMUM REQUIREMENTS FOR ENVIRONMENTAL STUDIES

REQUIREMENTS FOR ACTIVITIES THAT BLOCK FISH PASSAGE

- Purpose and type of works requiring fish passage to be blocked;
- Timing, duration and manner of proposed restriction / blockage to fish passage;
- Methods to be used to avoid stranding fish and any remediation works.

REQUIREMENTS FOR DREDGING AND RECLAMATION WORKS

- Purpose of works;
- Type(s) of marine vegetation in the vicinity of the proposed works;
- Distance of adjacent marine vegetation from the outer boundary of the proposed works;
- Method of dredging or reclamation to be used;
- Duration of dredging or reclamation works;
- Time of dredging or reclamation works;
- Dimension of area to be dredged or reclaimed;
- Depth of dredging height of reclamation activities;
- Nature of sediment to be dredged, including Acid Sulphate Soil and Potential Acid Sulphate Soils;
- Method of marking area subject to works;
- Environmental safeguards to be used during and after works;
- Measures for minimising harm to fish habitat under the proposal;
- Spoil type and source location for reclamation activities;
- Method of disposal of dredge material;
- Location and duration of spoil stockpiling, if planned;
- Volume of material to be extracted or placed as fill.

REQUIREMENTS FOR ACTIVITIES THAT DAMAGE MARINE VEGETATION

- Type of marine vegetation to be harmed;
- Amount of marine vegetation to be harmed, map distribution noting percentage densities of species of marine vegetation;
- Reasons for harming marine vegetation;
- Methods of harming marine vegetation;
- Construction details, including proposed drainage;
- Duration and timing of works/activities;
- Measures for minimising harm to marine vegetation under the proposal;
- Environmental measures to be employed;
- Method and location of transplanting activities or disposal of marine vegetation.

DPI – FISHERIES MANAGEMENT
MINIMUM REQUIREMENTS FOR ENVIRONMENTAL STUDIES

REQUIREMENTS FOR ACTIVITIES THAT COULD IMPACT ON THREATENED SPECIES OR CONTRIBUTE TO KEY THREATENING PROCESSES

- All assessments require a statement about the presence or absence of threatened species. Up to date listings are available on the Fisheries Scientific Committee website: www.fsc.nsw.gov.au
- In determining the presence of threatened species, consideration must be given to the habitat types present within the study area, recent records of threatened species in the locality and the known distributions of these species;
- The condition of the habitat within the area must be discussed noting habitat requirements of threatened species likely to occur and the effect of relevant historical events (including land clearing, agricultural activities, water abstraction/diversion, dredging, de-snagging, reclamation, siltation, commercial and recreational activities);
- Assess potential impacts on threatened species via the 'Eight-Part Test' and upon completion, consultation with DPI - Fisheries Management prior to the EIS being finalised;
- The proponent should note that where significant impact on threatened species is likely, a detailed Species Impact Statement must be prepared to assist in forming a determination.
- The proponent should also note that the *Fisheries Management Act* 1994 contains provisions for strict penalties (up to $220,000 and 2 years imprisonment) to be imposed for individuals or companies that harm an endangered species, population or community or their habitat without proper authority carries.

ASSESSMENT OF LIKELY IMPACTS

- Investigate and report on an area extending downstream and/or upstream as far as is necessary to take all potential impacts into account;
- Discussion possible indirect effects of the proposal on species/habitats in the area surrounding the subject site: for example, through altered hydrological regimes including stormwater runoff and drainage, soil erosion or pollution;
- Outline the habitat requirements of threatened species and species important to commercial or recreational fishing likely to occur in the study area;
- Discuss fish habitats within the study area and the nature and extent of habitat removal or modification which may result from the proposed action;
- Discuss the potential impact of the modification or removal of habitat on fish species in the area;
- For all species likely to have their lifecycle patterns disrupted by the proposal to the extent that individuals will cease to occupy any location within the subject site, the EIS must describe and discuss other locally occurring populations of such species;

- The relative significance of this location for these species in the general locality must be discussed in terms of the extent, security and viability of remaining habitat in the locality;
- Describe the potential contribution of the proposal to cumulative impacts on fish and fish habitat in the vicinity of the proposal.

AMELIORATIVE MEASURES

- Discuss measures for minimising impacts on fish and fish habitat and other environmental safeguards to be employed such as how erosion and run off will be reduced and water quality maintained;
- Specify the nature of any rehabilitation or environmental compensatory works to be undertaken and ongoing maintenance of these works to ensure their benefits are maintained;
- Describe ongoing management actions within the proposal, both during construction and after completion, which relate to impact minimisation eg Environmental Management Plans;
- Detail monitoring programs, including methodologies that assess Before and After, Control and Impact sites to determine the success of techniques used to ameliorate impacts on aquatic biodiversity level of impact of the development;

The EIS must consider how the proposal has been or may be modified and managed to conserve fisheries habitat on the subject site and in the study area.

In discussing alternatives to the proposal, and the measures proposed to mitigate any effects of the proposal, consideration must be given to developing long term management strategies to protect areas within the study area which are of particular importance for fish species. This may include proposals to restore or improve habitat.

Any proposed pre-construction monitoring plans or on-going monitoring of the effectiveness of the mitigation measures must be outlined in detail, including the objectives of the monitoring program, method of monitoring, reporting framework, duration and frequency.

Please Note: Persons undertaking aquatic surveys may be required to hold or obtain appropriate permits or licences under relevant legislation. It is recommend that, prior to any field survey activities taking place, those persons proposing to undertake those activities give consideration to their obligation to obtain appropriate permits or licences which may be required in the specific context of the proposed survey activities.
For example:

Fisheries Management Act 1994

- Permit to take fish or marine vegetation for research or other authorised purposes (Section 37)

- Licence to harm threatened (aquatic) species, and/or damage the habitat of a threatened species (Section 220ZW).

Animal Research Act 1985:
- Animal Research Authority to undertake fauna surveys.

USEFUL DEFINITIONS

The definitions given below are relevant to these requirements:

Fish means any part of marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history (whether alive or dead). Fish include oysters and other aquatic molluscs, crustaceans, echinoderms and beachworms and other aquatic polychaetes.

Marine vegetation means any species of plant that at any time in its life must inhabit water (other than fresh water).

Waters refers to all waters including tidal waters to the Astronomical High Tide Level (AHTL) as well as flowing streams, irregularly flowing streams, gullies, rivers, lakes, coastal lagoons, wetlands and other forms of natural or man made water bodies on both private and public land.

Further Information

The DPI - Fisheries Management Policy and Guidelines series contains more detailed information on techniques and practices that satisfy DPI – Fisheries Management requirements to minimise impacts of developments on fish and fish habitat. The Guidelines are available at www.fisheries.nsw.gov.au. Considering the information in these documents prior to developing and submitting your proposal is strongly recommended.

Another document "*Guidelines for the Assessment of Aquatic Ecology in EIA*" (Draft 1998) produced by the Department for Urban Affairs and Planning (now DIPNR) may prove useful in outlining appropriate procedures and methodologies for conducting aquatic surveys required for the preparation of an EIS.

NSW DEPARTMENT OF
PRIMARY INDUSTRIES

Now incorporating Department of Mineral Resources
ABN 51 734 124 190-003

DEPARTMENT OF PRIMARY INDUSTRIES - MINERAL RESOURCES DIVISION

EIS RESOURCE DATA REQUIREMENTS

The Department of Primary Industries, Mineral Resources Division considers that it is in the best interests of the proponent to fully assess the resources which are subject of the proposal. This means that a thorough geological assessment should be undertaken to determine the nature, quality and extent of the resource. Failure to undertake such an assessment could lead to operational problems and possibly failure of the proposal.

Resource Assessment

The following issues need to be addressed in the environmental impact statement (EIS):

1. A summary of the regional and local geology including information on the stratigraphic unit or units subject of the proposal.
2. The amount of material available for extraction and the method or methods used to determine this amount (e.g. drilling, trenching, geophysical methods). Plans and cross-sections summarising this data, at a standard scale, showing location of drillholes and/or trenches, and the area proposed for extraction, should be included in the EIS. Relevant supporting documentation such as drill logs should be appended. Major resource proposals should be subject to extensive drilling programs to identify the nature and extent of the resource.
3. Characteristics of the material or materials to be produced:
   a) For clay/shale extraction proposals, ceramic properties such as plasticity, drying characteristics (e.g. dry green strength, linear drying shrinkage), and firing characteristics (e.g. shrinkage, water absorption, fired colour) should be addressed.
   b) For sand extraction proposals, properties such as composition, grainsize, grading, clay content and contaminants should be indicated. The inclusion of indicative grading curves for all anticipated products as well as the overall deposit is recommended.
   c) For hard rock aggregate proposals, information such as grainsize and mineralogy, nature and extent of weathering or alteration, and amount and type of deleterious minerals, if any, should be indicated.
   d) For other proposals, properties relevant to the range of uses proposed for the particular material should be indicated.

   Details of tests carried out to determine the characteristics of the material should be appended. Such tests should be undertaken by NATA registered testing laboratories.
4. An assessment of the quality of the material and its suitability for the anticipated range of applications should be given.
5. The amount of material anticipated to be produced annually should be indicated. If the proposal includes a staged extraction sequence details of the staging sequence needs to be provided. The intended life of the operation should be indicated.
6. If the proposal is an extension to an existing operation, any past annual production data (by financial year) for all products should be supplied in support of the proposal.
7. An assessment of alternative sources to the proposal and the availability of these sources. The impact of not proceeding with the proposal should be addressed.

NSW Dept Primary Industries
Geological Survey of NSW
PO Box U86
University of New England
ARMIDALE NSW 2351

www.dpi.nsw.gov.au

Tel: 02 6738 8513
Fax: 02 6772 8664

8. Justification for the proposal in terms of the local and, if appropriate, the regional context. Identification of the subject site in relevant planning instruments such as regional environmental plans, should be noted.
9. Information on the location and size of markets to be supplied from the site.
10. Transport routes for the material to the market.
11. Disposal of waste products and the location and size of stockpiles.
12. Assessment of noise, vibration, dust and visual impacts, and proposed measures to minimise these impacts.
13. Proposed rehabilitation procedures during, and after completion of, extraction operations, and proposed final use of site.
14. Assessment of the ecological sustainability of the proposal.

Safety Issues

On the safety issues, the following points are made:

1. All operations are to comply with the Mines Inspection Act, 1901, as amended.
2. The company is to nominate a person (or persons) as General Manager and Production Manager as required by the Mines Inspection Act 1901, Section 5 and 5B.
3. The General Manager must appoint trained and competent shotfirers to conduct all blasting operations.
4. The company is required to contact the Regional Inspector of Mines for a list of guidelines and safety issues which are to be addressed and for the required competencies for a Production Manager.

Mineral Ownership

The *Mining Act 1992*, and its precursors, apply to those minerals specified in the regulations of the Act. Many construction materials are not prescribed minerals under the Mining Act. In general terms, this means these materials are owned by the Crown where they occur on Crown land and by the landowner in the case of freehold land. A Mining title is not required for their extraction although a Crown Lands licence is required where they occur on Crown land.

Construction materials such as s*and (except for marine aggregate), loam, river gravel, and coarse aggregate materials such as basalt, sandstone, and granite* are not prescribed minerals under the Mining Act 1992. Therefore, the Department of Primary Industries, Mineral Resources Division has no statutory authority over the extraction of these commodities, apart from its role under the Mines Inspection Act 1901 (as amended) with respect to safe operation of mines and quarries. However, the Department is the principal government authority responsible for assessing the State's resources of construction materials and for advising State and local government on their planning and management.

Minerals such as *structural clay (ie clay for brick, tile and pipe manufacture), dimension stone, quartzite, kaolin* and *limestone* are prescribed minerals under the Mining Act 1992. Minerals which are prescribed as minerals under the terms of the Mining Act may, in some cases belong either to the Crown or to the landowner, depending on a number of factors including the date on which the mineral was proclaimed and the date of alienation of the land. The proponent needs to determine whether the material is privately owned or Crown mineral (publicly owned). If it is privately owned, then either a notification under Section 8 of the Mining Act 1992 or, alternatively, a mining lease or mineral claim would be required. If it is a Crown mineral, an application for a mining lease or mineral claim will have to be lodged.

If you are unsure whether a mining title is required for your proposal you should contact the Department of Primary Industries, Mineral Resources Division.

Appendix C5
RTA

File No. 389.5351 07/1153 N01037
Reference. 6518

RTA

Ardill Payne & Partners
PO Box 20
BALLINA NSW 2478

RECEIVED
DATE 08-06-07 | BY RS 6518

Richmond River Council. Proposed Sand Extraction Cabbage Tree Creek.
EIS requirements.

Dear Sir

I refer to your letter dated 14 May 2007 concerning the above.

In accordance with SEPP11 the proposed quarry is classed as a Schedule 1 development and will required consideration in due course by the Regional Development Committee. It would be appreciate if an electronic copy of the document could be provided for dispersal.

The Environmental Impact Statement (EIS) Development should include a traffic study to determine the impact of the additional volume of traffic generated by development of this area, and the surrounding road network.

The traffic study should take into account the key issues relevant to the scale of this proposal as set out in Table 2.1 of the Roads and Traffic Authority's current 'Guide to Traffic Generating Developments" (copy attached). This should include information relating to:

- Total impact of existing and proposed development on the overall local road network
- Intersection sight distances
- Existing and proposed access conditions
- Detail of servicing and parking arrangements
- Improvements for road junctions
- Impact on Transport (School Bus Routes)
- Road Traffic Noise
- Contribution plan for the maintenance of the road network

Current AUSTROADS standards should be adopted for any necessary upgrading of the surrounding road infrastructure.

If you have any further enquiries please contact Mrs Leisa Sedger on 6640 1362 or email land_use_northern@rta.nsw.gov.au.

Yours faithfully

- 6 JUN 2007

Jim Campbell
A/Regional Manager, Northern Region

2.3 Issues to be addressed

A traffic impact study should follow the standard format and structure that is listed in Table 2.1. This format covers the key issues to be addressed in determining the impact on traffic of a development. Use of this format and the checklist will ensure those involved in the preparation and / or assessment of Development Applications that the most significant matters are considered.

Table 2.1
Key issues in preparing traffic impact studies

Procedures & Key Parameters	Source	Check ✓
Brief description of the development		
Application and study process		
Introduction		
Background		
Scope of report		
The key issues and objectives of a traffic impact study		
General Data Collection / Existing Conditions		
Description of the Site and Proposed Activity		
Site location		
Current land use characteristics (zoning) of the proposed site and land use in the vicinity	Council	
Site access		
The Existing Traffic Conditions		
Road hierarchy; including the identification of the classified road network (major and minor roads) which may be affected by the development proposal	Council / RTA	
Inventory of road widths, road conditions, traffic management and parking control	Council, RTA and Survey	
Current and proposed roadworks, traffic management works and bikeways	Council / RTA	
Traffic Flows		
Selection of key streets - possibly divided into the major and the minor road network; selection of key assessment periods, chosen to cover the times at which the development would be expected to have its major impacts	Section 3	
AADT on key streets	RTA / Council / Survey	
Daily traffic flow hourly distribution, particularly in or near residential areas	Survey	

Procedures & Key Parameters	Source	Check ✓
Estimate of the speed of traffic on the road to which vehicular access is proposed	Survey	
Current traffic generation of site	Survey	
Daily and peak period heavy vehicle flows and percentages	Survey	
The adaptation of appropriate computer models or techniques for assessing levels of traffic congestion and queuing conditions		
Traffic Safety		
Accident history of road network in the area	Accident Histories	
Parking Supply and Demand		
On-street parking provision	Local Council	
Off-street parking provision	Councils / Surveys	
Current parking demand, including utilisation by time of day and turnover rates	Survey	
Short term pick up and set down areas	Council / Survey	
Modal Split	STA / Survey	
Public Transport		
Rail station locations	SRA	
Bus routes and bus stop locations; Pedestrian access to bus stops; Constraints and conflicts	STA / Private Operators / Survey	
Rail and bus service frequencies, ideally separated into Monday to Friday, Saturday and Sunday, for both peak and off-peak times	SRA /STA / Private Operators	
Commuter parking provision	SRA / Survey	
Pedestrian Network		
Identify major pedestrian routes	Survey	
Pedestrian flows and potential conflicts with vehicles, particularly where such conflicts cause capacity constraint on either vehicular or pedestrian movement	Observation	
Pedestrian infrastructure	Survey	
Proposed developments in the vicinity	Council	

Procedures & Key Parameters	Source	Check ✓
Proposed Development		
The Development		
Plan reference, if plans not contained in study report		
Nature of development		
Gross floor areas of each component of development		
Projected number of employees/users/residents		
Hours and days of operations		
Staging and timing of development		
Selection of appropriate design vehicles for determining access and circulation requirements	Section 6	
Access		
Driveway location, including review of alternative locations	Sections 5, 6	
Sight distance of driveways and comparisons with stopping and desirable minimum sight distances	Section 6	
Service vehicle access	Section 6	
Analysis of projected queuing at entrances	Section 6	
Current access to site and comparison with proposed access		
Provision for access to, and by, public transport	Section 6	
Circulation		
Proposed pattern of circulation	Section 6	
Internal road widths	Section 6	
Provision for bus movements		
Service area layout		
Parking		
Proposed supply		
Parking provision recommended by State Government policy	RTA	
Council code and local parking policies and plans	Council	
Parking layout		
Projected peak demand, based where appropriate on similar research reports and on surveys of similar developments;	Section 5	
Parking for Service / courier vehicles and bicycles	Section 5	

Procedures & Key Parameters	Source	Check ✓
Impact Of Proposed Development		
Traffic generation during design periods		
Daily and seasonal factors		
Pedestrian generation and movements		
Traffic Distribution and Assignments		
Hourly distribution of trips		
Assignments of these trips to the road system, based where possible on development feasibility studies or on origin/destination surveys undertaken at similar developments in the areas		
Impact on Traffic Safety		
Assessment of Road Safety Impact		
Impact of Generated Traffic		
Daily traffic flows and composition on key streets and their expected effect on the environment, particularly in residential areas		
Peak period volumes at key intersections and effect of generated traffic on congestion levels	Survey	
Impact of construction traffic during construction stages		
Other proposed developments in the vicinity, their timing and likely impact, if known	Local Council	
Assessment of pedestrian movements	Survey	
Assessment of traffic noise		
Public Transport		
Options for extensions and changes to bus routes and bus stops, following discussions with the STA and or private bus operators	STA	
Provision for pedestrian access to bus stops		
Recommended Works		
Improvements to site access and circulation		
Improvements to roads, signals, roundabouts and other traffic management measures		
Improvements to pedestrian facilities		
Effect of recommended works on the operation of adjacent developments		

Procedures & Key Parameters	Source	Check ✓
Effect of recommended works on public transport services, including bus routes, bus stops and access thereto		
Provision of LATM measures		
Funding of proposed improvement projects		
Noise attenuation measures		

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Appendix C6
Casino Boolangle LALC

Casino Boolangle Local Aboriginal Land Council

110 WALKER STREET
CASINO, NSW 2470
Telephone: 02 - 6662 6286
6662 1308
Fax. 6662 6290

ABN 94 944 782 471
Postal Address:
PO BOX 1047
CASINO, NSW 2470

30 May 2007

RECEIVED
DATE 31-05-07 | 2 | BY PS 6518

Dear Mr Snellgrove

Re: Development Application Consultation

On behalf of the Casino Boolangle Local Aboriginal Land Council I would like thank you for your letter regarding the Development Application Consultation. After consulting with the local Aboriginal community, Elders and Aboriginal staff at Department of Environmental Conservation (DEC), it was decided that a number of recommendations are considered in the Application, and they are as follows:

1. That ARDILL PAYNE & PARTNERS send our local Junbung Elders a letter regarding this issue and ask for their input.
2. A meeting between ARDILL PAYNE & PARTNERS, Casino Boolangle Local Aboriginal Land Council, and representatives from the Junbung Elders to discuss issues regarding Aboriginal Culture & Heritage affected by these works.
3. A pre-site inspection is carried out and monitoring of the area and site be carried out for the duration of sand extraction from the Cabbage Tree Creek.

Please don't hesitate to call me on 6662 4829, 0401122309 if you have any questions.

Thank you for your co-operation.

Yours truly,

Bernie Walker
Co-ordinator

Appendix D
Fluvial geomorphic assessment

Fluvial Geomorphic Assessment

Sand Extraction Proposal

Cabbage Tree Creek
Brewers Road
Wyandah

Prepared for: Ardill Payne & Partners
FEBUARY 15 2008
Ref: RE2

Riparian Engineering Pty Ltd ACN: 128306525
RIVERINE & COASTAL GEOMORPHOLOGY & ECOLOGY | GIS | ASSESSMENT & PLANNING | DESIGN | ENGINEERING
3/7-9 Aubrey Street Surfers Paradise 4217 | M 0400 700 823
fluvial@bigpond.com

Project Identification

Project name: Sand Extraction Proposal Cabbage Tree Creek, Brewers Road, Wyandah.

Report Name: Fluvial Geomorphic Assessment Sand Extraction Proposal Cabbage Tree Creek, Brewers Road, Wyandah.

Client: Ardill Payne and Partners
Phone:(02) 66863280

Prepared by: **Riparian Engineering Pty Ltd**
3/7-9 Aubrey Street
Surfers Paradise
QLD 4217
Phone: 0400700823
Email: fluvial @bigpond.com

Date	Revision	Prepared by	Reviewed by
15.2.08	A	T.Dilworth	N. Yee

This document is not guaranteed to be free of error or emission. Riparian Engineering Pty Ltd and its employees disclaim liability for any act done on the information in the document and any consequence of such acts or omissions.

Executive Summary

Riparian Engineering Pty Ltd (Riparian Engineering) was commissioned by Ardill Payne and Partners to evaluate the Cabbage Tree Creek sand extraction proposal requested by Kingsbrae Partnership Pty Ltd. A detailed assessment of the creek's fluvial geomorphic characteristics, sediment transport processes and rates, and an evaluation of the proposed sand extraction on its geomorphic stability is undertaken in the report. This analysis was used to address issues identified by the Department of Natural Resources (DNR) that are specified in the terms of reference and are addressed individually in this summary.

It should be noted that in addressing these issues identified by DNR, the assessment was based on limited information provided to Riparian Engineering, regarding the operation of the proposed sand extraction operation. Hence, it is assumed that recommendations made in this report provide Ardill Payne and Kingsbrae Partnership Pty Ltd an effective tool to develop a sand excavation operation strategy that satisfies criteria specified by DNR. Fluvial geomorphic processes acting in creek systems are complex and dynamic. Therefore it is almost impossible to predict the creek's response to the proposed sand excavation. Hence, recommendations made in this report are a guide only and are not a substitute for real-time monitoring and observations, whereby adjustments to sand extraction operations may be required.

An assessment of stream stability

The proposed sand extraction operation can be undertaken in the specified area of Cabbage Tree Creek (see Appendix A) without causing detrimental impacts to stream bed and bank stability, if undertaken with due care and based on the constraints and recommendations outlined in this report and ongoing monitoring. If in the event that bank erosion occurs at a specific excavation point, excavation will cease in that area or excavations will be at a depth not to cause bank erosion. The eroded stream bank will be rehabilitated.

The effect of the operation on riparian vegetation

The proposed sand extraction will not have a detrimental impact on riparian vegetation and will provide new recruitment and revegetation sites on lower streams that are currently smothered with sediment.

Proposed works to stabilise and their justification if the creek is not in equilibrium

The proposed sand excavation operation can potentially facilitate the geomorphic recovery of Cabbage Tree Creek. The predicted recovery targets would follow those outlined for a Low Sinuosity Sand Bed River Style as specified by Fryirs and Brierley (2005). Refer to maximum equilibrium excavated areas found in Appendix A, Drawings 4 and 5. Regular monitoring of in-stream and upstream sediment supplies needs to be undertaken to determine if there is sufficient sediment supply and transport to the creek.

The cumulative effect with other similar activities, with other management works and other development in the area. The report should address bed load transport rates and impact on the upstream operation

Executive Summary

There are no upstream and downstream sediment excavation operations known to the assessor from Riparian Engineering Pty Ltd. The impact of the proposed sand excavation was assessed in relation to bedload sediment transport rates and actual sediment stored in the proposed excavation area. Currently there is **24881 m^3** of sandy bedload sediment available for extraction based on excavation constraints specified in the report. Approximately 69750 **m^3** of additional sandy bedload sediment is available and is stored in upstream channel supplies as excessive sedimentation. Subsequently there is approximately **94631 m^3** of sand available for extraction, which is the maximum yield of the operation until new investigations are undertaken were by additional sediment supplies are found. Annual extraction rates will vary based on the amount of sandy bedload sediment transported to the site. In the first year it is possible to extract **20000 m^3** without exceeding the maximum equilibrium excavation areas specified in Appendix A, Drawings 4 and 5. In following years sand extraction rates will be dependent on how much sandy bedload sediment is transported to the excavation area above the specified maximum equilibrium excavation area. Regular monitoring of in-stream and upstream sediment supplies needs to be undertaken to determine if there is sufficient sediment supply and transport to the creek.

Final contours and landscape links to flood hydraulics and fluvial geomorphology

The final contours of the excavated creek have been provided as cross section in Appendix A, Drawings 4 and 5. See specified maximum equilibrium excavation areas. The geomorphic and hydraulic impacts of these specified channel cross sections have also been evaluated in relation to channel flow capacity and bank erosion. The excavated channel cross will have a greater channel flow capacity thereby reducing the incidence of flooding on the floodplain. However, the channel flow capacity will increase naturally as the excessive sedimentation is transported downstream.

Details of the final landform and vegetation cover and their effects on stability of the creek system

The existing riparian vegetation coverage will not be altered and the final landform or river style of the creek will not be fundamentally altered, and will be based on cross section in Appendix A, Drawings 4 and 5. See specified maximum equilibrium excavation areas.

Long term river stability assessment

The proposed sand extraction operation is not likely to have a long term negative impact on the geomorphic stability of the creek, particularly bank and bed erosion, provided the operation is undertaken with due care and a regularly monitoring system is put into place, to validate the predictions made in this assessment. Removing excessive sandy bedload sedimentation from within the excavation area will prevent downstream sedimentation of Cabbage Tree Creek. Sand extraction will also facilitate the geomorphic recovery of the creek as specified in the report, by removing excessive sandy bedload sedimentation from within the creek. The proposed sand extraction operation should ensure that there is still sufficient sandy bedload sediment supplies available for natural sediment transport, thereby long term bed degradation will not occur.

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1 Introduction

1.1. Terms of Reference

Riparian Engineering Pty Ltd (Riparian Engineering) was commissioned by Ardill Payne and Partners to evaluate the sand extraction proposal requested by Kings Brae Partnerships Pty Ltd in relation to issues identified by Department of Natural Resources (DNR)[1]. A summary of these issues is provided below and they are addressed in the summary section of this report.

- An assessment of stream stability.
- The effect of the operation on riparian vegetation.
- Proposed works to stabilise and their justification if the creek is not in equilibrium.
- The cumulative effect with other similar activities, with other management works and other development in the area. The report should address bed load transport rates and impact on the upstream operation.
- Final contours and landscape links to flood hydraulics and fluvial geomorphology.
- Details of the final landform and vegetation cover and their effects on stability of the creek system.
- Long term river stability assessment.

Rather than addressing these issues individually in isolation from each other, a technical report was completed synthesising these issues into a geomorphic processes study which evaluated geomorphic impacts of the sand extraction proposal, based on the issues identified by DNR.

1.2. Background

Sand extraction can cause detrimental environmental impacts on rivers and creeks (Erskine 2005). The proposed sand extraction from Cabbage Tree Creek is likely to result in geomorphic changes that includes but is not limited to:

- Degradation of the creek bed or bed lowering;
- Channel widening and enlargement;
- Bank erosion; and
- Hydraulic impacts.

This report investigates the potential geomorphic changes (listed above) that are likely to be caused by the proposed sand extraction operation and provides recommendations and sets sand excavation constraints that will mitigate or prevent detrimental impact of the proposed sand extraction operation on Cabbage Tree Creek.

[1] Department of Natural Resoureces Ref: GRA6128169 EA370.

2 Methodology

2.1. Site Survey

A site survey was undertaken by Riparian Engineering in November 2007 to assess the geomorphology of Cabbage Tree Creek. Specific observations were made as they related to each section of the report. However a detailed explanation on how bedload sediment depths were determined is provided below.

Assessment of Bedload Sediment Depth

An excavator with a 4 m auger attachment was used to drill into the deposited bedload sediment at all the cross sections marked and surveyed by Ardill Payne and Partners. The maximum depth of the auger was 3.6 m.

Deposited bedload sediment stratigraphy samples were undertaken in November 2007.

Three to four sediment depth samples were taken for each surveyed cross section.

At each sediment depth sample the surface of the deposited sediment and the maximum depth was recorded by the surveyor from Ardill Payne and Partners. This data was calculated to determine the volume of deposited bedload sediment.

Drilling ceased once bedrock was hit.

After every meter drilled into the deposited bedload sediment the vertical stratigraphy of the extracted core was inspected to detect if there was changes in the particle size and colour in the sediment, which would indicate that the original creek bed had been reached. Black sandy loam was found when the creek bed bottom was found, using this method.

In most cases the auger could not reach the bottom of the creek and a note of no bottom @ 3.6 m was recorded. This meant that the bottom of the creek was not found and that the deposited bedload was greater than 3.6m in depth.

a) illustrates the length of the auger attachment used to drill samples

b) illustrates when the auger had reached its 3.6m capacity.

Figure 1 Demonstrates arguer attachment and operation.

2.2. Surveying

All channel cross section surveys and preparation of drawings were taken by Ardill Payne And Partners. Calculations of sediment volumes, bankfull area, bankfull perimeter, were measured from channel cross sections and are presented in Drawings 1 – 5 in Appendix A,

3 Fluvial Geomorphology

3.1. Geomorphic Characterisation of Cabbage Tree Creek

Catchment Characteristics

The catchment of Cabbage Tree Creek, upstream and including the proposed sand extraction site, is approximately 33 km^2 in area and is part of the Clarence-Moreton Basin. Based on available geological maps three geological formations are found within the catchment (Wells and O'Brien 1994b).

The geological formations are:

- *Kangaroo Creek Sandstone*. Soils on the Kangaroo Creek Sandstone consist of sands, earthy sands, earths and podzolics.
- *Grafton Formation*. Soils developed on the Grafton Formation were usually various types of earths and podzolics.
- *Quaternary Alluvium*. Soils on the Quaternary Alluvium consist of well developed clayey soils interlaced with sand.

The adjacent Six Mile Creek catchment has almost identical geomorphic characteristics as Cabbage Tree Creek with similar topography, geology, rainfall, vegetation, stream types and catchment area. Hence, interpretations regarding historical channel changes and rainfall events can be taken from existing work completed on Six Mile Creek Swamp by Erskine (1996, 2005).

Original Creek Morphology

The surveyed section of Cabbage Tree Creek was found on an alluvial valley setting where the channel abuts the valley margin less than 10% of the time with continuous floodplains along both valley margins. The macro-channel has a low sinuosity, is single thread, and relatively stable. The channel comprises an assemblage of sand dominated geomorphic units, although it has been completely eroded and subsequently in-filled with sand, and the floodplain comprises a levee in proximal locations, extending to backswamps in distal sections. Flood channels short cut the floodplain.

Analysis of the original portion plan[2] (refer Appendix B) for Cabbage Tree Creek in 1917 shows a permanent chain of ponds (permanent waterholes) found within the creek. This observation is a typical description by early surveyors for this style of creek. Hence, the likely original River Style classification was an intact <u>low sinuosity sand bed river</u>, with an intact chain of ponds (permanent water holes) with high loading of large woody debris (LWD) and intact riparian vegetation.

[2] Plan of Portion 38, Conty of Richmond, Parish of Wyandah, 1917. Refer to Appendix B.

3 Fluvial Geomorphology

Channel Changes (1917 – 2008)

Catastrophic channel changes have occurred in Cabbage Tree Creek since the publication of the portion plan in 1917. These catastrophic channel changes closely follow a chronology of events that are widely reported throughout eastern Australia and were based on the following information:

- Due to the proximity, and almost identical catchment characteristic shared between the Six Mile Creek Catchment and Cabbage Tree Creek Catchment, extensive investigations by Erskine (2005, 1996) regarding channel changes could be applied to Cabbage Tree Creek.
- Vertical stratigraphy cores undertaken as part of the field survey were used to locate the dimension of the expanded and incised creek section beneath the deposited sand.
- Extensive research in coastal rivers in New South Wales (Fryirs and Brierley 2001, Brierley *et al.* 1999, Erskine and Bell 1982), which has outlined a chronology of similar channel changes post European settlement in south-eastern Australia.

A chronology of catastrophic channel changes observed in the proposed sand extraction areas is provided below:

- In 1917 there was a permanent chain of ponds with permanent water, intact riparian vegetation with high loadings of LWD, with a narrow deep channel. Bedload sediment consisted of a mix of coarse sand to small gravel.
- Clearing of riparian vegetation and the removal of Large Woody Debris (LWD) from within the channel post European Settlement.
- The catchment experienced lower rainfall throughout the period from 1900 to 1946 based on analysis by Erskine (2005).
- A statistically significant increase in annual rainfall occurs throughout the period from 1947 to 1990 based on analysis by Erskine (2005).
- An extremely large rainfall event occurred in the catchment in February 1954, which was reported to have caused catastrophic bed and bank erosion in the adjacent Six Mile Creek catchment (Erskine 2005, 1996). It is likely that Cabbage Tree Creek experienced catastrophic morphogenesis (channel change) during this rainfall event.
- A series of smaller but still statistically significant rainfall events prior to the 1954 rainfall event, dating from 1947, possibly also caused significant channel morphogenesis.
- It is likely that a dramatic creek bed level adjustment occurred in the period from 1947 to 1954, which migrated upstream through the proposed sand extraction area, leading to a deeply incised and unstable channel.

- The channel went through a period of lateral expansion as riparian vegetation and LWD were removed, leading to a significantly wider and deeper channel than shown in the 1917 portion plan.
- Upstream catastrophic bank and bed erosion observed in Six Mile Creek (Erskine 2005, 1996) was also likely to have occurred in Cabbage Tree Creek at the same time, delivering excessive quantities of bedload sediment (sand) to the expanded channel. Studies undertaken in south-eastern NSW by Erskine and Saynor (1996a) report sediment yields from eroded bank and beds can contribute up to 280 times greater than the mean annual sediment yield from the whole drainage basin.

Due to dramatic channel enlargement, the channel was likely to have experienced significant drops in average channel velocity and tractive (boundary) shear stress. Hence, sediment transport capacity of the channel subsequently decreased and the channel was unable to transport the excessive quantities of sandy bedload sediment now moving through the channel. As a result, the enlarged and entrenched channel has been subject to excessive sedimentation and almost completely in-filled with sand, see figure 2. Significant quantities of sandy bedload sediment are stored within the creek, both within the surveyed creek section and in upstream and downstream creek section.

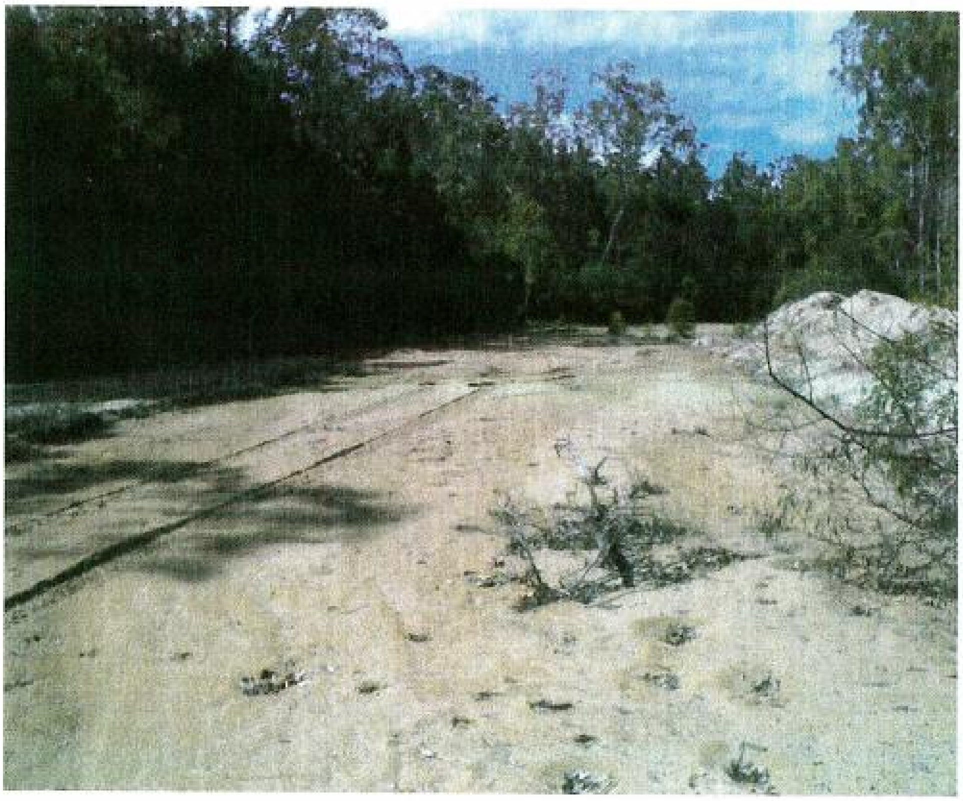

Figure 2 Excessive sedimentation completely smothering the channel.

Assessment of Existing Geomorphic Stability and Condition

The following points describe the current geomorphic condition and stability of the surveyed creek section.

3 Fluvial Geomorphology

- Field survey data indicate large volumes of sand (excessive sedimentation) still remain in the enlarged entrenched channel. This is shown in the cross section drawings. This sand has completely infilled the entire channel smothering all in-stream habitats. Depths of deposited sand exceeded 3.6 m.
- Current sediment transport capacity is very low and sediment has and will continue to deposit onto the adjacent floodplain in flood events. Creek banks are stable as they are not exposed to any hydraulic energy being completely smothered in sandy bedload sediment.
- Riparian vegetation is well established in parts of the proposed sand extraction area.
- Over time the deposited sediment will be vertically eroded from the survey creek section and transported downstream, smothering downstream sections of Cabbage Tree Creek.
- The geomorphic condition of the surveyed creek section is highly degraded and there are no aquatic habitats within the channel that require protection.

Recovery Potential

Cabbage Tree Creek has experienced irreversible geomorphic change since European settlement. The low sinuosity sand bed River Style now operates under fundamentally altered channel boundary conditions and upstream catchment conditions and recovery to its pre-European settlement or 'intact' condition is impractical.

The recovery diagram in Figure 2 demonstrates the likely trajectory of recovery based on the current condition of the channel for this River Style (Fryirs and Brierley 2005) The surveyed creek section would be equivalent, although not exactly the same as, the channel cross section D with extensive sand deposits almost to the top of the bank. Note the cross sections displayed in Figure 2 show an expanded and enlarged channel without extensive sand deposits. The likely and practical recovery potential is displayed in cross sections F and then followed by G, provided a substantial portion of sand can be removed or transported from the channel and that upstream sediment inputs are not exhausted, and natural bedload sediment transport rates are restored. At present, extensive sand deposits in the channel prevent the recruitment of riparian vegetation on stream banks smothered by sand. Furthermore, the depth of the existing sediment slug and the continous reworking of sand prevents the recruitment of pioneer riparian vegetation within the channel. Excessive sediment loads also prevent the natural formation of in-stream geomorphic features such as small scour pools, bars and channel islands.

The proposed sand extraction of Cabbage Tree Creek, if properly controlled and managed, is likely to facilitate the recovery of the surveyed creek to its predicted recovery potential outlined by channel cross section F and then later G depicted in Figure 2.

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Figure 6.5 Recovery diagram for the Low sinuosity sand bed River Style

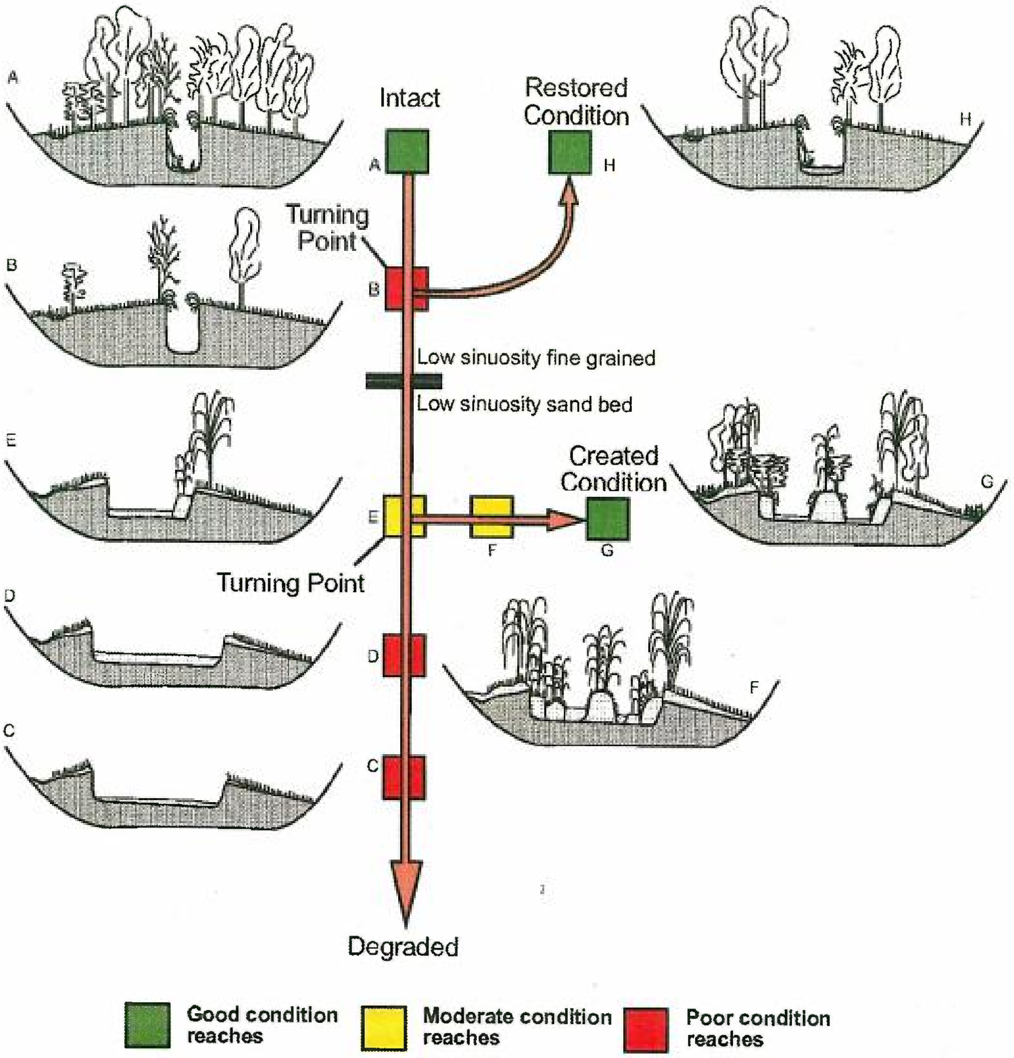

Figure 2. Recovery diagram of Low sinuousity sand bed River Style (taken from Fryirs and Brierley 2005, page 154). The existing condition of the surveyed section of Cabbage Tree Creek is best represented by cross section D with extensive sand accretion up to the bankfull channel capacity. Cross section F best represents the likely recovery potential if a major portion of the sand can be either removed or transported from the creek. Cross section G best represents the likely recovery potential after excavation and riparian vegetation is able to establish on lower stream banks.

3.2. Bedload Sediment Transport

Bedload Sediment Size Distribution (D^{50})

Field analysis of sediment grain size from samples collected throughout the surveyed section of the creek indicated a heterogenous mix of fine to coarse sands occur where excavation is proposed. Sediment samples collected from within the proposed sediment extraction sections of the creek were submitted to a laboratory for analysis of sediment particle distribution by Ardill Payne and Partners. Laboratory results are presented in Appendix B and report a D^{50} particle size of 0.699mm which corresponds to a coarse sand classification.

Previous assessments regarding the nearby Six Mile Swamp Creek by Erskine (2005) report that substantial quantities of coarse sand of approximately the same size particle distribution in the channel was transported in recessional flows after a daily rainfall event of 23.1 mm in the catchment. Similar daily rainfall events in the Cabbage Creek Catchment are expected to yield similar flows and sediment transport capacity, as both catchments have similar area, land cover and topography. Daily rainfall events exceeding 23.1 mm are relatively common in the catchment in any given year, therefore relatively low rainfall events for the Cabbage Tree Creek catchment will initiate sediment transport (Erskine, 2005).

As the magnitude and duration of rainfall events increases there will be a corresponding increase in stream flow that will lead to an increase in bedload sediment transport into the proposed operation area.

Upstream Bedload Sediment Replenishment Rates

Bedload sediment replenishment rates into the proposed sand extraction area will be dependent on:

- the supply of sediment from catchment sources (*i.e.* hillslopes and drainage systems);
- the supply of bedload sediment stored within upstream sections of Cabbage Tree Creek and adjoining upstream tributary streams;
- the intensity, duration and frequency of rainfall events and corresponding flow events in the Cabbage Tree Catchment; and
- sediment transport processes within the channel.

Catchment Sediment Supply

The upstream catchment area of Cabbage Tree Creek that flows into the operation site is approximately 33.47 km^2. Previous work on hillslope sediment erosion rates on Kangaroo Creek Sandstone slopes of the Clarence-Moreton basin by Erskine and Saynor, (1996a) found very low sediment yield from catchment hillslopes, despite substantial sediment redistribution on hillslopes. Eskine (1996) predicts that earlier logging and wildfire could have potentially increased sediment runoff from hillslopes from the area. However at this stage it is difficult to measure the exact amount of sediment input into the creek system and no attempt has been made to do so. It is likely that gully and rill erosion on catchment hillslope contributed and still contributes a significant supply of coarse sandy sediment to the main upstream arm of Cabbage Tree Creek. Further analysis is required to substantiate this assessment.

In-stream Channel Supplies

A review of aerial photographs and limited surveys of upstream sections of the creek indicate there are substantial supplies of coarse sandy bedload sediment in upstream sections of the creek. The entire upstream sections of Cabbage Tree Creek have been in-filled with coarse sandy bedload sediment smothering the natural creek bed substrate. These substantial supplies of coarse sandy bedload sediment will progressively migrate downstream, passing through the proposed sand extraction area. Previous analysis of historical aerial photographs of upstream creek sections of Six Mile Creek by Erskine (1996, 2005), concluded that upstream channel widening, channel incision, and lateral reworking of in-stream sediment supplies was the dominant supply of sediment to Six Mile Creek. Erskine (1996) linked these catastrophic channel changes to a statistical increase in annual rainfall in the period from 1947 to 1990, and particularly the massive rainfall event in February 1954.

Based on current aerial photograph interpretation (see Figure 3) approximately 5.9 km of Cabbage Tree Creek immediately upstream of the proposed excavation area has a significant oversupply of coarse sandy bedload sediment stored within the channel. The average estimated bedload sediment volume per km for this 5.9 km creek section was estimated to be 15000 m^3/km (estimated from field surveys[3]) that would contribute an estimated 88500 m^3 of sediment. The adjoining 1.5 km tributary stream to Cabbage Tree Creek contributes an estimated 11250 m^3 of sediment Therefore an estimated **99750 m^3** of coarse sandy bedload sediment can be transported downstream through the proposed sand extraction area on top of the estimated volume of sediment stored within the proposed operation area. Note these estimates are based on limited ground validation and should be treated cautiously.

[3] Estimates of bedload sediment stored within the creek were taken along a 1km section of creek approximately 2km upstream of proposed sediment extraction site. Estimates of bedload sediment storage were based on the average cross section area of bedload sediment multiplied by the length of the creek. An estimated 15000 m^3/Km of bedload sediment was estimated for this section of creek. This sediment consisted of mix of fine to coarse sand similar in distribution to proposed excavation site.

3 Fluvial Geomorphology

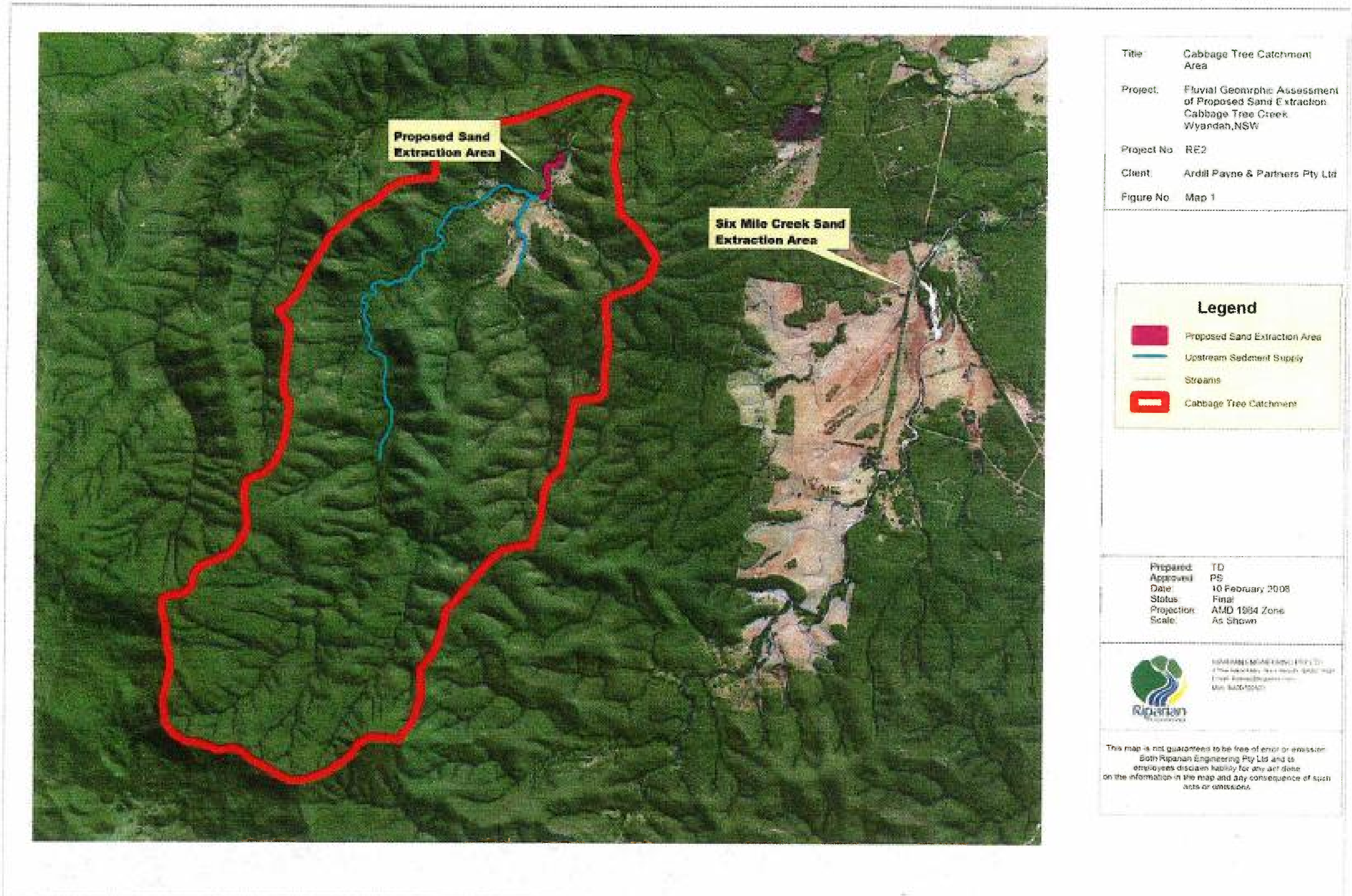

Figure 3. Catchment area of Cabbage Tree Creek showing upstream sediment supplies and sections of the creek where sand extraction is proposed.

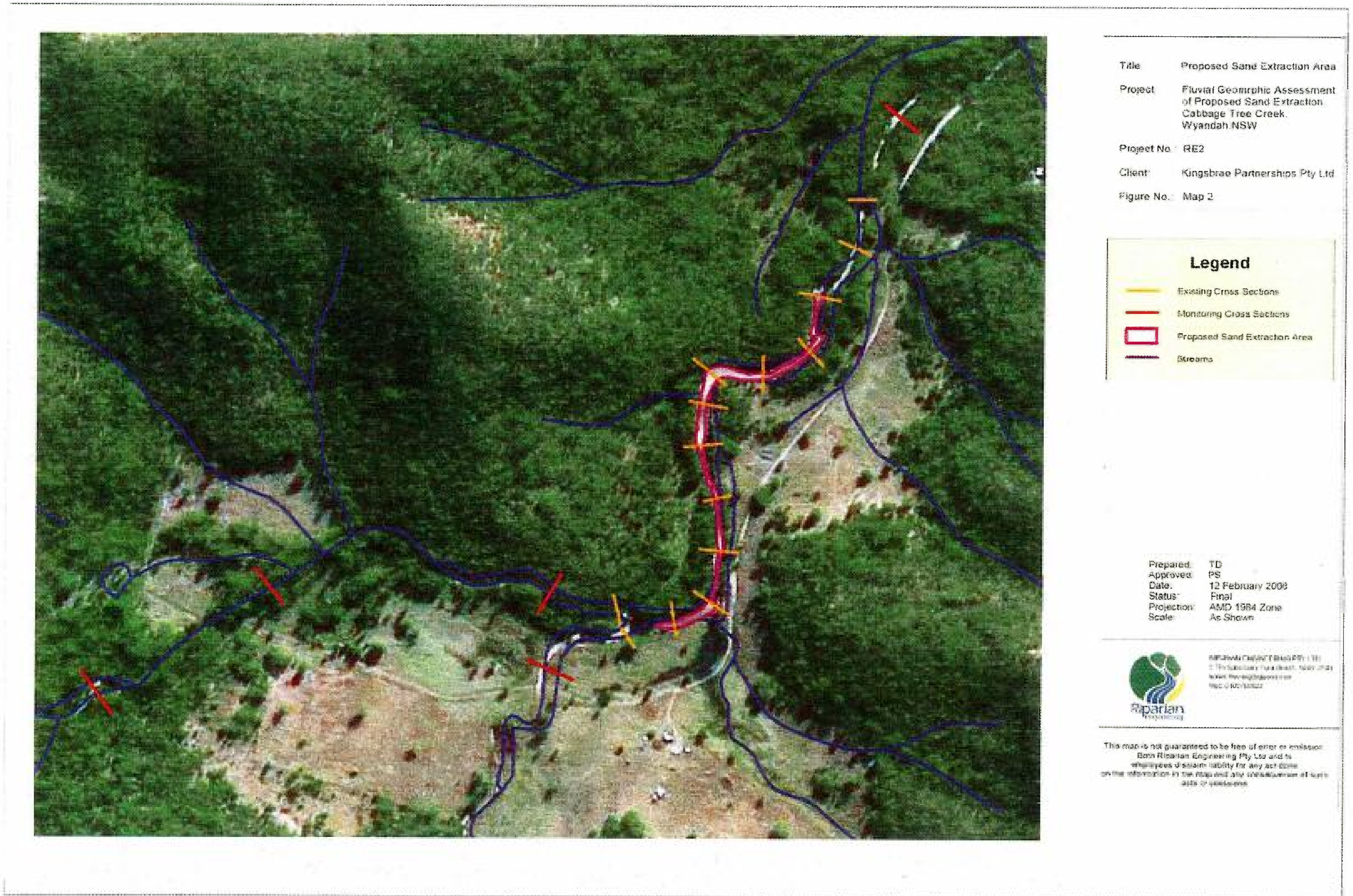

Figure 4. Proposed sand extraction area of Cabbage Tree Creek, existing cross sections, and additional cross sections required for monitoring.

4 Sediment Storage and Extraction Constraints

4.1. Volume of Stored Bedload Sediment

The volume of deposited coarse sandy bedload sediment stored in the surveyed channel, above the original boundary of the creek bed was calculated for each defined segment in Table 1. This was calculated by taking the average area for bedload sediment storage of the upstream and downstream cross section multiplied by the segment length. The total volume of bed load sediment in the proposed sand extraction area is **57357m^3**. Drawings 2 and 3 in Appendix A illustrate cross sections used to calculate these bedload sediment volumes.

Table 1. Total bedload sediment volumes for each creek segment.

CROSSS SECTION	SEGMENT LENGTH(M)	BEDLOAD SEDIMENT VOLUME(M^3)
A	0	137
A - AA	12	2073
AA - B	75	4822
B - C	107	6370
C - D	96	4862
D - E	87	4915
E - F	80	5851
F - FF	52	4542
FF- G	73	4250
G - H	96	4542
H - I	94	4250
I - J	95	5451
J - JJ	70	3785
JJ - K	21	3554
K - L	20	3195
	Total	**58570**

Sand excavation boundary constraints have been specified on channel cross section in Drawings 1, 2, 3, 4 and 5 in Appendix A.

4.2. Extraction Constraints

3 metre Excavation Exclusion Zone

No excavation within 3 m of the bank toe marked on cross section in Drawings 2, 3, 4 and 5 in Appendix A. This provision was based on recommendations made by Erskine (2005 and 1996) who recommended a 3 m excavation exclusion zone adjacent to riparian vegetation. This provision was applied to all steam banks from the bank toe as a means of protecting streams banks and riparian vegetation during excavation operation. It is recommended that all non-vegetated stream banks in the site be revegetated or regeneration allowed occur, especially were submerged bank toes become exposed due to sand extraction.

Maximum Excavation Depth

A maximum excavation depth has been specified for all cross sections (see cross section drawings in Appendix A) where sand extraction will take place. No excavation will be permitted past these maximum depths without further investigation. Communication with the sand excavation operator (Rob King, Kingsbrae Partnership Pty Ltd, *pers. comm. November 2007*) says that he is not likely to excavate down to this depth, citing difficultly with extracting sand from inundated areas. However, as sand is progressively extracted from this area throughout the duration of the operation (up to 30 years) and water tables drop due to seasonal variations in water table (dry condition) it may be commercially viable to extract sand down to these specified maximum depths.

The maximum excavation depth was determined for each cross section by applying a 1(v):4(h) grade from the defined bank toe to the deepest part of the excavated area. The deepest part of the excavated area was taken at the centre of the channel from bank toe to bank toe. Horizontal channel width was taken from bank toe to bank toe on channel cross sections and the maximum depth was calculated as 1/8 of the channel width. The maximum excavation depth was taken from below the existing level of deposited sediment. If the depth to bedrock or the stream bed was less than the maximum excavation depth then this depth was used as the maximum depth. Excavation pit grade was based on the recommendation by Erskine (1996), who recommended that bank batters be no steeper than 1(v): 4(h). Hence, adjacent stream banks will be protected from any potential bank collapse by the grade of the excavated pit during excavation operations.

Maximum Excavation Area

The maximum excavation area was based on the profile specified on cross section Drawings 2 and 3 in Appendix A. These profiles were based on the requirements to maintain a 1(v):4(h) grade during excavation from the defined bank toe to the deepest extraction point.

Maximum Extent of Excavation Zone

The maximum extent of excavation is shown in Drawing 1 in Appendix A. This area shows where excavation can take place. No excavation should extend downstream past cross section B. This was issued to prevent bed level adjustments moving downstream into the adjoining property, and to ensure that as much sediment is trapped upstream by the higher bed level, preventing excessive downstream bedload sediment transport. No excavation is to be undertaken past cross section JJ and cross section JJ is to be excavated to half of its maximum excavation depth. This was issued to ensure a gradual progression between upstream bed levels and excavated bed levels, preventing rapid bed degradation into upstream creek sections.

Maximum Equilibrium Depth and Maximum Equilibrium Excavated Area

The maximum equilibrium excavation area was calculated as equalling the same area as the maximum excavation area for each cross section. However, the maximum equilibrium depth was reduced to account for sand infilling the deepest part of the excavated pit. Sand from upstream, downstream and from the sides of the channel will quickly in-fill the excavated pit. Erskine (1996) discusses this sediment degradation process in more detail and has created a diagram outlying the processes of bed level readjustment caused by the excavated pit. This diagram is presented in Figure 5.

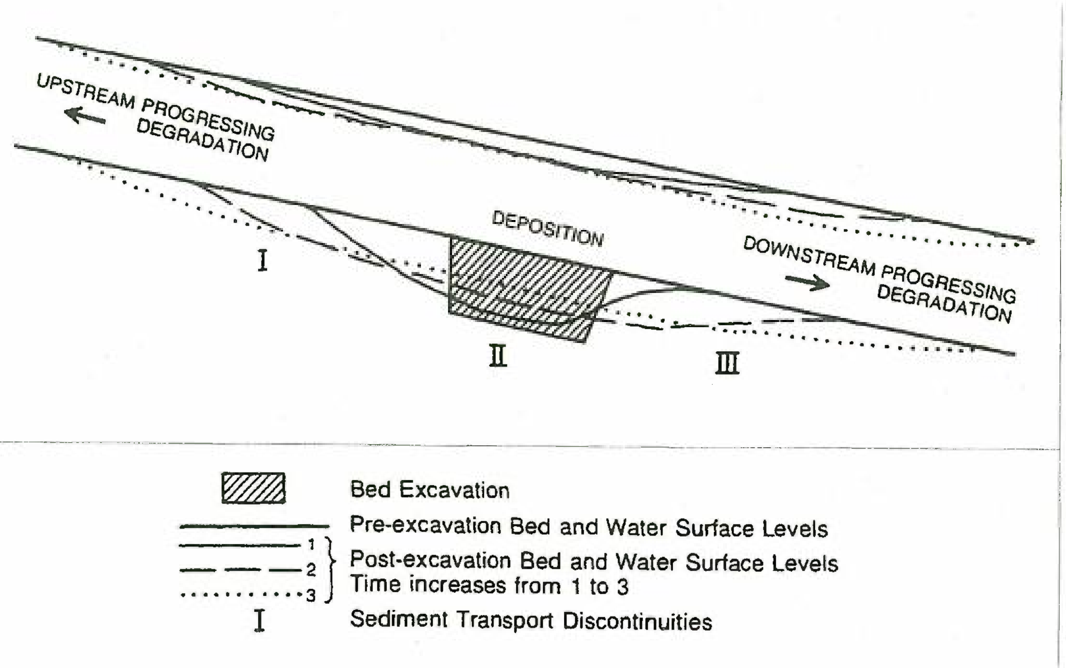

Figure 5 Schematic representation of extraction induced bed level adjustment as the channel reaches a new equilibrium (taken from Erskine 1996, page 24). Water surface levels refer to bed level.

The maximum equilibrium excavation area and depth are shown for channel cross sections in Drawings 4 and 5 in Appendix A. These areas represent what the channel cross sections are predicted to be once the maximum volume of sediment has been excavated and the morphology of the sand is allowed to find its equilibrium condition.

- Excavation will cease in the creek until new sediment is transported into the creek above the maximum equilibrium depth.
- Further assessment is required to determine the feasibility of excavating below the maximum equilibrium bed level. This should be undertaken once bed levels have reached this equilibrium level to consider existing impacts both at the excavation site and upstream (see Monitoring in Section 6.2). Detailed assessments of upstream and downstream monitoring sections should be undertaken to determine if there is sufficient sediment supply and transport.

It should be noted that small variations between maximum equilibrium elevation (AHD) between upstream and downstream cross sections are expected due to variations in channel width and slope, and natural variations in bedload sediment throughput. Small variations of up to 0.8 m in actual maximum equilibrium excavated depth are permitted provided these variations are averaged out and the total volume of excavated sand does not exceed significantly the estimate given in Section 4.3.

4.3. Total Volume of Bedload Sediment Available for Extraction

The maximum excavated volume of coarse sandy bedload sediment that can be removed from each cross section was based on the excavation constraints defined above. It was calculated by taking the average area of the upstream and downstream maximum excavated cross section area multiplied by the segment length. Drawing 2 and 3 in Appendix A, graphically define maximum excavated area for each cross section, that was used to calculate sediment volumes. The total volume of coarse sandy bed load sediment that can be excavated is **24881 m^3**. This volume is based on the assumption that there are no new sediment inputs into the system. However, in operating conditions new upstream sediment supplies would be deposited into the proposed extraction area, replacing sediment removed from the creek.

Table 2. Maximum sandy bedload sediment excavation volumes for each creek segment.

CROSS SECTION	SEGMENT LENGTH(M)	EXCAVATED BEDLOAD SEDIMENT VOLUME(M^3)
A	Not Excavated	Not Excavated
A - AA	Not Excavated	Not Excavated
AA - B	Not Excavated	Not Excavated
B - C	107	1490
C - D	96	2026
D - E	87	2130
E - F	80	3849
F - FF	52	3005
FF- G	73	3291
G - H	96	2482
H - I	94	1905
I - J	95	2689
J - JJ	70	1489
JJ - K	Not Excavated	Not Excavated
K - L	Not Excavated	Not Excavated
	Total	**24881**

5 Evaluation of Sand Extraction Proposal

5.1. Evaluation of Sand Supply

Ardill Payne and Partners have indicated that the client wishes to extract up to **20000 m^3** of sand per year. This rate of sand extraction was evaluated in relation to the information collected in this fluvial geomorphic assessment.

The volume of sandy bedload sediment currently available for extraction in the proposed extraction area is **24881 m^3**. Based on this estimate, there is sufficient storage of sandy bedload sediment to allow the proposed rate of extraction. However, without new sandy bedload sediment inputs from upstream there would only be **4881 m^3** available for extraction in the following year. Hence, annual extraction rates will be highly dependent on sediment replenishment rates into the proposed excavation area. For example, if **15000 m^3** of new bedload sediment is deposited into the proposed extraction area after **20000 m^3** has been excavated in one year, then there will be **19881 m^3** of sand available for extraction. The timing and delivery of this sediment will be dependent on the size, magnitude, and frequency of rainfall events significant enough to entrain sediment transport. So in any given year there may be more or less than the **20000 m^3** available for extraction.

The main controls on annual extraction rates will be sediment replenishment rates, and to ensure that the defined maximum equilibrium excavated area and depth for each cross section is maintained. Annual sediment replenishment rates are dependent on upstream (in-stream) supplies of sediment and its availability for transport through to the proposed sand extraction site. From Section 3.2, the estimated volume of sandy bedload sediment stored upstream is approximately **99750 m^3** . Not all of this will be supplied to the proposed sand extraction area with approximately **30000 m^3** remaining in upstream reaches, ensuring natural bedload sediment transport in the creek after excavation has ceased. Hence, there is approximately **69750 m^3** of sediment that can be transported to the proposed sand extraction area. Therefore, including sandy bedload sediment available for extraction that is stored in the proposed extraction site, there is potentially up to **94631 m^3** of sand available for extraction.

5.2. Changes to Hydraulic Regime of the Creek

The proposed sand extraction will lead to increases in bankfull flow capacity, which will have corresponding hydraulic impacts, which may negatively impact upon the stability of stream banks. This section assessed changes to the hydraulic regime of the creek by determining changes to channel flow capacity, average velocity, and boundary shear stress. The Mannings flow equation can be used to predict increases in channel flow capacity, average velocity and boundary shear stress due to changes in bankfull cross sectional area, hydraulic radius, and bankfull channel depth (Rutherfurd *et al.*, 2000), which were based on the maximum equilibrium excavated bankfull area shown in channel cross section on Drawings 4 and 5, Appendix A.

Changes to Channel Capacity and Average Velocity

The maximum equilibrium excavation area was used to determine the maximum increases in channel flow capacity and average velocity.

Calculations

Using Manning equations we have:

$$V_{bk} = (R^{2/3} S^{1/2}) / n$$

$$Q_{bk} = V_{bk} A$$

$$R = A_{bk}/P_{bk}$$

Where:

V_{bk} = average velocity m/sec at bankfull flood discharge

Q_{bk} = flow m3/sec

R = bankfull hydraulic radius (m)

S = channel slope m/m (given as 0.0021) as determined from survey data using methods given by Harrelson *et al.* (1994)

n = manning coefficient of roughness (given as 0.035 from Erskine 1996)

A_{bk} = bankfull area determined using criteria selected from Australian Rainfall and Runoff (Pilgrim, 1987).

P_{bk} = wetted perimeter of bankfull discharge

5 Evaluation of Sand Extraction Proposal

Table 3. Channel Flow Capacity *Q* (m^3/sec) before excavation and at maximum excavation limits based on creek bed equilibrium depth cross sections.

Cross Section	Q (m^3/sec) @ Bankfull Area (Before Excavation)	Q (m^3/sec) @ Maximum Equilibrium Excavated Bankfull Area
A	3.019	3.044
AA	5.130	5.130
B	6.763	6.335
C	18.231	62.825
D	12.154	32.765
E	17.708	74.702
F	15.829	124.125
FF	4.814	77.339
G	14.400	73.699
H	12.425	35.663
I	13.921	53.415
J	4.221	44.642
JJ	11.486	24.596
K	4.833	4.833
L	4.889	4.889

Results outlined in Table 3 indicate that there will be a dramatic increase in channel flow capacity (Q) as a result of proposed sand extraction down to the maximum equilibrium excavated bankfull area. This will result in less flooding on the floodplain as larger flow (rainfall) events will be required to reach bankfull discharge. This may have a minor impact on floodplain wetlands. It should be noted that the channel flow capacity has significantly decreased due to the excessive sedimentation observed in the creek, and that the proposed excavation operations will restore the channel flow capacity to near natural levels before excessive creek sedimentation.

5 Evaluation of Sand Extraction Proposal

Table 4. Average channel velocity before excavation, at maximum equilibrium excavation limits based on creek bed equilibrium depth cross sections and average increase in average channel velocity.

Cross Section	Average Channel Velocity (m/sec) @ Bankfull Area (Before Excavation)	Average Channel Velocity (m/sec) @ Maximum Excavated Bankfull Area	Average Channel Velocity Increase (%)
A	0.51	0.51	0
AA	0.55	0.55	0
B	0.56	0.52	-6.01
C	0.77	1.22	58.25
D	0.73	1.04	43.26
E	0.73	1.26	72.19
F	0.66	1.45	119.89
FF	0.39	1.17	193.55
G	0.69	1.28	86.25
H	0.74	1.09	48.05
I	0.71	1.18	64.70
J	0.44	1.09	147.23
JJ	0.61	0.81	33.77
K	0.60	0.60	0
L	0.56	0.56	0

Increases in average channel velocity that may occur in various sections of Cabbage Tree Creek are outlined in Table 4. These increases may range from 0 – 193%. As average channel velocities are already very low due to excessive sedimentation in the channel, it is not expected that the 'predicted' increases in average channel velocity (due to excavation) will lead to marked increases in bank erosion and streambed instability. Increases in average channel velocity would occur naturally due to the migration of the sand slug through to downstream reaches.

Changes to Boundary Shear Stress

Boundary shear stress can be used to measure the tractive force being applied to the boundary of the channel or the erosive force acting on stream banks. Dramatic increases in boundary shear stress may lead to bank erosion. However, as boundary shear stress in the existing channel was so low due to the shallow channel depth (caused excessive sedimentation in the creek), increases in boundary shear stress due to the excavated channel may not necessary indicate increased risk of bank erosion. Hence, boundary shear stresses were compared with an upstream reference channel, which had a similar channel capacity, depth and hydraulic radius to the excavated channel cross sections. The upstream reference channel showed little signs of bank erosion and had similar riparian vegetation coverage to the proposed excavation area (see Figure 6 & 7). Stream banks and bedload sediment on the upstream channel reference were also comprised of the same material as the proposed excavation area making the site suitable as a reference.

5 Evaluation of Sand Extraction Proposal

Calculations (Boundary Shear Stress)

$$\tau = \gamma R S$$

Where:

τ=critical shields stress: The force applied to the streambed from the bankfull flow.

γ= density of water (62.4lb/ft^3)

R=hydraulic radius of the bankfull stage converted from meters (m) to feet (ft).

S= average channel slope m/m (given as 0.0021) as determined from survey data using methods given by Harrelson *et al.* (1994).

Results presented in Table 5 suggest that although boundary shear stress in maximum equilibrium excavated cross sections have increased, they were still significantly smaller than that experience in the upstream reference. Hence, it is not likely that increases in boundary shear stress due to the enlarged excavated channel will cause bank erosion.

Table 5. Comparison of boundary shear stress calculated for the maximum equilibrium excavated bankfull area with an upstream reference cross section.

Cross Section	Boundary Shear Stress (lb/ft^3) @ maximum equilibrium excavated bankfull channel	Percentage Difference in Boundary Shear Stress compared to upstream reference channel[4]
A	0.032	-80.5
AA	0.036	-78.1
B	0.033	-79.8
C	0.19	-29.1
D	0.093	-43.9
E	0.12	-25.1
F	0.15	-8.1
FF	0.11	-33.6
G	0.13	-23.3
H	0.10	-39.8
I	0.11	-32.5
J	0.10	-39.8
JJ	0.06	-61.3
K	0.04	-75.3
L	0.04	-77.72

[4] Critical shields stress of upstream reference was based Hydraulic Radius (R)=0.95 and Channel Slope (S) of 0.0027.

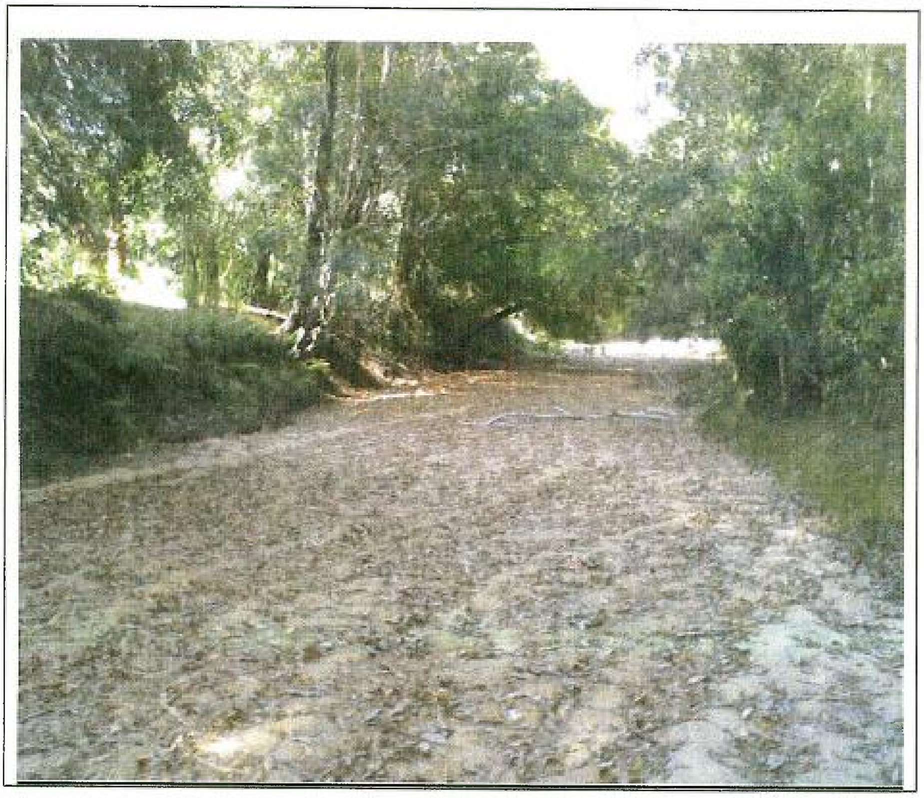

Figure 6. Photo of the reference upstream channel 2 km upstream of the proposed sand extraction site. Note extensive in-stream sandy bedload sediment supplies and a 2 m bank which is stable.

5.3. Bank Erosion & Riparian Vegetation

As sand is excavated from the channel, bank height will effectively increase, hence the stream banks susceptibility to bank slumping, erosion will theoretically increase, especially when the pore water pressure increases during floods (Erskine 1996). The bank materials within the proposed excavation site and upstream are very heterogenous but are often very sandy, usually consisting of fine sands to coarse silt. These banks are highly dependent on riparian vegetation and tree root mats to increase bank shear strength, to prevent bank erosion (Lindsay *et al.*, 1961).

In upstream reaches where riparian vegetation and tree root mass is well established stream banks are not prone to bank slumping or erosion, and stream banks are stable, steep and range from 1.5 m to 3 m high, see Figures 6 and 7.

At the present channel dimensions stream banks are relatively low. As sand is progressively removed from the channel, bank height will increase proportional to the maximum equilibrium excavated depth. To allow for this increase in bank height, it is recommended that additional riparian vegetation be planted or allowed to regenerate on exposed bank toes after sand has been removed from the channel. Field observations indicate that Broad–leaved Paper Bark (*Melaleuca quinquenervia*), Black Sheoak (*Allocasuarina littoralis)* and Teatree (*Leptospermum sp.)* are particularly effective in rapidly forming root systems, which are erosion resistant.

Other native indigenous riparian species recommended by Doyle and Cockerill (2007) can also be used.

Protection of existing riparian vegetation and new plantings are essential to stabilise stream banks. LWD can also be used to stabilise stream bank toes if erosion occurs. LWD should be placed based on recommended guidelines by Brooks (2006).

If in a particularl area bank slumping starts to occur excavation in the near vicinity should cease until the stream bank can be stabilised. Stream banks can be stabilised, by reducing excavation depth and proximity to the stream bank, with riparian vegetation, and or the correct placement of LWD.

Figure 7. Upstream stream banks with establishing riparian vegetation. Note riparian vegetation is only 5-7 years old and is already effective at stabilising stream banks.

5.4. Upstream Geomorphic Impacts

As Figure 5 illustrates, there is a draw down of sediment from upstream supplies into the excavated area, resulting in an excess of sediment transport capacity over sediment supply. This deficiency of sediment is satisfied by entrainment from the upstream bedload sediment supplies, and the discontinuity moves upstream over time (Erskine 1996). Bed level adjustments will migrate upstream from excavation areas to compensate for sediment transport discontinuities created by sand extraction. This sediment transport process will be responsible for delivering almost all of the sandy bedload sediment to the proposed sand extraction area from upstream in-stream sandy bedload sediment supplies. Hence, the immediate effect of excavation is to significantly increase sediment transport from upstream reaches that compensate for the sediment transport discontinuity created by excavation.

This will have positive impacts on the ecological function of upstream reaches by removing excessive high sandy bedload sediment loads, which have completely smothered in-stream geomorphic habitats (see Figure 6). As upstream reaches are extensively vegetated with appropriate riparian vegetation, adjustments to sandy bedload sediment levels will not have an impact on bank stability.

5.5. Recovery Potential and Rehabilitation Measures After Excavation

The proposed excavation operation if undertaken correctly will facilitate the geomorphic recovery potential of both the excavation area and upstream reaches. Based on the creek recovery diagram in Figure 2 developed by Fryirs and Brierley (2005), the proposed excavation area currently was categorised as being in condition D with extensive sedimentation up to the top of bank. Proposed sand excavation will allow for the development of condition F, based on maximum equilibrium excavation areas defined for each cross section in Appendix A, Drawings 4 and 5. Once, excavation operations have ceased in the channel and recommended revegetation works have been put into place, condition G will establish, and this will be the new equilibrium target condition for the creek after excavation has ceased.

6 Recommendations

6.1. Recommended Extraction Strategies

- It is essential to ensure the original bed material underlying the deposited sandy bedload sediment is not disturbed in anyway. No excavation is to proceed into the pre-aggradation long term bed profile.
- No excavation is to proceed below the maximum excavation depth specified for each cross section (see Appendix A, Drawings 2 and 3) until further investigation is completed.
- Existing riparian vegetation should be protected and if disturbed by revegetated with appropriate riparian vegetation species.
- It is essential that the excavation operation be properly monitored by Kings brae Partnerships Pty Ltd based on monitoring strategy provided below.
- No abrupt transitions in channel width and depth should remain at the completion of extraction, particularly with upstream stream sections. Furthermore, all access roads to the channel should be rehabilitated. All stockpiles should be removed and all disturbed areas should be revegetated.
- Optimum channel dimensions after excavation operations should closely resemble maximum equilibrium excavation areas defined for each cross section in Appendix A, Drawings 4 and 5.
- As bank toes covered in sediment become exposed it is recommended that these bank toes are revegetated with suitable riparian vegetation.

6.2. Monitoring

It is recommended that the following monitoring strategies be put into effect.

- Survey changes to bed levels at existing cross sections. At the same cross sections signs of bed and bank instability should be noted and assessed in more detail if they causing excessive bank erosion. Existing cross sections should be surveyed after 20000 m^3, 40000 m^3, 60000 m^3, 80000 m^3, and 99750 m^3 has been excavated from the creek.

- Survey changes to bed levels at upstream and downstream monitoring cross sections. There are four upstream and one downstream monitoring cross sections (see figure 4). At the same cross sections signs of bed and bank instability should be noted and assessed in more detail if they causing excessive bank erosion. Monitoring cross sections should be surveyed after 40000 m^3, 60000 m^3, 80000 m^3, and 99750 m^3 has been excavated from the creek.

- Survey changes at selected cross sections after major flood events (greater than a 1:10 yr ARI) in the creek, once a minium of 20000 m^3 has been removed, to determine sediment transport delivery (sand replenishment rates) to site and if there are any negative impacts to the geomorphic stability of the creek.

6 Recommendations

- A geomorphic assessment of the sand extraction operation after 99750 m^3 of bedload sediment has been removed from the creek, based on data collect from surveys, geomorphic assessment of channel stability and recovery processes, and upstream supplies of sediment. The assessment will establish if more sediment can be extracted from the creek.

7 References

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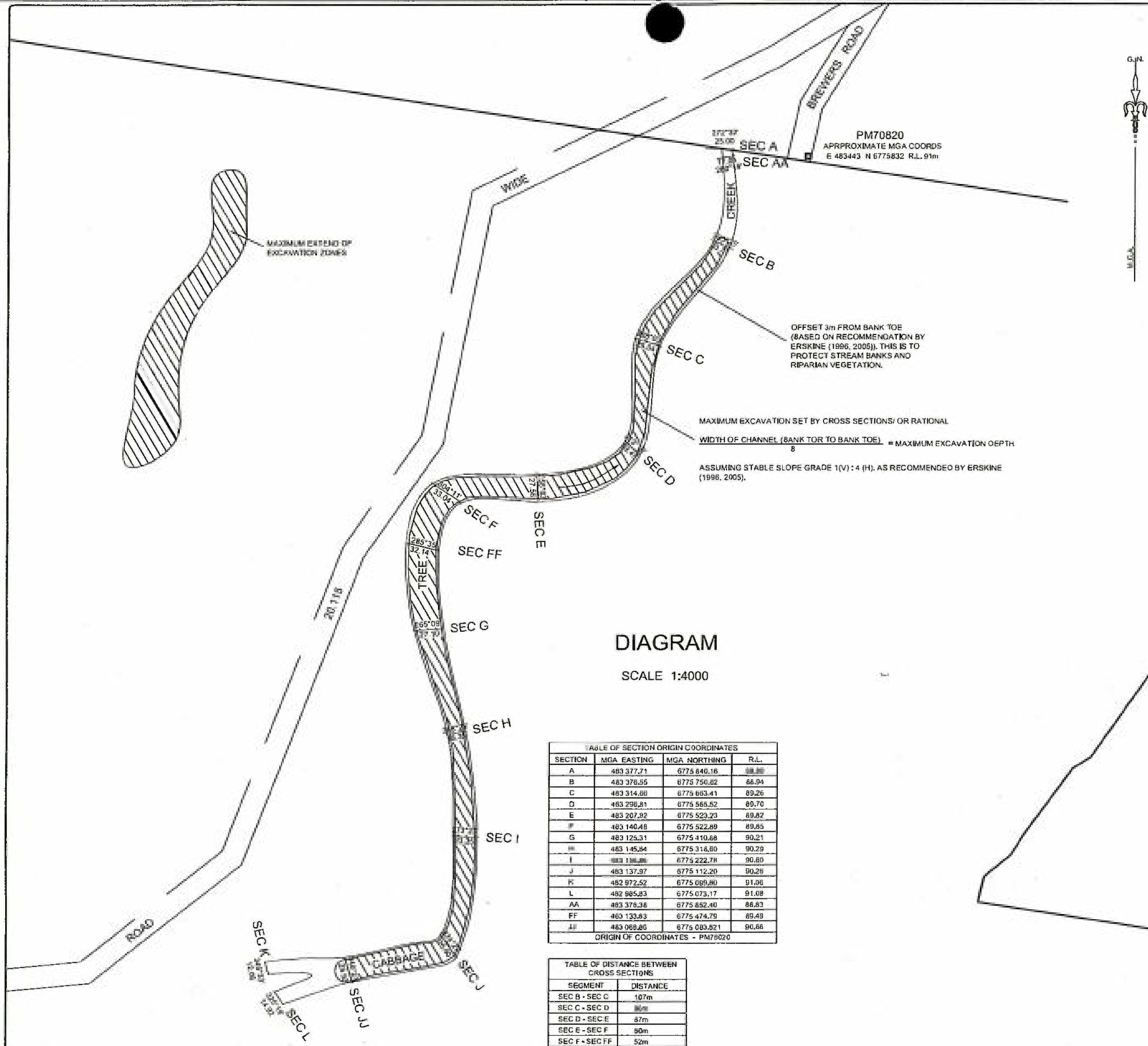
Appendix A
Cross section Drawings1 – 5

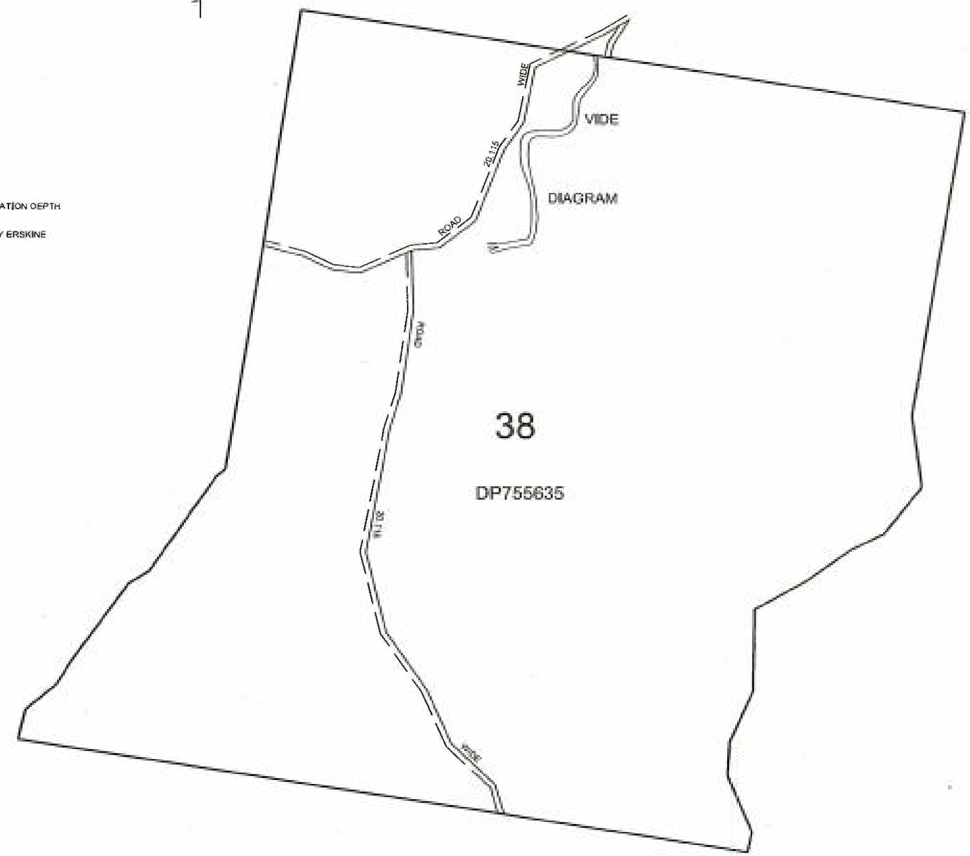


DIAGRAM

SCALE 1:4000

TABLE OF SECTION ORIGIN COORDINATES			
SECTION	MGA EASTING	MGA NORTHING	R.L.
A	483 377.71	6775 840.16	[illegible]
B	483 376.55	6775 750.62	88.94
C	483 314.66	6775 663.41	89.26
D	463 296.81	6775 565.52	89.70
E	483 207.82	6775 523.23	89.82
F	483 140.48	6775 522.89	89.85
G	483 125.31	6775 410.88	90.21
H	483 145.84	6775 318.60	90.29
I	[illegible]	6775 222.78	90.60
J	483 137.97	6775 112.20	90.26
K	482 972.52	6775 099.80	91.06
L	482 985.83	6775 073.17	91.08
AA	483 376.38	6775 852.40	88.83
FF	463 133.83	6775 474.79	89.49
JJ	483 068.86	6775 083.821	90.88
ORIGIN OF COORDINATES - PM78020			

TABLE OF DISTANCE BETWEEN CROSS SECTIONS	
SEGMENT	DISTANCE
SEC B - SEC C	107m
SEC C - SEC D	[illegible]
SEC D - SEC E	87m
SEC E - SEC F	80m
SEC F - SEC FF	52m
SEC FF - SEC G	73m
SEC G - SEC H	96m
SEC H - SEC I	94m
SEC I - SEC J	[illegible]
SEC J - SEC JJ	70m



PLAN

SCALE 1:20000

CREEK BED EXCAVATION DATA SUPPLIED BY

Riparian Engineering Pty Ltd
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3/7-9 Aubrey Street Surfers Paradise 4217
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fluvial@bigpond.com.au

Do not scale drawing. Use written dimensions only

Issue	Date	Amendment	Appd
		FINAL	

Client: KINGSBRAE SAND QUARRY

Project: LOT 38 DP755635 BREWERS ROAD KIPPENDUFF

Title: DRAWING 1 PLAN

ARDILL PAYNE & PARTNERS
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PROJECT MANAGERS AND TOWN PLANNERS
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79 Tamar Street
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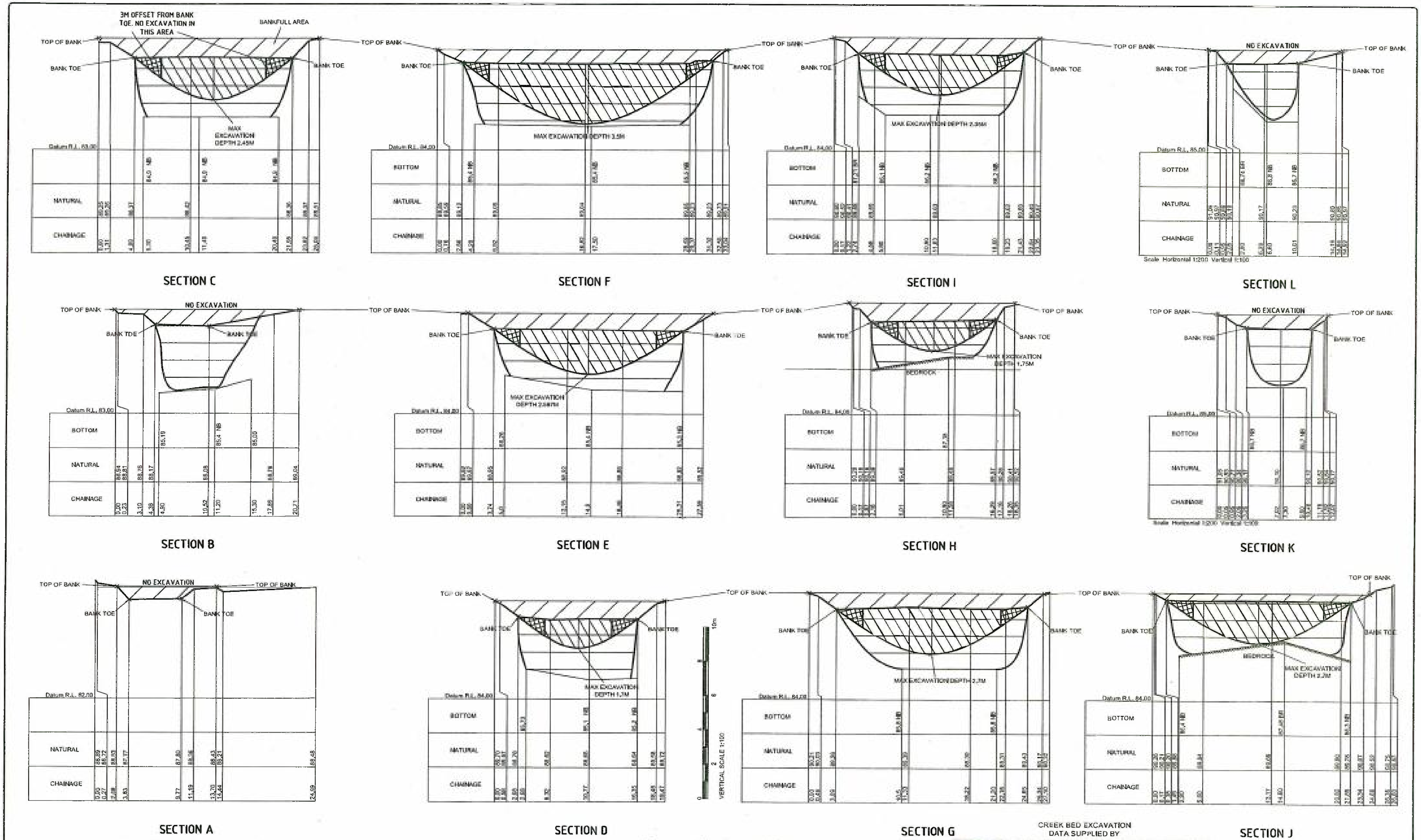
e-mail: info@ardillpayne.com.au

Surveyed	JS	Scale at A3	SEE ABOVE
Drawn	RB	Datum	A.H.D. (APPROX)
Date	FEB 2008	Filename	6518XS_2
Checked		Approved	
Job No.	07/6518	Dwg No.	Sv.04



HORIZONTAL SCALE 1:200

CREEK BED EXCAVATION
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Scale Horizontal 1:200 Vertical 1:100

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Issue	Date	Amendment	Appd
		FINAL	

Client: KINGSBRAE SAND QUARRY

Project: LOT 38 DP755635
BREWERS ROAD
KIPPENDUFF

Title: DRAWING 2
CREEK BED EXCAVATION
CROSS SECTIONS

ARDILL PAYNE & PARTNERS
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Surveyed	JS	Scale at A1	SEE ABOVE
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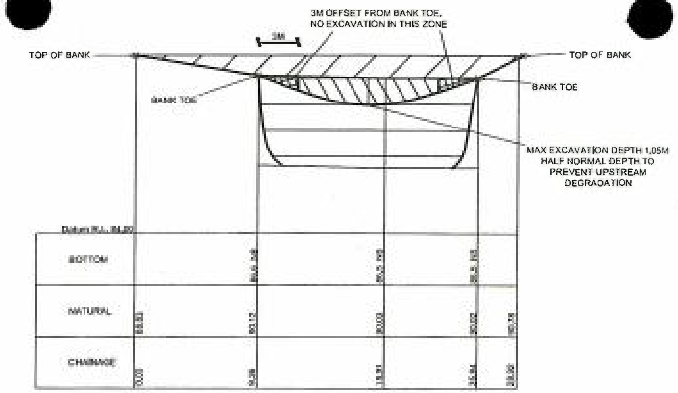
Date	FEB 2008	Filename	6518XS_2
Checked		Approved	
Job No.	07/6518	Drg. No.	Sv.05



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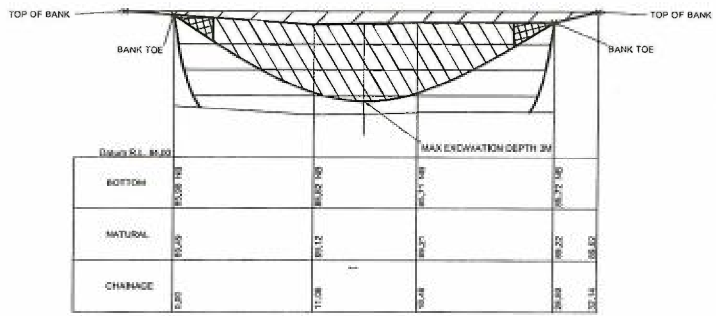

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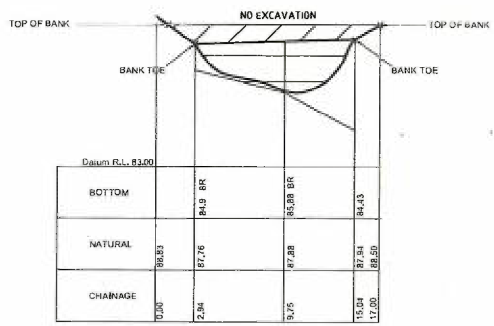

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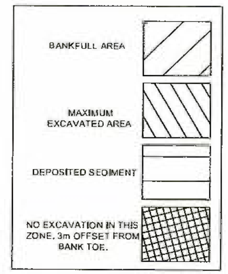

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C	23.6	52.0
D	16.6	40.0
E	24.1	57.0
F	23.9	66.6
FF	19.1	71.9
G	20.8	54.2
H	16.8	39.4
I	19.4	47.7
J	9.5	48.3
JJ	18.8	59.2
K	8.0	25.5
L	8.7	30.5

TOTAL SEDIMENT 58, 570m³
TOTAL EXCAVATED SEDIMET 24, 880m³

CREEK BED EXCAVATION
DATA SUPPLIED BY

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Scale Horizontal 1:200 Vertical 1:100

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Issue	Date	Amendment	App'd
		FINAL	

Client: KINGSBRAE SAND QUARRY

Project: LOT 38 DP755635
BREWERS ROAD
KIPPENDUFF

Title: DRAWING 3
CREEK BED EXCAVATION
CROSS SECTIONS

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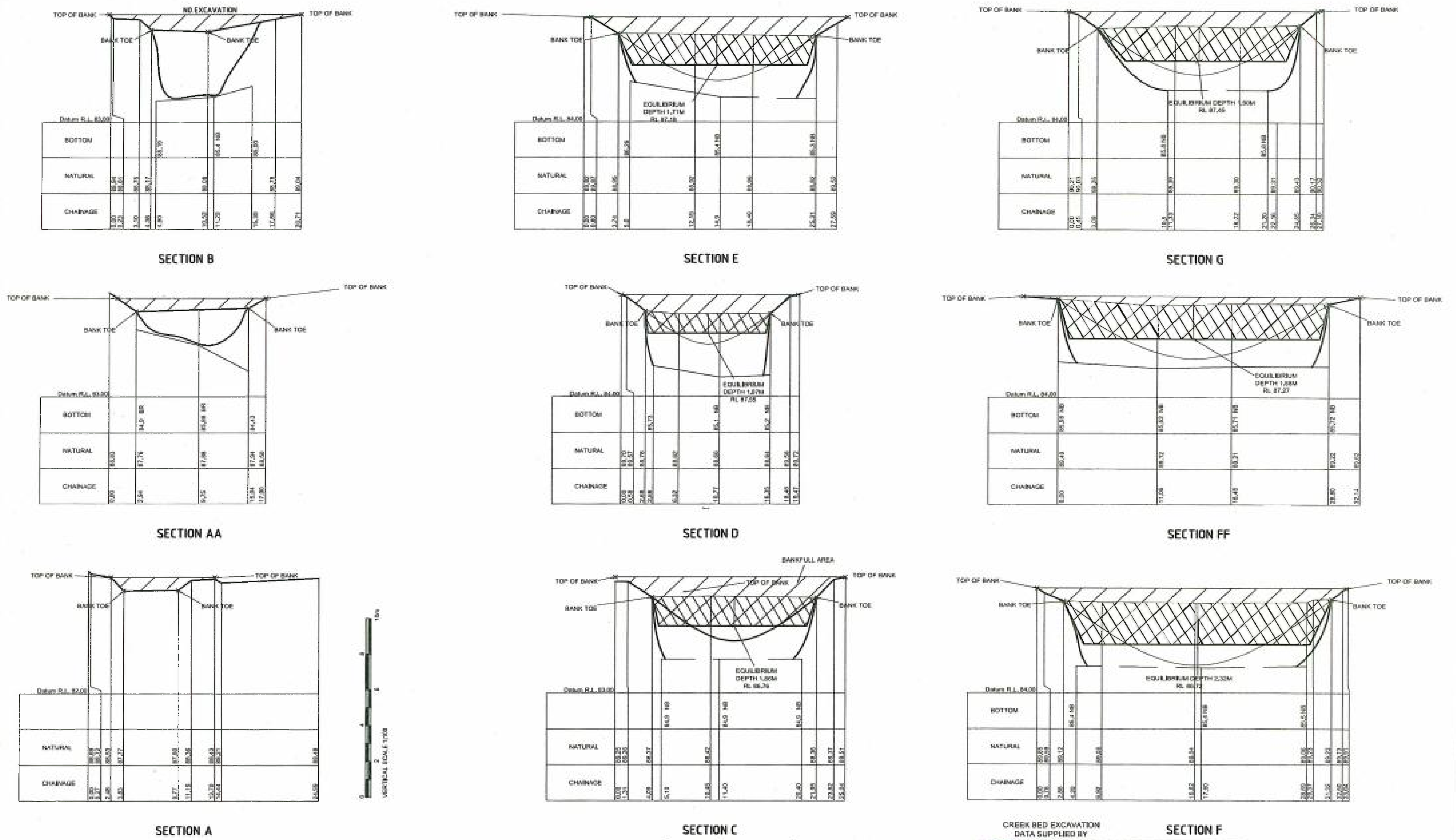

NOTE: SMALL VARIATIONS IN EQUILIBRIUM BED DEPTHS ARE EXPECTED REFLECTING NATURAL SEDIMENT PROCESSES.

CREEK BED EXCAVATION DATA SUPPLIED BY

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Issue	Date	Amendment	App'd
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Client: KINGSBRAE SAND QUARRY

Project: LOT 38 DP755635 BREWERS ROAD KIPPENDUFF

Title: DRAWING 4 CREEK BED EQUILIBRIUM EXCAVATED CROSS SECTIONS

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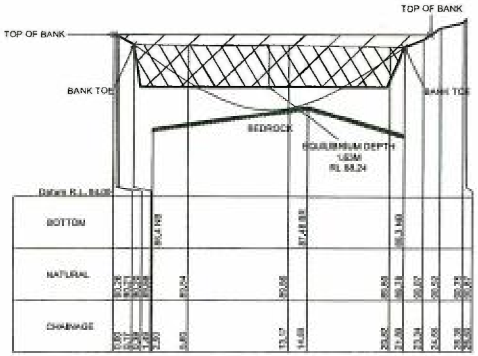

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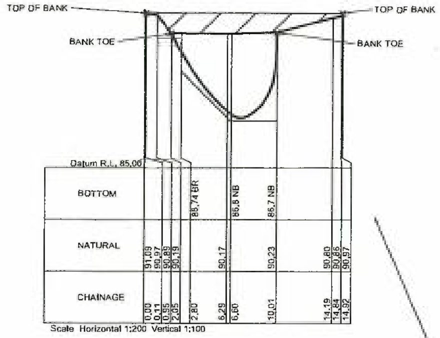

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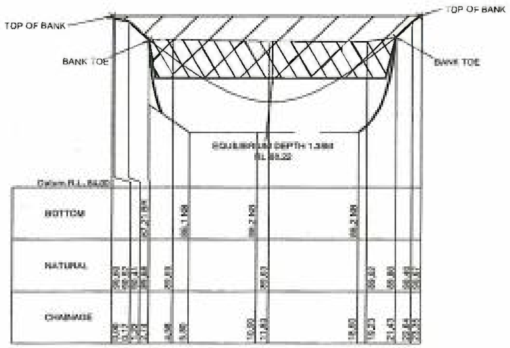

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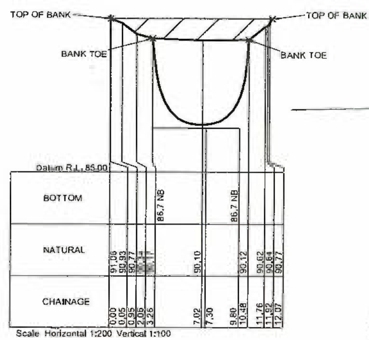


SECTION K

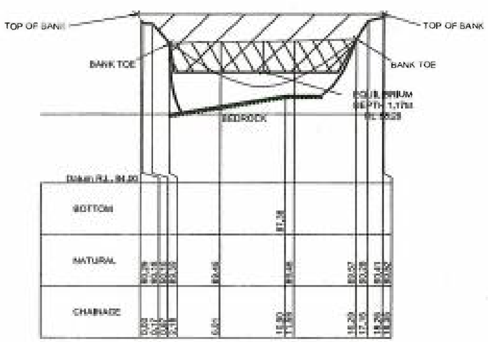
NOTE: EQUILIBRIUM BED DEPTH WILL LOWER IN THE CROSS SECTIONS L,K AND JJ. AS BED LEVEL ADJUSTMENTS MIGRATE UPSTREAM THROUGHOUT THE DURATION OF THE OPERATION

LEGEND

MAXIMUM EQUILIBRIUM EXCAVATED BANKFULL AREA	
MAXIMUM EQUILIBRIUM EXCAVATED AREA	
DEPOSITED SEDIMENT	

TABLE OF SECTION PROPERTIES		
SECTION	BANKFILL AREA (M²)	BANKFILL PERIMETER (M²)
A	5.9	23.7
AA	8.2	33.0
B	12.8	42.8
C	23.6	52.0
D	18.8	48.0
E	24.1	67.0
F	23.9	66.6
FF	12.5	71.9
G	20.8	54.2
H	15.8	38.4
I	19.4	47.7
J	9.5	45.3
JJ	18.8	59.2
K	6.3	35.5
L	6.7	30.5

TOTAL SEDIMENT VOLUME 58, 570m³
TOTAL EXCAVATED SEDIMENT 24, 880m³



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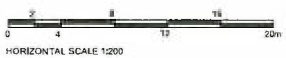

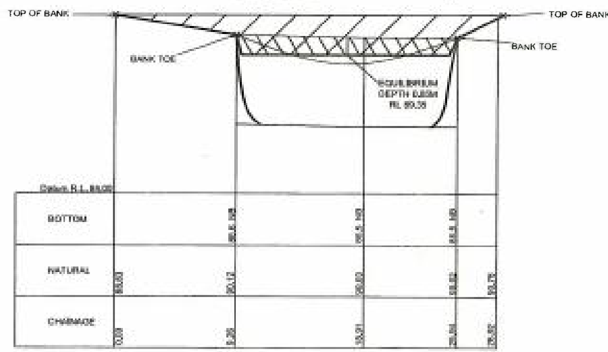

SECTION JJ

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Scale Horizontal 1:200 Vertical 1:100

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Issue	Date	Amendment	App'd
		FINAL	

Client: KINGSBRAE SAND QUARRY

Project: LOT 38 DP755635 BREWERS ROAD KIPPENDUFF

Title: DRAWING 5 CREEK BED EQUILIBRIUM EXCAVATED CROSS SECTIONS

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e-mail: info@ardillpayne.com.au

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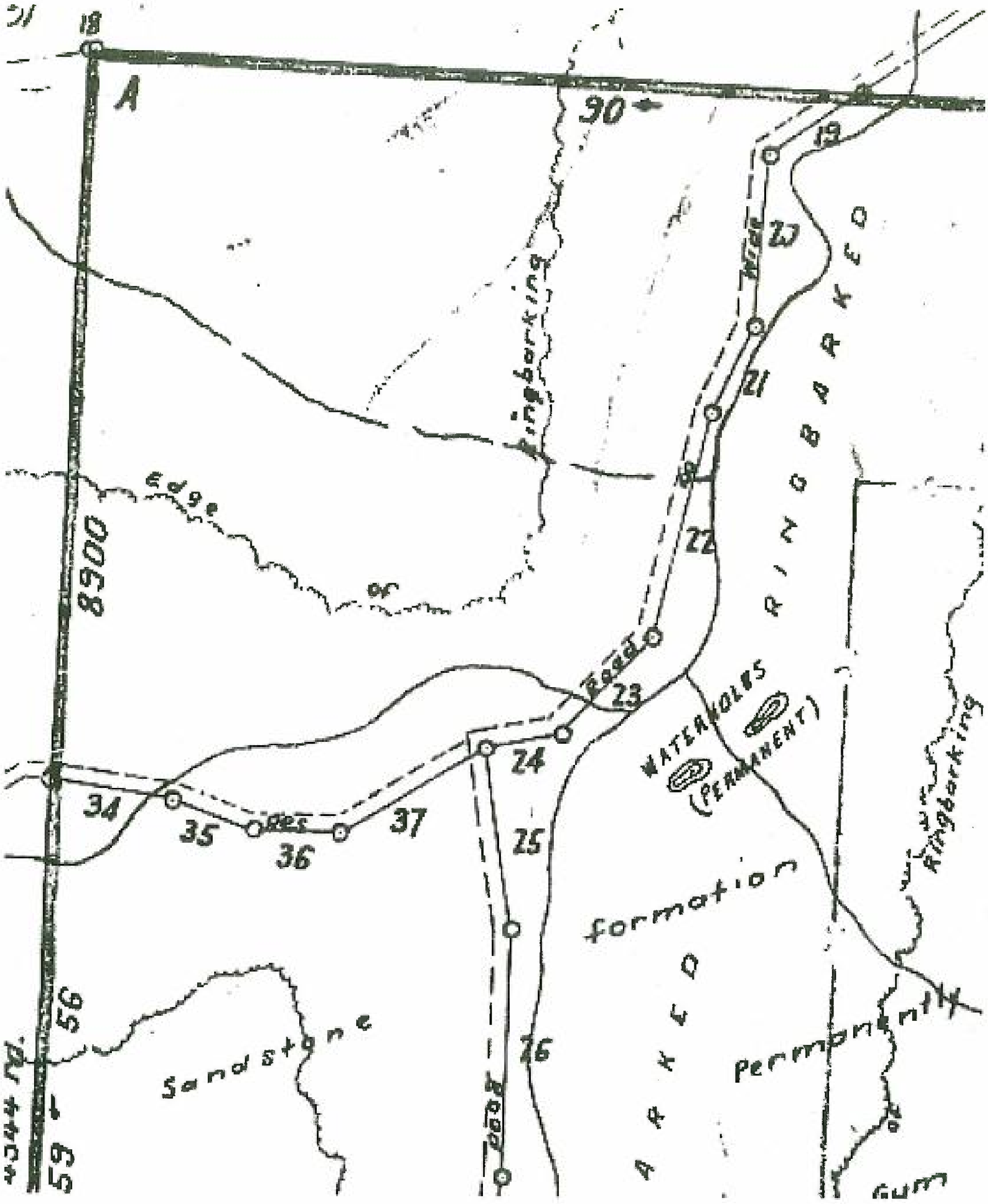
Date	FEB 2008	Filename	6518XS_2
Checked		Approved	
Job No.	07/6518	Dwg. No.	Sv.08

Appendix B

Plan of Portion 38, Conty of Richmond, Parish of Wyandah, 1917

Appendix B



18
A
90
19
20
Wide
21
Ringbarking
RINGBARKED
Edge
of
8900
22
Road
23
WATERHOLES (PERMANENT)
24
34
35
36
37
25
formation
Ringbarking
Permanently
56
Sandstone
26
59
Road
Gum

Appendix C
Bedload Sediment Particle Size

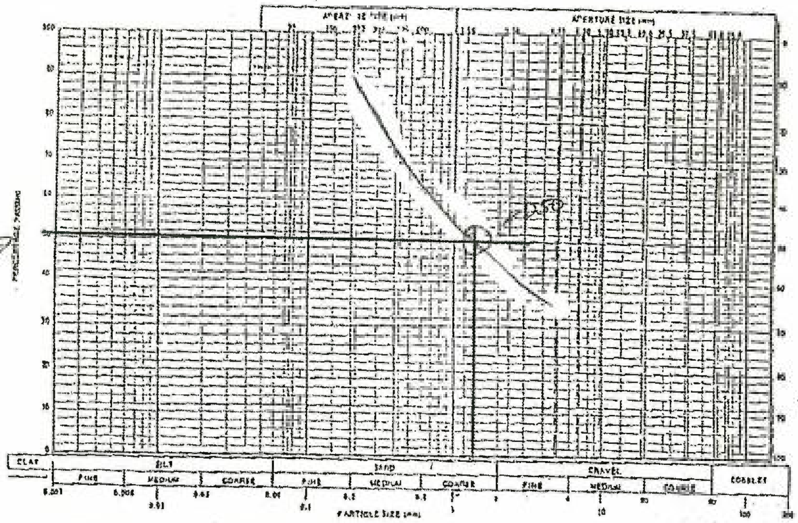
M. L. Smith
Rapville

CONTROL TESTING LABORATORIES

Inc. Concrete Control - A.C.N. 000 130 349
PORT MACQUARIE * COFFS HARBOUR * BYRON BAY
066-811688 066-538216 066-858604
Correspondence : P.O. Box 871, Coffs Harbour, NSW 2450 Tel. & Fax (066) 53 8216

CLIENT:	MARTIN HAULAGE	A/C Ref:	MIS 379	Lab.No:	3329
PROJECT:	ASSESSMENT OF SAND	TEST DATE:	29/11/93	BY:	SM
LOCATION:	EX CASINO CONCRETE	DATE SAMPLED:	–	BY:	CLIENT
MATERIAL:	FINE AGGREGATE	TEST No.:	1307	PAGE	2 OF 2

AGGREGATE REPORT - Test Method AS 1141.11, T201



D50

Sieve Analysis(%passing)	Test Result	AS Specified	RTA Specified
75.0mm			
63.0mm			
37.5mm			
26.5mm			
19.0mm			
13.2mm			
9.5mm			
6.7mm			
4.75mm	100	90-100	
2.36mm	99	60-100	
1.18mm	92	30-80	
0.850mm	–		
0.600mm	D50 → 50	15-60	
0.425mm	–		
0.300mm	9	5-40	
0.150mm	0	0-25	
0.075mm		0-10	

This Laboratory is [illegible] by the National [illegible] of Testing Authorities, Australia. The [illegible] herein have been performed in [illegible] of registration. This document [illegible]

Appendix E
Flora and fauna assessment

CONACHER

TRAVERS

environmental consultants

FLORA AND FAUNA ASSESSMENT

PROPOSED SAND EXTRACTION OPERATION

CABBAGE TREE CREEK
BREWERS ROAD
WYANDAH

SEPTEMBER 2007
(REF: 7147F)

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FLORA AND FAUNA ASSESSMENT

PROPOSED SAND EXTRACTION OPERATION

CABBAGE TREE CREEK
BREWERS ROAD
WYANDAH

SEPTEMBER 2007

Conacher Travers

Environmental Consultants

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PREFACE

This Flora and Fauna Assessment Report has been prepared by *Conacher Travers Pty Ltd* to provide information regarding a proposed sand extraction operation in Cabbage Tree Creek within land at Brewers Road, Wyandah. This Report provides an assessment of existing habitats and the potential for threatened species, as listed within the *Threatened Species Conservation Act* (1995), to occur within the site. This information will be used for the completion of a 7-part test in accordance with Section 5A of the *Environmental Planning and Assessment Act* (1979) to assess the significance of the proposed development. It will also be used to provide background information for use in a Site Rehabilitation Plan to be implemented for the active mining area and adjacent areas.

Report and Field Survey completed by:

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1. BACKGROUND

This report provides an assessment of the flora and fauna and potential for threatened species to occur within land at Lot 38 DP 755635, No. 543 Brewers Road, Wyandah. An area of the bed of Cabbage Tree Creek within this land has been identified for sand extraction, and as such an assessment of the sites habitat value and presence or potential presence of threatened species as listed within the *Threatened Species Conservation (TSC) Act* (1995) has been completed.

The report will also determine whether or not a Species Impact Statement should be prepared for the proposed development according to the provisions of the *Threatened Species Conservation Act (TSC) (1995)* and Section 5(A) of the *Environmental Planning & Assessment (EP&A) Act (1979).* A Site Rehabilitation Plan is also to be prepared detailing measures required for short and long term rehabilitation of the active mining site and adjacent areas.

For the purposes of this assessment the subject site refers to the area of impact, that is the creek bed, and the adjacent riparian vegetation. A plan of the subject site is shown as Figure 1.

1.1 SITE DETAILS

The planning and cadastral details of the subject site are provided in Table 1.1 while Table 1.2 summarises the geographical characteristics of the site.

TABLE 1.1 SITE DETAILS	
Location	Cabbage Tree Creek, Lot 38 DP 755635, No. 543 Brewers Road, Parish of Wyandah, County of Richmond
Topographic Map	Clearfield 1:25 000
MGA Grid Reference	483000E 6775000N
Local Government Area	Richmond Valley Council
Existing Land Use	Sand extraction site until 2000 and disused since/Cattle grazing
Proposed Development	Sand extraction from creek bed

TABLE 1.2 SITE CHARACTERISTICS	
Elevation	Approximately 85m AHD
Slope	Less than 2%
Catchment	Cabbage Tree Creek
Drainage	Cabbage Tree Creek flows in northerly direction through subject site
Vegetation	Riparian Tall Open Forest, Disturbed Swamp Low Woodland, Disturbed Regrowth Scrub, Grassland with Scattered Trees.

1.2 PROPOSED DEVELOPMENT

The re-establishment of a sand extraction operation is proposed for an approximately 700-800 metre area of the bed of Cabbage Tree Creek. Activities will be restricted to the creek bed. Access to the creek will be from points used as part of previous extraction activities. No clearing of vegetation will be required as part of the extraction operation. A sand extraction plant operated at the site for five years until 2005 as part of a previous approval. No operations have occurred since this date. The sand extraction methods and treatments will occur similar to that granted as part of the previous approval. This will involve the removal of up to 25 000 tonnes of sand per annum. A Site Rehabilitation Plan has been prepared for the site (*Conacher Travers* 2007).

Flora and fauna survey locations are approximate and have not been fixed by land survey.

*Subject Site boundary subject to final survey

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0 20 40 60 80 100 m

1:2,500

Original plan produced in A3 colour

Drawing No.	7147	Date
Drawn By	KF	12/09/07
Amendment		Date
A		
B		
C		

Figure 1 -
Vegetation Communities & Survey Locations
Cabbage Tree Creek

Source: DLWC 1:25,000 Aerial Photograph.

2. THREATENED SPECIES DETAILS

A search of the Atlas of NSW Wildlife (DECC, 2007) was undertaken to identify records of threatened flora and fauna species, as listed within the *Threatened Species Conservation (TSC) Act 1995*, located within 20km of the subject site. This enabled the preparation of a list of threatened flora and fauna species that could possibly occur within the habitats found on the site. Details on these species are provided in Table 2.1 (Threatened Flora) & Table 2.2 (Threatened Fauna).

TABLE 2.1
THREATENED FLORA SPECIES OF THE AREA

Species	TSC Act	EPBC Act	Growth Form and Habitat Requirements	Comments
Heart-leaved Star Hair *Astrotricha cordata*	E	-	A shrub to 3m tall growing in dry eucalypt forest on exposed rocky summits, cliff edges and rocky slopes. Restricted to approximately five populations occurring in Mt Belmore State Forest and Mount Neville Nature Reserve in north-east NSW.	No suitable habitat present.
Water Nutgrass *Cyperus aquatilis*	E	-	A sedge 10-30cm tall appearing as an annual during the wet summer period. Growing in ephemerally wet sites, such as roadside ditches and seepage areas from small cliffs, in sandstone areas. In NSW, it is known only from a few sites north from Grafton.	Suitable habitat present. Not observed within the subject site.
Square-stemmed Spike-rush *Eleocharis tetraquetra*	E	-	A tufted perennial plant found in damp locations on stream edges and in and on the margins of freshwater swamps. Distributed from Coffs Harbour along the north coast to Murwillumbah and the SE QLD.	Suitable habitat present. Not observed within the subject site.
Bordered Guinea Flower *Hibbertia marginata*	E	E	A small shrub growing to 0.5m tall in grassy or shrubby dry open eucalypt forest at low altitudes on sandstone. Occurs only in north-east NSW, where it is restricted to the southern Richmond Range between Casino and Grafton.	No suitable habitat present.
Rupp's Wattle *Acacia ruppii*	E	E	An erect, open shrub 1-2m tall in height and spread growing in dry open forest and shrubland in sandstone areas, often near creeks and on roadsides. Occurs at altitudes of 50-150m in the Banyabba–Coaldale area to the north-west of Grafton. Although plentiful in some locations it is restricted to a small area.	Sub-optimal habitat present. Not observed within the subject site.

TABLE 2.1 (Cont.) THREATENED FLORA SPECIES OF THE AREA				
Species	**TSC Act**	**EPBC Act**	**Growth Form and Habitat Requirements**	**Comments**
Narrow-leaf Finger Fern *Grammitis stenophylla*	E	-	A little fern growing in small colonies in moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest. Occurs in eastern Queensland and eastern NSW. In NSW it has been found on the south, central and north coasts and as far west as Mount Kaputar National Park near Narrabrai.	Sub-optimal habitat present. Not observed within the subject site.
Nightcap Plectranthus *Plectranthus nitidus*	E	E	A small shrub 30-150cm tall growing on rocky cliff-faces and boulders, in the shelter and shade provided by the adjacent rainforest. Co-occurs with *Plectranthus graveolens* and Croften Weed. Known only from Nightcap National Park, and the Nullum and Richmond Range State Forests.	No suitable habitat present.
Spiny Mint-bush *Prostanthera spinosa*	V	-	An aromatic, scrambling, prostrate shrub, to 0.5m tall growing in skeletal sandy soils of rocky areas. Occurs in NSW, VIC and SA. In NSW it is located within a small area to the north of Grafton.	No suitable habitat present.
Woodland Babingtonia *Babingtonia silvestris*	E	-	A shrub growing to 2.5m tall amongst granite or rhyolite rock outcrops in shrubby woodland. Occurs with species such as *Eucalyptus prava*, *Leptospermum brevipes* and *Leucopogon melaleucoides*. Occurs in scattered localities in NE NSW and south Queensland. In NSW the species is known from the Dorrigo area and Mount Neville Nature Reserve.	No suitable habitat present.
Slaty Red Gum *Eucalyptus glaucina*	V	V	Medium-sized tree to 30m tall growing in grassy woodland and dry eucalyptus forest on deep, moderately fertile and well-watered soils. Found only on the north coast of NSW in Casino and Taree to Broke, west of Maitland.	Sub-optimal habitat present. Not observed within the subject site.
Weeping Paperbark *Melaleuca irbyana*	E	-	Weeping Paperbark (formerly *Melaleuca tamariscina subsp. irbyana*) grows to 8m tall in open eucalypt forest in poorly drained, usually clay soils. Found only Coraki, Casino and Coutts Crossing south of Grafton in NE NSW. Also near Ipswich SE Qld.	Sub-optimal habitat present. Not observed within the subject site.

TABLE 2.1 (Cont.) THREATENED FLORA SPECIES OF THE AREA				
Species	**TSC Act**	**EPBC Act**	**Growth Form and Habitat Requirements**	**Comments**
Square-stemmed Olax *Olax angulata*	V	V	An upright shrub, which may be parasitic on the roots of other plants, growing in low-lying coastal heathland and heathy woodlands on sandy soils near swamps, often in association with *Banksia aemula*. Restricted to a small area east of Grafton, near Minnie Water and Wooli, mainly in Yuraygir National Park and on nearby leasehold land. Locally common.	No suitable habitat present.
Native Milkwort *Polygala linariifolia*	E	-	Native annual or perennial herb about 20cm tall growing in dry eucalypt forest and woodland with a sparse understorey. In NSW, it is found on the north coast near Casino and Kyogle.	No suitable habitat present.
Banyabba Grevillea *Grevillea banyabba*	V	V	An open-branched shrub to 1-1.5m tall growing in shrubby open eucalypt forest on low ridges and slopes with poor sandy soil. Often growing in association with *Eucalyptus psammitica*, *Angophora robur* and *Corymbia intermedia*. Restricted to the Fortis Creek–Coaldale area between Grafton and Whiporie. Most plants are in one population in the Banyabba Nature Reserve.	No suitable habitat present.
Four-tailed Grevillea *Grevillea quadricauda*	V	V	A bushy shrub to 2m growing in gravely loam, in the understorey of dry eucalypt forest, usually along or near creeks. In NSW it is found to the north-west of Whiporie in Mount Belmore State Forest and Mount Neville Nature Reserve, and at Tucabia east of Grafton.	Sub-optimal habitat present. Not observed within the subject site.
Sweet False Galium *Hedyotis galioides*	E	-	An erect or ground-hugging annual herb growing around margins of seasonally inundated wetlands in paperbark swamps and Forest Red Gum (*Eucalyptus tereticornis*) woodlands. In NSW it is found in Whiporie State Forest south of Casino and one location in the Tweed district.	Sub-optimal habitat present. Not observed within the subject site.

TABLE 2.2 THREATENED FAUNA SPECIES OF THE AREA				
Species	**TSC Act**	**EPBC Act**	**Growth Form and Habitat Requirements**	**Comments**
Giant Barred Frog *Mixophyes iteratus*	E	E	Terrestrial inhabitant of rainforest and open forests. Distribution Limit- N-Border Ranges National Park. S-Narooma.	Suitable habitat present.
Green-thighed Frog *Litoria brevipalmata*	V	-	Found in rainforests and open forests within or at the edge of streams, swamps, lagoons, dams and ponds. Distributed along the coast and ranges from the NSW central coast to south-east Queensland.	Suitable habitat present.
White-crowned Snake *Cacophis harriettae*	V	-	Occurs in rainforest and open forests along the coastal areas and adjacent slopes utilising rotting logs, litter and debris for shelter. Distribution Limit- N-Condong S-Wentworth Falls.	Suitable habitat present.
Black Bittern *Ixobrychus flavicollis*	V	-	Freshwater & brackish streams & ponds. Distribution Limit - N-Tweed Heads. S-South of Eden.	Suitable habitat present.
Black-necked Stork *Ephippiorhynchus asiaticus*	E	-	Occurs in tropical to warm temperate terrestrial wetlands, estuarine and littoral habitats. Distribution Limit - N-Tweed Heads. S-Nowra.	Suitable habitat present.
Comb-crested Jacana *Irediparra gallinacea*	V	-	Deep and permanent vegetation-choked tropical and warm temperate wetlands. Distribution Limit - N-Tweed Heads. S - Ku-ring-gai Chase National Park.	No suitable habitat present.
Wompoo Fruit-Dove *Ptilinopus magnificus*	V	-	Inhabits large undisturbed patches of lowland and adjacent highland rainforest and moist eucalypt forests where it feeds on fruit. Distribution Limit - N-Tweed Heads. S-Sydney.	No suitable habitat present.
Rose-crowned Fruit-Dove *Ptilinopus regina*	V	-	Occurs in dense rainforests with a substantial understorey where it feeds entirely on fruit. Distribution Limit - N-Tweed Heads. S-Wollongong.	No suitable habitat present.
Superb Fruit-Dove *Ptilinopus superbus*	V	-	Rainforests, adjacent mangroves, eucalypt forests, scrubland with native fruits. Distribution Limit - N-Border Ranges National Park. S-Bateman's Bay.	Suitable habitat present.
Glossy Black-Cockatoo *Calyptorhynchus lathami*	V	-	Open forests with *Allocasuarina* species and hollows for nesting. Distribution Limit - N-Tweed Heads. S-South of Eden.	Suitable habitat present. Observed during surveys.

TABLE 2.2 (Cont.) THREATENED FAUNA SPECIES OF THE AREA				
Species	**TSC Act**	**EPBC Act**	**Growth Form and Habitat Requirements**	**Comments**
Barking Owl *Ninox connivens*			Inhabits principally woodlands but also open forests and partially cleared land and utilises hollows for nesting. Distribution Limits- N-Border Ranges National Park S-Eden.	Suitable habitat present.
Powerful Owl *Ninox strenua*	V	-	Found in forests containing mature trees for shelter or breeding & densely vegetated gullies for roosting. Distribution Limits – N-Border Ranges National Park. S-Eden.	Suitable habitat present.
Masked Owl *Tyto novaehollandiae*	V	-	Open forest & woodlands with cleared areas for hunting and hollow trees or dense vegetation for roosting. Distribution Limit - N-Border Ranges National Park. S-Eden.	Suitable habitat present.
Brown Treecreeper *Climacteris picumnus victoriae*	V	-	Found in Eucalypt woodlands and dry open forest with fallen dead timber and lacking a dense understorey. Distribution Limits – Central NSW west of Great Div. Cumberland Plains, Hunter Valley, Richmond, Clarence, and Snowy River Valleys.	Suitable habitat present.
Speckled Warbler *Pyrrholaemus sagittatus*	V	-	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. Distribution Limit - N-Urbanville. S-Eden.	Suitable habitat present.
Black-chinned Honeyeater (eastern subspecies) *Melithreptus gularis gularis*	V	-	Found in woodlands containing box-ironbark associations and River Red Gums, also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence. Distribution Limit. N – Cape York pen. Qld. S – Victor H. Mt Lofty Ra & Flinders Ra. SA	No suitable habitat present.
Regent Honeyeater *Xanthomyza phrygia*	E	E	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. Distribution Limit - N-Urbanville. S-Eden.	Suitable habitat present.
Hooded Robin *Melanodryas cucullata*	V	-	Found in Eucalypt woodlands, *Acacia* scrubland, open forest, and open areas adjoining large woodland blocks, with areas of dead timber. Distribution Limit N – Central Qld S – Spencer Gulf SA.	Suitable habitat present.

TABLE 2.2 (Cont.) THREATENED FAUNA SPECIES OF THE AREA				
Species	**TSC Act**	**EPBC Act**	**Growth Form and Habitat Requirements**	**Comments**
Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis*			Found in open Box-Gum Woodlands on slopes and Box-Cypress-pine and open Box Woodlands on alluvial plains. In NSW it occurs on the western slopes and western plains, Hunter Valley and in several locations on the north coast of NSW.	No suitable habitat present.
Diamond Firetail *Stagonopleura guttata*	V	-	Found in Eucalypt woodlands, forests and mallee where there is grassy understorey west of the Great Div. also drier coastal woodlands of the Cumberland Plain and Hunter Richmond and Clarence River Valleys. Distribution Limit N Rockhampton Q. S- Eyre Pen Kangaroo Is. SA.	Suitable habitat present.
Spotted-tailed Quoll *Dasyurus maculatus*	V	V	Dry and moist open forests containing rock caves, hollow logs or trees within large areas of unfragmented habitat. Distribution Limit- N-Mt Warning National Park S-South of Eden.	Suitable habitat present.
Brush-tailed Phascogale *Phascogale tapoatafa*	V	E	A largely arboreal mammal of open forests and woodlands using hollows as nesting in hollow bearing trees. Distribution Limit - N-Border Ranges National Park. S-Eden.	Suitable habitat present.
Common Planigale *Planigale maculata*	V	-	Utilises a range of habitats including rainforest, dry open forest, grasslands and marshland with dense groundcover, a deep litter layer and log debris. Distribution Limit- N-Walgett S-Sydney.	Suitable habitat present.
Koala *Phascolarctos cinereus*	V	-	Inhabits both wet & dry Eucalypt forest on high nutrient soils containing preferred feed trees. Distribution Limit – N-Tweed Heads. S-South of Eden.	Suitable habitat present.
Yellow-bellied Glider *Petaurus australis*	V	-	Tall mature eucalypt forests with high nectar producing species and hollow bearing trees. Distribution Limit- N-Border Ranges National Park. S-South of Eden.	Sub-optimal habitat present.
Squirrel Glider *Petaurus norfolcensis*	V	-	Mixed aged stands of eucalypt forest & woodlands including gum barked & high nectar producing species & hollow bearing trees. Distribution Limit - N- Tweed Heads S-Albury.	Suitable habitat present.

TABLE 2.2 (Cont.) THREATENED FAUNA SPECIES OF THE AREA				
Species	**TSC Act**	**EPBC Act**	**Growth Form and Habitat Requirements**	**Comments**
Rufous Bettong *Aepyprymnus rufescens*	V	-	Generally found in dry, open woodland dominated by eucalypts preferring a virtual absence of scrub but with dense native grass cover. Distribution Limit - N-Border Ranges National Park. S-Newcastle.	No suitable habitat present.
Black-striped Wallaby *Macropus dorsalis*	V	-	Utilises forested country with dense scrub layer including Brigalow scrub. Forages in adjoining open grassy areas. Distribution Limit - N-South of Goondiwindi. S-Port Macquarie.	Sub-optimal habitat present.
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. Distribution Limit – N – Tweed Heads S – Eden.	Suitable habitat present. Observed during surveys.
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	V	-	Rainforests, sclerophyll forests and woodlands. Distribution Limit - N-North of Walgett. S-Sydney.	Suitable habitat present.
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. Distribution Limit - N-Border Ranges Nation Park. S-Wollongong.	Sub-optimal habitat present.
Hoary Wattled Bat *Chalinolobus nigrogriseus*			Occurs in dry open eucalypt forests, favouring forests dominated by Spotted Gum, boxes and ironbarks, and heathy coastal forests where Red Bloodwood and Scribbly Gum are common. In NE NSW it reaches the lower Clarence and Richmond River areas, extending from near Murwillumbah in the north, south to between Grafton and Coffs Harbour.	Suitable habitat present.
Golden-tipped Bat *Kerivoula papuensis*	V	-	Rainforest and adjoining moist open forest habitats, roosting in tree hollows and dense vegetation. Distribution Limit- N- Border Ranges Nation Park. S-South of Eden.	Sub-optimal habitat present.

TABLE 2.2 (Cont.) THREATENED FAUNA SPECIES OF THE AREA				
Species	**TSC Act**	**EPBC Act**	**Growth Form and Habitat Requirements**	**Comments**
Little Bentwing-bat *Miniopterus australis*	V	-	Roosts in caves, old buildings and tree hollows in the higher rainfall forests along the south coast of Australia. Distribution Limit - N-Border Ranges National Park. S-Sydney.	Suitable habitat present. Observed during surveys.
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	V	-	Prefers areas where there are caves, old mines, old buildings, stormwater drains & well timbered areas. Distribution Limit - N-Border Ranges National Park. S-South of Eden.	Suitable habitat present.
Large-footed Myotis *Myotis adversus*	V	-	Roosts in caves, mines, tunnels, buildings, tree hollows and under bridges. Forages over open water. Distribution limits - N - Border Ranges National Park, S - South of Eden.	Sub-optimal habitat present.
Greater Broad-nosed Bat *Scoteanax rueppellii*	V	-	Inhabits areas containing moist river & creek systems especially tree lined creeks. Distribution Limit - N-Border Ranges National Park. S-Pambula.	Suitable habitat present. Observed during surveys.

It is considered that there is suitable or sub-optimal habitat for the following threatened flora species known from the local area within the subject site.

- *Cyperus aquatilis*
- *Eleocharis tetraquetra*
- *Acacia ruppi*
- *Grammitis stenophyllai*
- *Eucalyptus glaucina*
- *Melaleuca irbyana*
- *Grevillea quadricauda*
- *Hedyotis galioides*

The subject site contains suitable habitats for the following threatened fauna species:

- Giant Barred Frog
- Green-thighed Frog
- White-crowned Snake
- Black Bittern
- Black-necked Stork
- Superb Fruit-Dove
- Glossy Black-Cockatoo
- Barking Owl
- Powerful Owl
- Masked Owl
- Brown Treecreeper
- Speckled Warbler
- Regent Honeyeater
- Hooded Robin
- Diamond Firetail
- Spotted-tailed Quoll
- Brush-tailed Phascogale
- Common Planigale
- Koala
- Yellow-bellied Glider
- Squirrel Glider
- Black-striped Wallaby
- Grey-headed Flying-fox
- Yellow-bellied Sheathtail-bat

- Large-eared Pied Bat
- Hoary Wattled Bat
- Golden-tipped Bat
- Little Bentwing-bat
- Eastern Bentwing-bat
- Large-footed Myotis
- Greater Broad-nosed Bat

3. ENDANGERED POPULATIONS AND ECOLOGICAL COMMUNITIES

Endangered Populations

Flora

There are no endangered flora populations known within the local area.

Fauna

Emu population in the NSW North Coast Bioregion and Port Stephens Local Government Area

The Emu *(Dromaius novaehollandiae)* within the NSW North Coast Bio region has been listed as an endangered population in Part 2 of the *TSC Act* (1995). This species occupies a range of predominantly open habitats, including plains, grasslands, woodlands and shrubs, and may occur occasionally in forests (NSW Scientific Committee 2001).

This species was not observed on site or in adjacent areas. There are no recent or historical records for the endangered Emu population on the Atlas of NSW Wildlife within the Lismore 1:100 000 map sheet (DEC 2006). It is not considered that the endangered population is likely to occur within the subject site or within the locality.

Endangered Ecological Communities

Six Endangered Ecological Communities (EECs) are known in the local area. These Communities are:

I) Lowland Rainforest in the NSW North Coast and Sydney bioregions.
II) Lowland Rainforest on Floodplains in the NSW North Coast bioregion.
III) River flat Eucalypt Forest on Coastal Floodplains.
IV) Subtropical Coastal Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions.
V) Swamp Sclerophyll Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.
VI) Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

It is considered that the vegetation observed on site contains a number of the floristic characteristics and specific geomorphological requirements of three EECs; Subtropical Coastal Floodplain Forest, Swamp Sclerophyll Forest on coastal floodplains and River flat Eucalypt Forest on Coastal Floodplains. A detailed description and assessment of their occurrence within the site is provided below.

RIVER FLAT EUCALYPT FOREST ON COASTAL FLOODPLAINS (RFEF)

General Description:
RFEF is typically associated with coastal floodplains, of the NSW North Coast, Sydney Basin and South-east Corner Bioregions This community occurs on silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains (NSW Scientific Committee, December 2004). RFEF includes and replaces the endangered ecological community known as Sydney Coastal Riverflat Forest (SCRFF).

Habitat Requirements and Characteristics

- Geology / Soils: Alluvial soils, namely silts, clay-loams and sandy loams.
- Topography: Periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains.
- Canopy Species: Composition of species varies between locations and local conditions (NSW Scientific Committee, December 2004). Characteristic canopy species are highly variable and include the following: *Eucalyptus tereticornis, Eucalyptus amplifolia, Angophora floribunda, Angophora subvelutina Eucalyptus baueriana, Eucalyptus botryoides, Eucalyptus elata, Eucalyptus ovata, Eucalyptus saligna, Eucalyptus grandis* and *Eucalyptus benthamii.*

Conservation Status and Distribution
RFEF has been recorded in Port Stephens, Maitland, Singleton, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Parramatta, Penrith, Blue Mountains, Fairfield, Holroyd, Liverpool, Bankstown, Wollondilly, Camden, Campelltown, Sutherland, Wollongong, Shellharbour, Kiama, Shoalhaven, Eastern Capital City Regional, Eurobodalla and Bega Valley.

Small areas of RFEF is presently included in Blue Mountains, Cattai, Dharug, Georges River, Marramarra, Moreton, Deua and Wadbilliga National Parks and Gulguer and Mulgoa Nature Reserves (NSW Scientific Committee, 2004).

Key Threatening Processes
Large areas of RFEF have been cleared for agriculture, mining and other developments. Identified threats include continuing fragmentation, flood mitigation and drainage works, landfilling and earthworks associated with urban and industrial development, pollution from urban and agricultural runoff, weed invasion, overgrazing, trampling and other soil disturbance by domestic livestock and feral animals including pigs, activation of 'acid sulphate soils', removal of dead wood and rubbish dumping. Key threatening processes listed in Schedule 3 of Part 2 of the Threatened Species Conservation Act (1995) as affecting this community are 'clearing of native vegetation', 'removal of dead wood' and 'Invasion by perennial grasses'.

Occurrence in Subject Site:
The habitat requirements and a number of the key canopy, shrub and groundcover species that characterise the EEC, RFEF are present within the Riparian Open Forest vegetation community observed within the subject site. Analysis of the quadrat data within this community identified that their were 20 key characteristic species of the EEC, SCFF and 16 species of RFEF, indicating that the Riparian Open Forest vegetation community was likely to be a natural transition of these Two EECs.

It is accepted that the canopy of the Riparian Open Forest is dominated in areas by *Eucalyptus grandis,* a key canopy species of RFEF. However, given the co-dominance in the canopy by *Lophostemon suaveolens,* the presence of a sub-canopy dominated by *Melaleuca alternifolia, Callistemon salignus*, and in areas characteristic rainforest species, and given the results of the quadrat analysis, it is determined that the Riparian Open Forest vegetation community is more closely representative of the EEC, SCFF and not RFEF.

SUBTROPICAL COASTAL FLOODPLAIN FOREST (SCFF)

General Description
The ecological community associated with clay-loams and sandy loams on periodically inundated alluvial flats, drainage lines and river terraces of coastal floodplains, in the North Coast Bioregion.

Habitat Requirements

- Geology / Soils: Alluvial soils of fluvial origin.
- Topography: Flood plains and associated flats and terraces.
- The most widespread canopy species of Subtropical Coastal Floodplain Forest include: *Eucalyptus tereticornis, Eucalyptus siderophloia, Corymbia intermedia* and *Lophostemon suaveolens*. Other prominent species are: *Eucalyptus moluccana, Eucalyptus propinqua, Eucalyptus seeana, Angophora subvelutina, Eucalyptus robusta, Eucalyptus resinifera* subsp. *hemilampra, Eucalyptus acmenoides, Angophora woodsiana, Angophora paludosa, Ficus* spp. And *Cupaniopsis* spp.

Conservation Status and Distribution
Small areas of Subtropical Coastal Floodplain Forest are contained within existing conservation reserves, including: Stotts Island NR, Ukerebagh NR, Limeburners Creek NR, Bundjalung NP and Myall Lakes NP.

Key Threatening Processes
Clearing of native vegetation; alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; invasion of native plant communities by exotic perennial grasses; predation, habitat destruction, competition and disease transmission by feral pigs; anthropogenic climate change; high frequency fire and removal of dead wood and dead trees.

Occurrence in Subject Site
The habitat requirements and a number of the key canopy, shrub and groundcover species that characterise the EEC, SCFF are present within the Riparian Open Forest vegetation community observed within the subject site. Analysis of the quadrat data within this community identified that their were 20 key characteristic species of the EEC, SCFF and 16 species of RFEF, indicating that the Riparian Open Forest vegetation community was likely to be a natural transition of these Two EECs.

It is accepted that the canopy of the Riparian Open Forest is dominated in areas by *Eucalyptus grandis,* a key canopy species of RFEF. However, given the co-dominance in the canopy by *Lophostemon suaveolens,* the presence of a sub-canopy dominated by *Melaleuca alternifolia*, *Callistemon salignus*, and in areas characteristic rainforest species, and given the results of the quadrat analysis, it is considered that the Riparian Open Forest vegetation community is more closely representative of the EEC, SCFF and not RFEF.

Therefore the impacts of the proposal on the EEC, SCFF will be assessed in detail in section 7 of this report.

SWAMP SCLEROPHYLL FOREST ON COASTAL FLOODPLAINS (SSFCF)

General Description
The ecological community associated with humic clay loams and sandy loams on waterlogged or periodically inundated alluvial flats and drainage lines of coastal floodplains.

Habitat Requirements

- Geology / Soils: Waterlogged or periodically inundated humic clay loams and sandy loams.
- Topography: Alluvial flats and drainage lines of coastal floodplains below the 1 in 100 year flood line.
- The most widespread canopy species of Swamp Sclerophyll Forest on Coastal Floodplains include: *Eucalyptus robusta, Melaleuca quinquenervia and eucalyptus botryoides*. Other prominent species are: *Callistemon salignus, Casuarina glauca, Eucalyptus resinifera subsp. hemilampra, Livistona australis,* and *Lophostemon suaveolens.*

Conservation Status and Distribution

Small areas of Subtropical Swamp Sclerophyll Forest on Coastal Floodplains are contained within existing conservation reserves, including: Bungawalbin NR, Tuckean NR, Moonee Beach NR, Hat Head NP, Crowdy Bay NP, Wallingat NP, Garigal NP and Myall Lakes NP.

Key Threatening Processes

Clearing of native vegetation; alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; invasion of native plant communities by exotic perennial grasses; predation, habitat destruction, competition and disease transmission by feral pigs; anthropogenic climate change; high frequency fire and removal of dead wood and dead trees.

Occurrence in Subject Site

The habitat requirements and a number of the key canopy, shrub and groundcover species that characterise the EEC, SSFCF are present within the Disturbed Swamp Woodland vegetation community observed within the subject site. Therefore it is considered that the EEC, SSFCF occurs on the site and will be assessed accordingly within section 7 of this report.

4. SURVEY DETAILS

Flora

To determine the likely and actual occurrence of flora species and plant communities on the subject site field survey work was undertaken to supplement literature reviews and previous flora surveys of the area. The methods utilised for the flora survey are outlined below.

Literature Review

- A review of available literature for the area was undertaken to obtain reference material and background information for this study. These documents are listed in the References section of this Report.

- A search of the Atlas of NSW Wildlife (DECC, 2007) was undertaken to identify records of threatened flora species located within 10km of the site. This enabled the preparation of a predictive list of threatened flora species that could possibly occur within the habitats found on the site.

Aerial Photograph Interpretation

- Aerial photographs at 1:25,000 scales were utilised to identify the extent of vegetation with respect to the site and surrounding areas.

Field Survey

- A field survey which consisted of foot traverses within vegetated areas was conducted according to Cropper (1993) to identify the occurrence of flora species and the extent and location of vegetation communities present across the subject site. This survey was also used to determine the positioning of more intensive survey quadrats. The flora survey was conducted on 21st August 2007.

- Determination of species composition as well as structural descriptions of the vegetation on the site according to Specht *et. al.* (1995) was also carried out.

Quadrat Survey

- The locations of the flora quadrats were generally restricted to the areas surrounding the proposal and gave consideration to important influencing environmental variables such as geographic location; geology, soil type and/or physiographic location. The quadrat survey was completed to assist in identifying the dominant floristic characteristics of each vegetation community and provided detailed information on community's structure and their complete floristic assemblage. The approximate locations of these surveys are provided in Figure 1.

- A total of three (3) 20 X 20 metre quadrat plots were completed within the subject site. Due to the high levels of disturbance no quadrats were sampled within the Exotic Grassland or Regrowth Scrub communities.

- Each 20 x 20m plot survey recorded the presence of vascular plant taxa and assigned a cover abundance estimate for each species based on a modified Braun-Blanquet 1-6 scale. The cover abundance values for each 1 to 6 class is provided below.

Cover Abundance Scale used in Floristic Survey

Class	Cover Abundance	Notes
1	Few individuals (less than 5% cover)	Herbs, sedges and grasses: < 5 individuals Shrubs and small trees: < 5 individuals
2	Many individuals (less than 5% cover)	Herbs, sedges and grasses: 5 or more individuals Shrubs and small trees: 5 or more individuals Medium-large overhanging tree
3	5 –20% cover	
4	20 –50% cover	
5	50 –70% cover	
6	70 – 100% cover	

- Specimens of plants not readily identified in the field were collected for identification.

- Determination of species composition as well as structural descriptions of the vegetation on the site according to Specht *et. al.* (1995) was also carried out. All vascular plants were identified using keys and nomenclature in Harden (1990a, 1991, 1992 and 1993), Harden and Murray (2000) and Harden, G.J. (2002). Wherever they were known, changes to nomenclature and classification have been incorporated into the results.

Vegetation Community Nomenclature

- The vegetation communities identified within the site by *Conacher Travers* were classified according to a modified Walker and Hopkins (1990) methodology, however within these descriptions the dominant canopy species are listed after the structural description.

- Corresponding Endangered Ecological Communities listed on both the TSC Act and EPBC Act are also provided.

Survey Limitations

- The floristic survey was affected by limitations in time, existing levels of disturbance and seasonal influences. Identification to the species level of several specimens recorded in the survey was also limited by the availability of flowering and/or fruiting material. As the surveys were carried out during winter, the diversity of annual herbs and grasses was expected to be underrepresented within the recorded ground flora.

- Field surveys were restricted to remnants on the eastern bank due of the flooding of the creek at the time of the survey. Observations of the vegetation type and dominant species on the far creek bank were made during random meanders and have been reflected in the mapping.

Fauna

Due to high level of disturbance within the subject site and low quality of habitat of the area proposed for impact the fauna survey was limited to targeted habitat searches. This consisted of diurnal and nocturnal searches with particular emphasis on searches of habitats for threatened fauna species. Diurnal searches were carried out on 25th July between 3.30 and 5 pm (Warm 20°C, 4/8 cloud no wind, no rain) and 21st August between 1 and 4pm (Mild 15°C, 8/8 cloud, gusty SE wind, rain). Diurnal searches included bird observations and call identification, herpetofauna surveys, threatened species searches and habitat assessment. The nocturnal surveys were completed on 25th July 2007 (Mild 18°C, 0/8 cloud, light-mod SE wind, no rain, 2/4 moon) between 5.30pm and 7.30pm. Nocturnal surveys consisted of spotlighting, Anabat echolocation and owl call playback.

5. FLORA AND FAUNA CHARACTERISTICS

5.1 Flora

The vegetation within the subject site consists of two separate stands of remnant vegetation comprising of Riparian Open Forest and Disturbed Swamp Woodland and two disturbed regrowth communities comprising, Regrowth Scrub and Grassland. A description of each community is provided below.

RIPARIAN TALL OPEN FOREST (*Eucalyptus grandis, Lophostemon suaveolens & Eucalyptus tereticornis*):

EEC on the TSC Act – Subtropical Coastal Floodplain Forest
EEC on the EPBC Act - NA

***Structure*:**

Trees: To 30 metres high with a Projected Foliage Cover (PFC) of 25-60%.

Shrubs: To 8 metres high with a 55 - 80% PFC.

Groundlayer: To 1.5 metres high with variable 60 - 85% PFC.

Floristics:
(Main Species Present)

Trees: *Eucalyptus grandis* (Flooded Gum), *Lophostemon suaveolens* (Swamp Turpentine), *Cinnamomum camphora* (Camphor Laurel) *Angophora woodsiana* (Rough Barked Apple) & *Eucalyptus tereticornis* (Forest Redgum).

Shrubs: *Acacia fimbriata* (Fringed Wattle), *Acmena smithii* (Lillypilly), *Allocasuarina torulosa* (Forest Oak), *Banksia integrifolia subsp. integrifolia* (Coast Banksia), *Callistemon salignus* (Willow Bottlebrush), *Duboisia myoporoides* (Corkwood), *Ficus coronata* (Sandpaper Fig), *Leptospermum polygalifolium subsp. cismontanum* (Lemon Scented Tea-tree), *Melaleuca alternifolia* and *Trochocarpa laurina* (Tree Heath).

Groundlayer: *Adiantum aethiopicum* (Common maidenhair), *Hydrocotyle laxiflora* (Stinking Pennywort), *Hypolepis muelleri* (Harsh Ground Fern) *Imperata cylindrica* var. *major* (Blady Grass), *Lomandra longifolia* (Spiky-headed Mat-rush), *Microlaena stipoides var. stipoides* (Weeping Rice Grass), *Oplismenus* spp., *Parsonsia straminea* (Common Silkpod) *Schoenus melanostachys* (Black Bog Rush), and *Smilax australis* (Lawyer Vine) and *Viola hederacea* (Ivy-leaved Violet).

Location and Distribution:
This vegetation community is located on the sandy alluvial soils adjoining the creek line.

Variation:
There are a number of minor variations within this community's canopy, particularly in regards to variations in the structure and dominant species. One of the more significant variations in this regards, is the dominance of *Eucalyptus grandis* in the north of the community's distribution and *Lophostemon suaveolens* in the south.

Disturbance:
This community has been disturbed by edge effects and minor weed invasion in the shrub and groundlayers, selective clearing, and low levels of grazing.

Weed Invasion:
The majority of this community exhibits only minor weed invasion, predominately within the shrub and ground layers adjoining the previously cleared areas.

DISTURBED SWAMP LOW WOODLAND (*Melaleuca alternifolia*):

EEC on the TSC Act – Swamp Sclerophyll Forest on Coastal Floodplains
EEC on the EPBC Act - NA

***Structure*:**

Emergent Trees: To 20 metres high with a Projected Foliage Cover (PFC)10%.

Shrubs: To 10 metres high with a <10 - 60% PFC.

Groundlayer: To 1.5 metres high with variable <15 - 85% PFC.

Floristics:
(Main Species Present)

Emergent Trees: *Eucalyptus tereticornis* (Forest Redgum) and *Lophostemon suaveolens* (Swamp Turpentine),

Shrubs: *Melaleuca alternifolia*

Groundlayer: *Ageratina* spp., *Axonopus affinis* (Narrow-leaved Carpet Grass), *Blechnum indicum*, *Juncus continuus, Persicaria strigosa*, *Philydrum lanuginosum* (Woolly Frogmouth) and *Ranunculus inundatus* (River Buttercup).

Location and Distribution:
This vegetation community occurs on the poorly drained alluvial floodplain and low-lying depressions of the site.

Disturbance:
This community has been extensively disturbed by significant weed invasion in the ground layers, a history of rural activities, vehicle tracks, moderate grazing, selective clearing and continual slashing.

Weed Invasion:
This community exhibits extensive weed invasion with a variety of exotic herbs and pasture grasses occur throughout the ground layer.

DISTURBED REGROWTH SCRUB (*Acacia fimbriata* and *Banksia integrifolia subsp. integrifolia*):

***Structure*:**

Emergent Trees: To 20 metres high with a Projected Foliage Cover (PFC)10%.

Shrubs: To 10 metres high with a <10 - 60% PFC.

Groundlayer: To 1.5 metres high with variable <10 - 45% PFC.

Floristics:
(Main Species Present)

Emergent Trees: *Eucalyptus tereticornis* (Forest Redgum).

Shrubs: *Acacia fimbriata* (Fringed Wattle), *Banksia integrifolia subsp. integrifolia* (Coast Banksia), *Callistemon salignus* (Willow Bottlebrush), *Lantana camara*, *Leptospermum polygalifolium subsp. cismontanum* (Lemon Scented Tea-tree) and *Melaleuca alternifolia*.

Groundlayer: *Adiantum aethiopicum* (Common maidenhair), *Ageratina* spp., *Axonopus affinis* (Narrow-leaved Carpet Grass), *Hypolepis muelleri* (Harsh Ground Fern), *Imperata cylindrica* var. *major* (Blady Grass), *Lomandra longifolia* (Spiky-headed Mat-rush), *Microlaena stipoides var. stipoides* (Weeping Rice Grass), *Oplismenus* spp., *Parsonsia straminea* (Common Silkpod), *Pteridium esculentum* (Bracken) and *Smilax australis* (Lawyer Vine).

Location and Distribution:
This vegetation community occurs as a small disturbed remnant in the south of the site associated with the sandy alluvial soils adjoining the creek line.

Disturbance:
This community has been extensively disturbed by moderate weed invasion in the shrub and ground layers, a history of rural activities, massive earth movement, vehicle tracks, and selective clearing and slashing.

Weed Invasion:
This community exhibits moderate weed invasion in both the shrub and ground layers. Areas of *Lantana camara* (Lantana) dominate portions of the shrub layers, while a variety of exotic herbs and pasture grasses occur throughout the ground layer.

GRASSLAND WITH SCATTERED TREES

***Structure*:**

Trees: To 30 metres high with a variable Percentage Foliage Cover (PFC) of <5%

Groundlayer: To 1.5 metres high with variable 40 - 95% PFC.

Floristics:
(Main Species Present)

Trees: *Eucalyptus tereticornis* (Forest Redgum), *Angophora subvelutina* and *Angophora woodsiana* (Rough Barked Apple).

Groundlayer: *Ageratina* spp., *Axonopus affinis* (Narrow-leaved Carpet Grass), *Cerastium glomeratum* (Mouse-ear Chickweed), *Conyza bonariensis* (Flax-leaf Fleabane), *Cynodon dactylon* (Couch), *Imperata cylindrica* var. *major* (Blady Grass), *Oplismenus aemulus* (Basket Grass), *Paspalum urvillei* (Paspalum), *Pteridium esculentum* (Bracken), *Pratia purpurascens* (Whiteroot), *Sporobolus indicus var. capensis* and *Senecio madagascariensis* (Fireweed).

Location and Distribution:
This vegetation community occurs throughout the subject site associated with highly disturbed areas.

Disturbance:
This community has been highly disturbed by extensive weed invasion, clearing, grazing, earth movement and alterations to the natural drainage.

Weed Invasion:
This community exhibits extensive weed invasion in the ground layer.

The following table lists all flora species identified within the subject site.

TABLE 5.1 FLORA SPECIES OBSERVED ON THE SUBJECT SITE		
Family	**Scientific Name**	**Common Name**
TREES		
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak
Cunoniaceae	*Callicoma serratifolia*	Black Wattle
Cyatheaceae	*Cyathea australis*	Rough Tree-fern
Lauraceae	*Cinnamomum camphora**	Camphor Laurel
Lauraceae	*Cryptocarya microneura*	Murrogun
Mimosaceae	*Acacia irrorata* subsp. *irrorata*	Green Wattle
Mimosaceae	*Acacia mearnsii*	Black Wattle
Mimosaceae	*Acacia melanoxylon*	Blackwood
Moraceae	*Ficus coronata*	Sandpaper Fig
Myrtaceae	*Acmena smithii*	Lillypilly
Myrtaceae	*Angophora subvelutina*	-
Myrtaceae	*Angophora woodsiana*	Rough-barked Apple
Myrtaceae	*Eucalyptus grandis*	Flooded gum
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum
Myrtaceae	*Lophostemon confertus*	Brush Box
Myrtaceae	*Lophostemon suaveolens*	Swamp Turpentine
Myrtaceae	*Melaleuca decora*	-
Myrtaceae	*Syzygium australe*	Brush Cherry
Myrtaceae	*Syzygium oleosum*	Blue lillypilly
Oleaceae	*Notelaea longifolia*	Mock Olive
Pinaceae	*Pinus radiata**	Radiata or Monterey Pine
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Proteaceae	*Grevillea robusta*	Silky Oak
Rhamnaceae	*Alphitonia excelsa*	Red Ash
SHRUBS		
Apiaceae	*Platysace lanceolata*	Lance-leaf Platysace
Apocynaceae	*Gomphocarpus fruiticosus**	Narrow Leaf Cotton Bush
Epacridaceae	*Trochocarpa laurina*	Tree Heath
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush
Mimosaceae	*Acacia fimbriata*	Fringed Wattle
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush
Myrtaceae	*Leptospermum petersonii*	Lemon Scented Tea-tree
Myrtaceae	*Leptospermum polygalifolium* subsp. *cismontanum*	Lemon Scented Tea-tree
Myrtaceae	*Melaleuca alternifolia*	-
Pittosporaceae	*Bursaria spinosa*	Blackthorn
Proteaceae	*Banksia integrifolia* subsp. *integrifolia*	Coast Banksia
Proteaceae	*Persoonia conjuncta*	-
Rosaceae	*Rubus moluccanus*	Broad-leaf Bramble
Rosaceae	*Rubus parvifolius*	Native Raspberry
Rosaceae	*Rubus rosifolius*	Forest Bramble

TABLE 5.1 (Cont.) FLORA SPECIES OBSERVED ON THE SUBJECT SITE		
Family	**Scientific Name**	**Common Name**
SHRUBS (Cont.)		
Solanaceae	*Duboisia myoporoides*	Corkwood
Verbenaceae	*Lantana camara**	Lantana
GROUNDCOVERS		
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair
Apiaceae	*Centella asiatica*	Swamp Pennywort
Apiaceae	*Hydrocotyle laxiflora*	Stinking Pennywort
Apiaceae	*Hydrocotyle peduncularis*	Pennywort
Apiaceae	*Hydrocotyle tripartita*	Pennywort
Asteraceae	*Ageratina riparia**	Mist Flower
Asteraceae	*Ageratum houstonianum*	Blue Billy Goat Weed
Asteraceae	*Bidens pilosa**	Cobbler's Pegs
Asteraceae	*Centipeda minima*	Spreading Sneezeweed
Asteraceae	*Conyza bonariensis**	Flax-leaf Fleabane
Asteraceae	*Hypochaeris radicata**	Flatweed
Asteraceae	*Senecio madagascariensis**	Fireweed
Blechnaceae	*Blechnum indicum*	-
Carophyllaceae	*Cerastium glomeratum**	Mouse-ear Chickweed
Convolvulaceae	*Dichondra repens*	Kidney Weed
Cyperaceae	*Cyperus gracilis*	-
Cyperaceae	*Gahnia aspera*	Saw Sedge
Cyperaceae	*Schoenus melanostachys*	Black Bog Rush
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern
Dennstaedtiaceae	*Pteridium esculentum*	Bracken
Euphorbiaceae	*Poranthera microphylla*	
Fabaceae	*Trifolium repens**	White Clover
Juncaceae	*Juncus continuus*	-
Juncaceae	*Juncus usitatus*	Common Rush
Lamiaceae	*Plectranthus parviflorus*	Cockspur Flower
Lobeliaceae	*Pratia purpurascens*	Whiteroot
Lomandraceae	*Lomandra longifolia*	Spiky-headed Mat-rush
Oxalidaceae	*Oxalis corniculata**	Yellow Wood Sorrel
Philydraceae	*Philydrum lanuginosum*	Woolly Frogmouth
Phormiaceae	*Dianella caerulea* var. *producta*	Blue Flax Lily
Plantaginaceae	*Veronica plebeia*	Creeping Speedwell
Poaceae	*Axonopus affinis**	Narrow-leaved Carpet Grass
Poaceae	*Cynodon dactylon*	Common Couch
Poaceae	*Entolasia marginata*	Bordered Panic
Poaceae	*Entolasia stricta*	Wiry Panic
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass
Poaceae	*Imperata cylindrica* var. *major*	Blady Grass
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Rice Grass

TABLE 5.1 (Cont.) FLORA SPECIES OBSERVED ON THE SUBJECT SITE		
Family	**Scientific Name**	**Common Name**
GROUNDCOVERS (Cont.)		
Poaceae	*Oplismenus aemulus*	Basket Grass
Poaceae	*Oplismenus imbecillis*	-
Poaceae	*Panicum simile*	Two Colour Panic
Poaceae	*Sporobolus indicus var. capensis*	Slender Rat's Tail Grass
Polygonaceae	*Persicaria strigosa*	-
Ranunculaceae	*Ranunculus inundatus*	River Buttercup
Sinopteridaceae	*Cheilanthes sieberi* subsp. *sieberi*	Poison Rock Fern
Thymelaeaceae	*Pimelea latifolia* subsp. *altior*	Rice Flower
Violaceae	*Viola hederacea*	Ivy-leaved Violet
VINES		
Apocynaceae	*Parsonsia straminea*	Common Silkpod
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily
Menispermiaceae	*Stephania japonica* var. *discolor*	Snake Vine
Ranunculaceae	*Clematis glycinoides* var. *glycinoides*	Clematis
Rubiaceae	*Morinda jasminoides*	-
Smilacaceae	*Smilax australis*	Lawyer Vine
Species name^{TS} = Threatened Species * = Introduced Species		

5.2 Fauna

A number of fauna habitats are present on the site. These consist of:

- Riparian bushland
- Flower, nectar and seed producing tree and shrub species
- Sparse to dense groundcover
- Leaf Litter layer
- Hollow trees
- Ephemeral aquatic/sand substrate habitats within creek bed
- Dam
- Cleared areas adjacent to the creek

The subject site consists of an ephemeral creek line with adjacent riparian bushland containing predominately Open Forest variant vegetation communities. The creek bed has been accessed by cattle and grazing has occurred within riparian bushland causing some modification to ground and shrub layers, mild weed incursion and bank erosion.

Bushland has moderate groundcover, leaf litter and understorey layers providing suitable refuge and foraging microhabitat types for a number of bird, reptile and terrestrial mammal species. The creek line provides ephemeral habitat, and the swamp permanent habitat for amphibian and semi-aquatic species. The creekline was dry at the time of first surveys, however was flowing after heavy rain during the second site survey period.

Cleared areas adjacent to the creek provide suitable habitat for species preferring open landscapes including predatory birds.

The flower, nectar and seed producing tree and shrub species provide foraging habitat for a range of locally occurring bird, arboreal mammal and microchiropteran bat species. The tree species within the site also provide refuge habitat and potential den/roost sites within hollows for bird, arboreal mammal and microchiropteran bat species.

The riparian bushland within the site forms part of a semi-connected bushland tract of similar vegetation extending along local hills, riparian zones and some lowland areas.

Four threatened fauna species were observed during surveys. The Glossy Black-Cockatoo was observed flying over the subject site on 25th July 2007. The Grey-headed Flying-fox was observed foraging within riparian vegetation on the evening of 25th July 2007. The Little Bentwing-bat and Greater Broad-nosed Bat were observed foraging along riparian edges during Anabat surveys on 25th July 2007. All other species recorded during surveys are considered relatively common within the local area. The fauna species observed within the subject site during surveys are included within Table 5.2.

TABLE 5.2
FAUNA OBSERVED DURING SURVEYS

Common Name	Scientific Name	Method
Birds		
Australian Wood Duck	*Chenonetta jubata*	O
Australasian Grebe	*Tachybaptus novaehollandiae*	O
White-faced Heron	*Egretta novaehollandiae*	X
Cattle Egret	*Ardea ibis*	O
Australian White Ibis	*Threskiornis molucca*	O
Straw-necked Ibis	*Threskiornis spinicollis*	O
Black-shouldered Kite	*Elanus axillaris*	O
Masked Lapwing	*Vanellus miles*	O C
Glossy Black-Cockatoo T	*Calyptorhynchus lathami*	O C
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	O C
Rainbow Lorikeet	*Trichoglossus haematodus*	O C
Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*	O
Australian King-Parrot	*Alisterus scapularis*	O C
Eastern Rosella	*Platycercus eximius*	O C
Pheasant Coucal	*Centropus phasianinus*	O C
Tawny Frogmouth	*Podargus strigoides*	Sp
Laughing Kookaburra	*Dacelo novaeguineae*	O
Sacred Kingfisher	*Todiramphus sanctus*	O
White-throated Treecreeper	*Cormobates leucophaeus*	O C
Superb Fairy-wren	*Malurus cyaneus*	O C
Forty-spotted Pardalote	*Pardalotus quadragintus*	O
Striated Thornbill	*Acanthiza lineata*	O
Little Wattlebird	*Anthochaera chrysoptera*	O C
Noisy Friarbird	*Philemon corniculatus*	O C
Noisy Miner	*Manorina melanocephala*	O
Lewin's Honeyeater	*Meliphaga lewinii*	C
Brown Honeyeater	*Lichmera indistincta*	O
Jacky Winter	*Microeca fascinans*	O
Golden Whistler	*Pachycephala pectoralis*	O C
Magpie-lark	*Grallina cyanoleuca*	O

TABLE 5.2 (Cont.) FAUNA OBSERVED DURING SURVEYS		
Common Name	**Scientific Name**	**Method**
Birds (Cont.)		
Grey Fantail	*Rhipidura fuliginosa*	O C
Grey Butcherbird	*Cracticus torquatus*	O
Australian Magpie	*Gymnorhina tibicen*	O
Pied Currawong	*Strepera graculina*	O C
Australian Raven	*Corvus coronoides*	O C
Welcome Swallow	*Hirundo neoxena*	O
Silvereye	*Zosterops lateralis*	O
Mammals		
Echidna	*Tachyglossus aculeatus*	Sc
Red-necked Wallaby	*Macropus rufogriseus*	O
Grey-headed Flying-fox ^{T}	*Pteropus poliocephalus*	Sp
Goulds Wattled-bat	*Chalinolobus gouldii*	A
Greater Broad-nosed Bat ^{T}	*Scoteanax rueppellii*	A
Eastern Broad-nosed Bat	*Scotoropens orion*	A
Little Bentwing-bat ^{T}	*Miniopterus australis*	A
Dog	*Canis familiaris*	O
Fox	*Canis vulpes*	O Sc
Cow	*Bos taurus*	O
Reptiles		
Red-bellied Black Snake	*Pseudechis porphyriacus*	O
Amphibians		
Great Barred Frog	*Mixophyes fasciolatus*	C
Common Eastern Froglet	*Crinia signifera*	C
Green Tree Frog	*Litoria caerula*	OC
Tylers Tree Frog	*Litoria tyleri*	C

Key to Methods of Observation

O	-	Observation	S	-	Search
C	-	Call identification	A	-	Anabat II
Sp	-	Spotlight	Sc	-	Scat, Track or Sign
T	-	Trap (ElliotCage)	L	-	Larval Stage

Note: * indicates introduced species
^{T} indicates threatened species

6. KOALA HABITAT ASSESSMENT

The subject site was assessed for activity by Koalas using the following methods:

i. A search of the Atlas of NSW Wildlife (DECC, 2007).

ii. The site was surveyed on foot with any species of Koala food trees being inspected for signs of Koala usage. Trees were inspected and identified for presence of Koalas, scratch and claw marks on the trunk and scats around the base of each tree. The proportion of any trees showing signs of Koala use was calculated for the whole of the site. Additionally the location and density of droppings if found were documented.

iii. Koalas were also targeted during spotlight surveys.

One preferred Koala food tree species *Eucalyptus tereticornis* was observed within the subject site. This species did not constitute greater than 15% of the tree species within the subject site in the vegetation communities they occurred. As such, it is considered that in accordance with State Environmental Planning Policy No. 44 Koala Habitat Protection, the site does not contain Potential Koala Habitat. No evidence of Koala habituation in the area, such as scats, suitable scratch marks on trees or Koalas were observed during the fauna survey of the site and surrounding area.

7. IMPACT ON THREATENED SPECIES

An assessment of the potential impact of the proposed development on the habitats or populations of threatened species is provided below in accordance with the matters required for consideration under Section 5A of the EP& A. Act.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

FLORA

A number of habitats that may support other threatened flora species were identified on the site. An assessment of threatened flora species that may have potential habitat on site is provided below.

Cyperus aquatilis
This species is a an annual sedge 10-30cm tall appearing during the wet summer period in ephemerally wet sites, such as roadside ditches and seepage areas from small cliffs, in sandstone areas.

Suitable habitat for this species was observed within the Disturbed Swamp Woodland on this site, however no specimens were observed during targeted survey. The proposed development is unlikely to require the removal of habitat for this species. Therefore, it is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Eleocharis tetraquetra
This species is a tufted perennial plant found in damp locations on stream edges and in and on the margins of freshwater swamps.

Suitable habitat for this species was observed within the Disturbed Swamp Woodland on this site, however no specimens were observed during targeted survey. The proposed development is unlikely to require the removal of habitat for this species. Therefore, it is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Acacia ruppi
This species is an erect, open shrub 1-2m tall in height and spread growing in dry open forest and shrubland in sandstone areas, often near creeks and on roadsides.

Suitable habitat for this species was observed within the Riparian Open Forest on this site, however no specimens were observed during targeted survey. The proposed development is unlikely to require a significant removal of habitat for this species. Therefore, it is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Grammitis stenophyllai
This species is a little fern growing in small colonies in moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest.

Suitable habitat for this species was observed within the Riparian Open Forest on this site, however no specimens were observed during targeted survey. The proposed development is unlikely to require a significant removal of habitat for this species. Therefore, it is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Eucalyptus glaucina
This species is a medium-sized tree to 30m tall in growing in grassy woodland and dry eucalyptus forest on deep, moderately fertile and well-watered soils.

Suitable habitat for this species was observed within the Riparian Open Forest and Disturbed Swamp Woodland on this site, however no specimens were observed during targeted survey. The proposed development is unlikely to require a significant removal of habitat for this species. Therefore, it is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Melaleuca irbyana
This species is a small tree to 8m tall in open eucalypt forest in poorly drained, usually clay soils.

Suitable habitat for this species was observed within the Disturbed Swamp Woodland on this site, however no specimens were observed during targeted survey. The proposed development is unlikely to require the removal of habitat for this species. Therefore, it is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Grevillea quadricauda
This species is a bushy shrub to 2m growing in gravely loam, in the understorey of dry eucalypt forest, usually along or near creeks.

Suitable habitat for this species was observed within the Riparian Open Forest on this site, however no specimens were observed during targeted survey. The proposed development is unlikely to require a significant removal of habitat for this species. Therefore, it is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Hedyotis galioides
This species is an erect or ground-hugging annual herb growing around margins of seasonally inundated wetlands in paperbark swamps and Forest Red Gum (*Eucalyptus tereticornis*) woodlands.

Suitable habitat for this species was observed within the Disturbed Swamp Woodland on this site, however no specimens were observed during targeted survey. The proposed development is unlikely to require the removal of habitat for this species. Therefore, it is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

FAUNA

A number of habitats that may support other threatened fauna species were identified on the site. An assessment of these threatened fauna species that have potential habitat on site is provided below.

Giant Barred Frog (*Mixophyes iteratus*)
This frog occurs generally in subtropical and dry rainforest and wet sclerophyll forests with moist leaf litter in the mountains of New South Wales and Eastern Victoria but has been observed in drier forests.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. All sand extraction will occur at times when the creek bed is dry and as such the proposed development is not expected to significantly impact upon the potential suitable habitats for this species. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Green-thighed Frog (*Litoria brevipalmata*)
The preferred habitats of the Green-thighed Frog are largely unknown. The Green-thighed Frog has been found in mostly terrestrial habitats including along the grassy margins of semi-permanent and permanent ponds in late spring and rainforests, moist open forest (Robinson 1993), drier open forest and woodland (Nattrass & Ingram 1993), coastal swamp forest and along the perimeter of flooded paddocks (Barker & Grigg 1977).

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. All sand extraction will occur at times when the creek bed is dry and as such the proposed development is not expected to significantly impact upon the potential suitable habitats for this species. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

White-crowned Snake (*Cacophis kreftii*)
The White-crowned Snake favours low to mid elevation dry eucalypt forest and woodland, particularly areas with a well developed leaf litter layer. It is also occasionally found in moist eucalypt forest and coastal heathland (DEC 2006a).

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Black Bittern (*Ixobrychus flavicollis*)
This species inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation, roosting in trees or on the ground amongst dense reeds.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. Sand extraction will be limited to the dry creek bed and as such all potential suitable habitats for this species within and adjacent to the site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Black-necked Stork (*Ephippiorhynchus asiaticus*)
This species inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. Sand extraction will be limited to the dry creek bed and as such all potential suitable habitats for this species within and adjacent to the site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Superb Fruit-dove (*Ptilinopus poliocephalus*)
The Superb Fruit-dove lives mainly within rainforests but will feed in adjacent mangroves or Eucalypt forests (Blakers *et al.* 1984). Nests are well hidden within the rainforest habitat and are built in trees from 10 to 30m off the ground (Recher *et al.* 1995). The nest consists of a flimsy structure of twigs, constructed in the fork of a branch.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Glossy Black-Cockatoo (*Calyptorhynchus lathami*)
The Glossy Black-Cockatoo inhabits mountain forests, coastal woodland, open forest and trees bordering watercourses where there are substantial stands of casuarinas. Foraging within Casuarinas tends to be concentrated on trees with greater crops of cones (Clout 1989). This species nests in large trees with large hollows (dead and alive). The Glossy Black-Cockatoo usually forages close to the nest but is capable of traveling up to 20km away thus requiring a water source (DEH 2000).

Suitable habitat for this species was observed within this site. This species was observed flying over the subject site during surveys.

No vegetation removal is proposed as part of the operation and as such all suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Barking Owl (*Ninox connivens*)
The Barking Owl mainly inhabits area of savannah woodland, open eucalypt wetland and riverine forest. It is generally absent from the arid interior (Lindsey 1992). This species breeds in large hollows in large, live trees; near or on floodplains; associated with forest types and sparse groundcover; dry forest woodland with dense thickets of eucalypt, paperbark or vine scrub (Environment Australia 2000).

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Powerful Owl *(Ninox strenua)*
The Powerful Owl inhabits mature rainforest and wet and dry eucalypt forest (Schodde Tidemann 1986). Large trees with hollows at least 0.5m deep are required for shelter and breeding (Schodde et al. 1980; SWC Consultancy 1993). Estimates of the home range of this species vary greatly but territories are thought to be a minimum of 800 hectares (Kavanagh 1988). It is suggested that Powerful Owls forage by concentrating their activities in pockets of their large home range until they reduce their population of preferred prey below limits where it becomes difficult to catch the remaining animals (Kavanagh, 1988).

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Masked Owl (*Tyto novaehollandiae*)
The Masked Owl is widespread through forests and woodlands, utilising caves for shelter in treeless country. The Masked Owl is known to utilise forest margins and isolated stands of trees within agricultural land (Hollands 1991; Hyem 1979). This species is often found in heavily disturbed forest where its prey of small and medium sized mammals can be readily obtained (Kavanagh Peake 1993). The Masked Owl requires old mature trees with large hollows for breeding and as diurnal roosting sites, being dependent upon hollow bearing trees all year round rather than only during the breeding season (Hyem, 1979).

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Brown Treecreeper (*Climacteris picumnus victoriae*)
This eastern sub-species of the Brown Treecreeper can be found in eucalypt woodland over much of eastern Australia. They prefer drier forests/woodlands with fallen branches and its distribution is known to coincide with that of River Red Gums and other eucalypts bordering river courses preferring rough-barked trees, especially the boxes and peppermints (Longmore 1991). Hollows in trees provide nesting chambers, roosting sites refuges from predators and sources of food for the Brown Treecreeper (Longmore 1991).

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Speckled Warbler (*Pyrrholaemus sagittatus*)
This species inhabits a wide range of *Eucalyptus* dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Large, relatively undisturbed remnants are required for the species to persist in an area.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Regent Honeyeater (*Xanthomyza phrygia*)
The Regent Honeyeater inhabits mostly dry eucalypt woodlands and forests dominated by box ironbark eucalypts; on inland slopes of Great Divide, especially associations in moister more fertile sites, along creeks, broad river valleys and on lower slopes of foothills. (Higgins et al 2001). Nectar is the principle food but sugary exudates from insects are also used (Oliver 1998, 2000). The Regent Honeyeater is known to breed along the western Slopes of the Great Dividing Range in New South Wales (Bundarra-Barraba district, Capertee Valley).

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Hooded Robin (*Melanodryas cucullata cucullata*)
This species prefers structurally diverse habitats within lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. It requires low dead stumps and fallen timber or low-hanging branches for hunting.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Diamond Firetail (*Stagonopleura guttata*)
This species prefers grassy eucalypt woodlands, including Box-Gum Woodlands and *Eucalyptus pauciflora* Woodlands, but also occurs in open forest, mallee, Natural Temperate Grassland, in secondary grassland derived from other communities, riparian areas, and sometimes in lightly wooded farmland. It feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Spotted-tailed Quoll (*Dasyurus maculatus*)
The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry open forest and rainforest. It appears to prefer moist forest types and riparian habitat. It has been recorded from dry sclerophyll forest, open woodland and coastal heathland, and despite its occurrence in inland riparian areas, it also ranges over dry ridges.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Brush-tailed Phascogale (*Phascogale tapoatafa*)
The principle habitat of the Brush-tailed Phascogale is dry open forest and woodlands containing various associations of bloodwood, messmate, box, stringybark and ironbark trees (Cuttle 1982, 1992; Traill 1991; Traill Coates 1993) with an understorey varying between acacias, grasses and low herbs and dense leaf litter (Cuttle 1982). Tree hollows are used for shelter and nesting which can be shared by several individuals.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Common Planigale (*Planigale maculata*)
This species inhabits rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water. During the day shelter in saucer-shaped nests built in crevices, hollow logs, beneath bark or under rocks.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Koala *(Phascolarctos cinereus)*
Koalas inhabit forested areas with acceptable Eucalypt food trees, also utilising non-Eucalypt species as a food source. Koalas inhabit both wet and dry Eucalypt forests that contain a canopy cover of approximately 10 to 70% (Reed *et al.* 1991) growing on high nutrient soils.

The subject site contains suitable foraging habitat for this species within the *Eucalyptus tereticornis* present, however no individuals were observed during targeted survey. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Yellow-bellied Glider *(Petaurus australis)*
The Yellow-bellied Glider is restricted to tall mature eucalypt forests found within high rainfall regions of temperate through to sub-tropical eastern Australia (Russell 1988). Forest areas known to support populations of this species are generally located on undulating or low relief landforms with soils of moderate to high fertility. Preferred habitat areas for the Yellow-bellied Glider generally contain a complex mosaic of trees (Braithwaite 1991, Davey 1984, Kavanagh 1984). Yellow-bellied Gliders are dependant on the presence of large hollows within mature trees for nesting and breeding, occupying several den trees within a single home range (Henry and Craig 1984).

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Squirrel Glider *(Petaurus norfolcensis)*
The Squirrel Glider is an arboreal, tree dwelling mammal that feeds on nectar, pollen, eucalypt sap, Acacia gum, honeydew and arthropods (Quin 1993). The Squirrel Glider feeds on sugary exudates to obtain its energy requirements and arthropods for protein (Smith 2002). The Squirrel Glider feeds on nectar of flowering tree species, honeydew and by gleaning arthropods from vegetation. This species also feeds on sap flows by incising the bark of trees. The Squirrel Glider uses tree hollows for den sites either alone or communally.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Black-striped Wallaby (*Macropus dorsalis*)
This species inhabits dense woody or shrubby vegetation adjacent to a more open, grassy area to provide suitable feeding habitat. On the NSW North Coast, it is closely associated with dry rainforest but also occur in moist eucalypt forest with a rainforest understorey or a dense shrub layer.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Grey-headed Flying-fox (*Pteropus poliocephalus*)
The Grey-headed Flying-fox is found in a variety of habitats including rainforest, mangroves, paperbark swamps, wet and dry sclerophyll forests and cultivated areas (Churchill, 1998). Grey-headed Flying Foxes congregate in large camps of up to 200,000 individuals, depending on availability of surrounding blossoming plants, from early until late summer (Churchill, 1998). Camps are commonly formed in gullies, typically not far from water and in vegetation with a dense canopy. Roost sites are an important resource where mating, birth and rearing of young occur as well as providing refuge (Strahan, 1995).

Suitable habitat for this species was observed within this site. This species was observed foraging within riparian vegetation during surveys.

No vegetation removal is proposed as part of the operation and as such all habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)
This species roosts in tree hollows, buildings, and mammal burrows in treeless areas, foraging in most habitat types with and without trees across its very wide range.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Large-eared Pied Bat (*Chalinolobus dwyeri*)
This species is found in well-timbered areas containing gullies, where it roosts in caves, crevices in cliffs, old mine workings and in the disused, mud nests of the Fairy Martin (*Hirundo ariel*), and frequents low to mid-elevation dry open forest and woodland close to these features.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Hoary Wattled Bat (*Chalinolobus nigrogriseus*)
This species inhabits dry open eucalypt forests, favouring forests dominated by Spotted Gum, boxes and ironbarks, and heathy coastal forests where Red Bloodwood and Scribbly Gum are common. Because it flies fast below the canopy level, forests with naturally sparse understorey layers may provide the best habitat.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Golden-tipped Bat (*Kerivoula papuensis*)
This species inhabits rainforest and adjacent sclerophyll forest, and roosts in abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests located in rainforest gullies on small first- and second-order streams. It flies up to two km from roosts to forage in rainforest and sclerophyll forest on upper-slopes.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Little Bentwing-bat (*Miniopterus australis*)
The Little Bentwing-bat forages below the canopy within open forests and woodlands, feeding on small insects. The Little Bentwing-bat is known to roost in caves, tunnels, tree hollows and occasionally old buildings (Dwyer, 1995b).

Suitable habitat for this species was observed within this site. This species was observed foraging along the riparian vegetation edge during surveys.

No vegetation removal is proposed as part of the operation and as such all habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
The Eastern Bentwing-bat forages above and below the canopy within open forests and woodlands, feeding on small insects (Dwyer 1988). The Eastern Bentwing-bat is known to roost in a range of habitats including stormwater channels, under bridges, occasionally in buildings, old mines and, in particular, caves (Dwyer 1988). Roost sites in tree hollows have not been reported within the literature reviewed.

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Large-footed Myotis (*Myotis adversus*)
The Large-footed Myotis inhabits rainforests and open forests containing creeks and lakes over which it feeds and roosts in tree hollows, caves, mines, under bridges, in tunnels and occasionally buildings (Richards 1995). The Large-footed Myotis predominantly forages along creeklines and over waterbodies where it takes insects and small fish from on and just below the water surface (Richards 1995).

Suitable habitat for this species was observed within this site, however no individuals were observed during surveys. No vegetation removal is proposed as part of the operation and as such all potential suitable habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

Greater Broad-nosed Bat (*Scoteanax rueppellii*)
Greater Broad-nosed Bats roost in hollow tree trunks and branches as well as the roofs of old buildings. They prefer moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range (Churchill, 1998). They have also been found to inhabit cool temperate to tropical moist hardwood forest and woodland and in gullies associated with these forest types (Richards, 1991; Strahan, 1992;Churchill, 1998). Has been commonly found at woodland clearing ecotones foraging over the understorey (Richards, 1991).

Suitable habitat for this species was observed within this site. This species was observed foraging along the riparian vegetation edge during surveys.

No vegetation removal is proposed as part of the operation and as such all habitats for this species on site will be retained. There are large amounts of similar and higher quality habitat for this species within the local area including lands within a number of conservation reserves and state forests of the Richmond Range. It is considered that the proposed development is not likely to have an adverse effect on the life cycle of this species within the local area such that a viable local population is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

The Emu (*Dromaius novaehollandiae*) is listed within the TSC Act (1995) as an endangered population within the NSW North Coast Bioregion. The Emu was not observed within the subject site during surveys. The subject site is of low habitat quality for this endangered population. It is considered that the lifecycle of the Emu is not likely to be disrupted such that the viability of the endangered population is likely to be placed at risk of extinction.

(c) In the case of a critically endangered or endangered ecological community, whether the action proposed:

a. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Two endangered ecological communities were observed on the subject site. The Disturbed Swamp Woodland is commensurate with the EEC, Swamp Sclerophyll Forest on Coastal Floodplains, while the Riparian Open Forest is commensurate with the EEC Subtropical Floodplain Forest.

These communities occupy approximately 10-15 ha respectively within the subject site.

The proposed development is unlikely to require the removal of these communities as it currently is only proposing to extract sand from the creek bed and not the surrounding floodplain. While it is accepted that the proposed development may result in some minor indirect impacts associated with edge effects on the Riparian Open Forest interface with the creek bank, a site rehabilitation plan has been prepared to ensure that the weed and erosion management activities are in place to control these potential impacts.

Given the presence of large areas of similar and better quality examples of these EECs located along Cabbage Tree Creek and its associated floodplain and the proposals likely retention and ongoing management of the EECs within the subject site, it is considered that the proposal is unlikely to result in an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction

b. Is likely to substantially and adversely modify the composition such that its local occurrence is likely to be placed at risk of extinction,

The proposed development is unlikely to require the removal of these communities as it currently is only proposing to extract sand from the creek bed and not the surrounding floodplain. While it is accepted that the proposed development may result in some minor indirect impacts associated with edge effects on the Riparian Open Forest interface with the creek bank, a site rehabilitation plan has been prepared to ensure that the weed and erosion management activities are in place to control these potential impacts.

Given the presences of large areas of similar and better quality examples of these EECs located along the Cabbage Tree Creek and its associated floodplain and the proposals likely retention and ongoing management of the EECs within the subject site, it is considered that the proposal is unlikely to substantially and adversely modify the composition such that its local occurrence is likely to be placed at risk of extinction.

(d) In relation to the habitat of threatened species, populations or ecological community:

i. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed development is unlikely to significantly impact the sites natural vegetation and habitats as they are only proposing to extract sand from the creek bed and not the surrounding floodplain. While it is accepted that the proposed development may result in some minor indirect impacts associated with edge effects on the Riparian Open Forest interface with the creek bank, a site management plan has been prepared to ensure that the weed and erosion management activities are in place to control these potential impacts.

The removal of sand from the creek bed may result in the removal of an amount of sub-optimal habitat for a small number of threatened fauna species. However the habitat values of the dry creek bed are generally lower than when containing water. No removal of sand will occur when water is within this section of creek. All of the higher quality vegetation and habitats within the riparian areas adjacent to the creek and on the floodplain will be retained as part of the proposal.

ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The proposed development is unlikely to result in the sites natural vegetation connectivity to be further fragmented as they are only proposing to extract sand from the creek bed and not the surrounding floodplain. While it is accepted that the proposed development may result in some minor indirect impacts associated with edge effects on the Riparian Open Forest interface with the creek bank, a site management plan has been prepared to ensure that the weed and erosion management activities are in place to control these potential impacts.

The vegetation and habitat management strategies proposed for the site will result in improvements to native vegetation and habitat quality within the context of the local landscape. Due to the retention of native vegetation within the site it is considered that no area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Given the low habitat quality of the dry creek bed it is not considered that the habitats to be removed are of significance to the long term survival of any threatened species, population or ecological community in the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The site has not been identified as critical habitat within the provisions of the *Threatened Species Conservation Act* (1995). Therefore, this matter does not require further consideration at this time.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Recovery Plans or Draft Recovery plans have been prepared for the following threatened species with potential habitat within the subject site:

- Draft Recovery Plan for the Large Forest Owls (Powerful Owl, Masked Owl and Sooty Owl) (DEC 2005).
- Draft Recovery Plan for *Corchorus cunninghamii* (DEC 2004).
- Draft Recovery Plan for the Koala *(Phascolarctos cinereus) (*DEC, 2003a).
- Draft Recovery Plan for the Barking Owl *(Ninox connivens)* (DEC, 2003b).

The subject site contains suitable habitat for these species. All of the suitable vegetation and habitat types for these species within the subject site will be retained as part of the proposal. It is considered that the proposal is generally consistent with the objectives or actions of these recovery plans.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process,

The removal of sand from the site as part of the extraction process does not constitute part of any key threatening process within the *Threatened Species Conservation Act* (1995).

8. COMMONWEALTH LEGISLATION

The *Environment Protection and Biodiversity Conservation Act, (1999)* requires that Commonwealth approval be obtained for certain actions. The Act provides an assessment and approvals system for actions that have a significant impact on matters of national environment significance (NES). These may include:-

- Wetlands protected by international treaty (the Ramsar Convention)
- Nationally listed threatened species and ecological communities
- Nationally listed migratory species

Actions are projects, developments, undertakings, activities, and series of activities or alteration of any of these. An action that needs Commonwealth approval is known as a controlled action. A controlled action needs approval where the Commonwealth decides the action would have a significant effect on a NES matter.

Where a proposed activity is located in an area identified to be of NES, or such that it is likely to significantly affect threatened species, ecological communities, migratory species or their habitats, the matter needs to be referred to Department of Environment and Heritage.

One threatened fauna species the Grey-headed Flying-fox (*Pteropus poliocephalus*) as listed under EP&BC Act (1999) as observed on the subject site. All suitable habitat for this species will be retained as part of the proposal and as such it is not considered that the proposal constitutes a controlled action.

No endangered ecological communities or threatened flora listed in the EP&BC Act (1999) were identified on or near to the site.

It is considered that a referral of this project to Department of Environment and Water Resources is not required as it is not likely to impact on a significant population of nationally listed threatened species or on any nationally listed endangered ecological community.

9. CONCLUSIONS

Based on the field survey and information provided in this report it is concluded that:

i. The subject site contains habitats for a number of threatened species and endangered ecological communities. The area to be impacted however is generally of low value for threatened species. The higher quality habitats and vegetation types will be retained as part of the proposal.

ii. Four threatened fauna species the Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Little Bewnting-bat (*Miniopterus australis*) and Greater Broad-nosed bat (*Scoteanax rueppellii*) were observed within the subject site.

iii. Two endangered ecological communities Subtropical Coastal Foodplain Forest and Swamp Sclerophyll Forest on Coastal Floodplains were observed within the subject site. These will be wholly retained as part of the proposal.

iv. No threatened flora species or endangered populations were observed within the subject site during surveys.

v. The proposed development is not likely to have a significant effect on threatened species, populations, endangered ecological communities or their habitats.

vi. A Species Impact Statement should not be required for the proposed development.

vii. It is considered that a referral of this project to Environment Australia is not required.

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APPENDIX I

FAUNA SURVEY METHODOLOGY

FAUNA SURVEY METHODOLOGY

Introduction

Fauna survey methods used by *Conacher Travers Pty Ltd* are based upon the standard methods utilised by the NSW National Parks and Wildlife Service (NPWS 1999), State Forests of NSW (York *et al.* 1991), LHCCREMS (2003), Wyong Shire Council and Department of Environment and Conservation (DEC 2004). Specific fauna groups are targeted using methods specific to that group. This appendix provides specific information on each of the fauna survey methods applied for this survey. During each of the methods used the following data is gathered relating to weather conditions:

- Air temperature
- Moon (where relevant) (e.g. none, 1/4 moon, 1/2 moon, 3/4 moon, full moon)
- Rain (e.g. none, light drizzle, heavy drizzle, heavy rain)
- Recent rain events (where relevant)
- Wind Strength e.g. calm, light (leaves rustle), moderate (moves branches), strong (moves tree crowns)

The survey methods outlined below are the standard survey methods utilised by *Conacher Travers Pty Ltd.* The specific survey methods used for each site will depend upon the site characteristics such as size of the site, number of vegetation communities and amount of disturbance. The specific fauna survey methods used are outlined within Section 4 of this report.

1. *Diurnal Birds*

a. Bird Census

- A diurnal bird census is undertaken on each day of the survey. Each census involves a 1-2 hour census throughout the site. Birds may be recorded by the observer traversing the subject site or from targeted census points within the site. A bird census is undertaken during peak activity periods (6am-9am and 3pm-6pm or later depending on season) and birds are identified through observation and call identification. Specific habitats of threatened species are also targeted across the study areas either during the bird census or opportunistically.

- Opportunistic bird counts are also made while undertaking other survey work and during spotlight surveys of the site.

- Birds are observed and identified using binoculars. Calls are generally identified in the field by the observer. If an unknown call is heard it is recorded and identified using reference libraries.

b. Opportunistic Sampling

- When carrying out any particular method of fauna survey, any birds observed or heard are recorded. Signs of birds such as feeding stations are also noted and analysed. This provides a wider opportunity for observation of species.

c. **Habitat Searches**

- Habitat searches involve targeted searches for signs of likely bird activity such as nesting or hollow tree use. Signs of feeding such as the characteristic chew marks of Allocasuarina cones are also targeted during searches.

2. *Nocturnal Birds*

a. Spotlighting

- Spotlight surveys are conducted in the evening for 1 hour after sunset in small or highly disturbed sites and for 2 hours in large, undisturbed sites. Surveys are carried out by one or more persons and involve the use of a 55 watt spotlight powered by a 12 volt rechargeable battery. Spotlighting is carried out along existing tracks and/or roads, animal paths, boundary fence lines, woodland or forest with open understorey, individual trees, and where accessible, trapping transects.

b. Owl Call Playback

- The recorded calls of the Powerful, Barking, Masked, and Sooty Owls are broadcast at the completion of spotlighting via a 13 watt battery operated loudspeaker. Calls are broadcast separately for 5 minutes followed by a listening period of 2 minutes. The immediate area is then surveyed with a spotlight to detect any responses. Calls for each species are played separately. Calls are broadcast from different locations depending on the size of the site and the length of the survey.

c. Stagwatch

- Stagwatch surveys are conducted in the evening for approximately 15 minutes prior to and 45 minutes after sunset. Hollow trees identified with habitat potential are observed for use by fauna. Any owls observed leaving hollows are noted and identified.

3. *Arboreal Mammals*

a. Elliott Trapping

- No arboreal Elliott Trapping was undertaken.

b. Spotlighting

- Spotlight surveys are conducted in the evening for 1 hour after sunset in small or highly disturbed sites and for 2 hours in large, undisturbed sites. Surveys are carried out by one or more persons and involve the use of a 55 watt spotlight powered by a 12 volt rechargeable battery. Spotlighting is carried out along existing tracks and/or roads, animal paths, boundary fence lines, woodland or forest with open understorey, individual trees, and where accessible, trapping transects.

c. Hair Tubes

- No hair tube sampling was undertaken.

d. Stagwatch

- Stagwatch surveys are conducted in the evening for approximately 15 minutes prior to and 45 minutes after sunset. Hollow trees identified with habitat potential are observed for use by fauna. Any arboreal fauna observed leaving hollows are noted and identified.

4. ***Terrestrial Mammals***

a. Elliott Trapping

- No Elliott Trapping was undertaken.

b. Spotlighting

- Spotlight surveys are conducted in the evening for 1 hour after sunset in small or highly disturbed sites and for 2 hours in large, undisturbed sites. Surveys are carried out by one or more persons and involve the use of a 55 watt spotlight powered by a 12 volt rechargeable battery. Spotlighting is carried out along existing tracks and/or roads, animal paths, boundary fence lines, woodland or forest with open understorey, individual trees, and where accessible, trapping transects.

c. Hair Tubes

- No terrestrial hair tube sampling was undertaken.

d. Cage Trapping

- No terrestrial cage trapping was undertaken.

5. ***Bats***

a. Sonar Detection

- The ultrasonic calls of Microchiropteran bats are recorded to audio cassette tapes using an Anabat II echolocation call detector. Recordings are made at suitable locations within the study area for a 45 minute continuous recording or all night call activated recording.

- An Anabat II ZCA Interface Module and Anabat 5.2b Software package for an IBM Compatible computer are used to analyse the ultrasonic call patterns recorded during the field and to identify those species recorded on site.

- A survey for Flying-foxes can be conducted by spotlighting potential food trees and by identifying their characteristic social calls.

b. Harp Traps

- No harp trapping was undertaken.

c. Stagwatch

- Stagwatch surveys are conducted in the evening for approximately 15 minutes prior to and 45 minutes after sunset. Hollow trees identified with habitat potential are observed for use by microchiropteran bats. Any bats observed leaving hollows are identified by Anabat II detectors positioned at the base of the tree.

6. *Amphibians*

a. Habitat Search

- Habitat searches involve searching likely niches such as dense undergrowth, around trees, under logs and rocks, and aquatic and gully habitats. Amphibian species observed during habitat searches are noted and the calls of species not observed are recorded onto a personal cassette recorder for later comparison with call reference libraries. Captured individuals were identified on site using field reference texts and released.

- If aquatic habitats are present on the site they are sampled for the presence of particular fish species to gather information on any predatory fish species such as *Gambusia holbrooki.* A small dip net is passed through the waterbody a number of times to sample the fish stock of the aquatic habitat.

- Opportunistic sightings of any reptiles or amphibians are also made while undertaking other survey work and during spotlight surveys of the site.

- Field traverses are made across the study area 0.5 hours at a time. Optimal times for conducting habitat searches are early morning, late afternoon or when favourable weather conditions for a particular species prevail.

b. Call Identification

- Where suitable habitats are present, areas frogs are heard calling are targeted and any frogs heard calling are identified in the field or recorded onto cassette for later identification. This method is specifically used during times of peak calling activity, that is, after rain/storms and in periods of warm weather.

- Field traverses are made across the study area 0.5 hours at a time. Optimal times for conducting habitat searches are early morning, late afternoon or when favourable weather conditions for a particular species prevail.

7. *Reptiles*

a. Habitat Search

- Habitat searches involve searching likely niches such as dense undergrowth, around trees, under logs and rocks, and aquatic and gully habitats. Destructive searches whereby bark, logs, debris, rocks and ant-nests are displaced are also carried out. Reptile species observed during habitat searches are noted and if individuals are captured they are identified on site using field reference texts and released.

- Opportunistic sightings of any reptiles are also made while undertaking other survey work.

- Field traverses are made across the study area for up to 3 hours at a time, usually by one person. Optimal times for conducting habitat searches are between 6am to 9am and 3pm to 6pm, or in suitable weather conditions depending on the season.

b. Spotlighting

- Spotlight surveys are conducted in the evening for 1 hour after sunset in small or highly disturbed sites and for 2 hours in large, undisturbed sites to target nocturnal reptile species. Both terrestrial and arboreal habitats are searched during nocturnal searches. Surveys are carried out by one or more persons and involve the use of a 55 watt spotlight powered by a 12 volt rechargeable battery. Spotlighting is carried out along existing tracks and/or roads, animal paths, boundary fence lines, woodland or forest with open understorey, individual trees, and where accessible, trapping transects.

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Department of Environmental and Conservation (2006) Threatened Biodiversity Survey and Assessment Guidelines.

Forest Fauna Surveys and East Coast Flora Surveys (2001) *Flora and Fauna Survey Guidelines*. Prepared for Lake Macquarie City Council.

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York, A., Binns, D. and Shields, J. (1991) *Flora and Fauna Assessment in NSW State Forests. Survey Guidelines*. Report by Forest Ecology and Silviculture Section, Wood Technology and Forest Research Division, Forestry Commission Forestry Commission of NSW.

Appendix F
Traffic impact assessment

TRAFFIC IMPACT STUDY

LOT 38 DP 755608

PROPOSED EXTRACTIVE INDUSTRY
CABBAGE TREE CREEK,
543 BREWERS ROAD
KIPPENDUFF via RAPPVILLE

For

Kingsbrae Partnership Pty Ltd

March 2008

ARDILL PAYNE & PARTNERS

Civil & Structural Engineers, Town Planners, Project Managers & Surveyors

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FIGURES

1.0 INTRODUCTION

Ardill Payne & Partners has been commissioned by Kingsbrae Partnership Pty Ltd to act as Town Planning and Engineering Consultants to prepare and lodge a development application (and attendant environmental impact statement) to obtain approval to extract sand from a deposit within the bed of Cabbage Tree Creek at Kippenduff via Rappville.

This Traffic Impact Study is a component part of the development application.

1.1 Background

The development proposal is for the resumption of sand extraction from the subject site. The site is the subject of a previous consent for sand extraction (DA 55/95), with sand extraction activities occurring on the site during the period circa 1995 to 2000. DA 55/95 expired on 23 November 2000.

The sand supply within the creek is replenished by natural processes.

1.2 Structure and Scope of Report

Section 2 gives a brief outline of the development proposal, and describes the site location.

Section 3 describes the existing traffic and road conditions in the vicinity of the development and along the haulage routes; examines existing traffic flows and accident history and identifies existing on-site parking demands.

Section 4 describes in detail the development proposal, including access, circulation and parking requirements, traffic generation and distribution.

Section 5 assesses the impact of the development on the existing road network and traffic flows.

Section 6 provides recommendations with respect to required road improvements.

Section 7 provides a summary and conclusions.

2.0 DESCRIPTION OF PROPOSAL

2.1 Proposed Development

Development consent is sought to extract sand from within a creek bed. The sand resource is suitable for use in "ready-mix" concrete, nursery/landscaping supplies and other construction related purposes.

Sand extraction will be conducted via mechanical means utilising an excavator. The material will then screened through a screening plant (dry sieve process) and stockpiled prior to dispatch by trucks to the local markets. A front end loader or excavator will be used to load the haulage trucks.

The extraction operations are situated within a flood-out within Cabbage Tree Creek and will be limited to specific channel areas as described in the EIS.

A maximum amount of 20,000m^3 is proposed to be extracted each year for a period of 30 years. The proposed extraction area has dimensions of approximately 800m x 20m with a total surface area of approximately 1.6ha.

2.2 Zoning

The land is zoned 1(a) (Rural (General) Zone) under the provisions of the Copmanhurst Local Environmental Plan 1990.

2.3 Location and Cadastral Description

The subject land is accessed via Brewers Road and is approximately 5km to the west of Old Tenterfield Road, 22km north-west of the Village of Whiporie and 49 km south-west of Casino.

The land is described in real property terms as Lot 38 in DP 755635, Parish of Wyandah, County of Richmond. **Figure 1** identifies the regional location of the site, and **Figure 2** depicts the immediate locality.

The land is commonly known as No. 543 Brewers Road, Kippenduff via Rappville.

2.4 Existing Land Use

Sand extraction was conducted at the site from circa 1995 to 2000. The land outside of the watercourse consists of unimproved grazing pastures and vegetated woodlands.

2.5 Adjoining Land Use

The adjoining locality is characterised by low intensity agricultural uses (predominantly cattle grazing) and stands of forest and woodland.

3.0 EXISTING CONDITIONS

3.1 Existing Road Conditions

The principal haulage route will follow Brewers Road, Old Tenterfield Road and Wyan Road – Rappville Road via Rappville and the Summerland Way (Main Road No. 83) to Casino. Haulage routes will also follow Old Tenterfield Road and the Summerland Way south to Grafton.

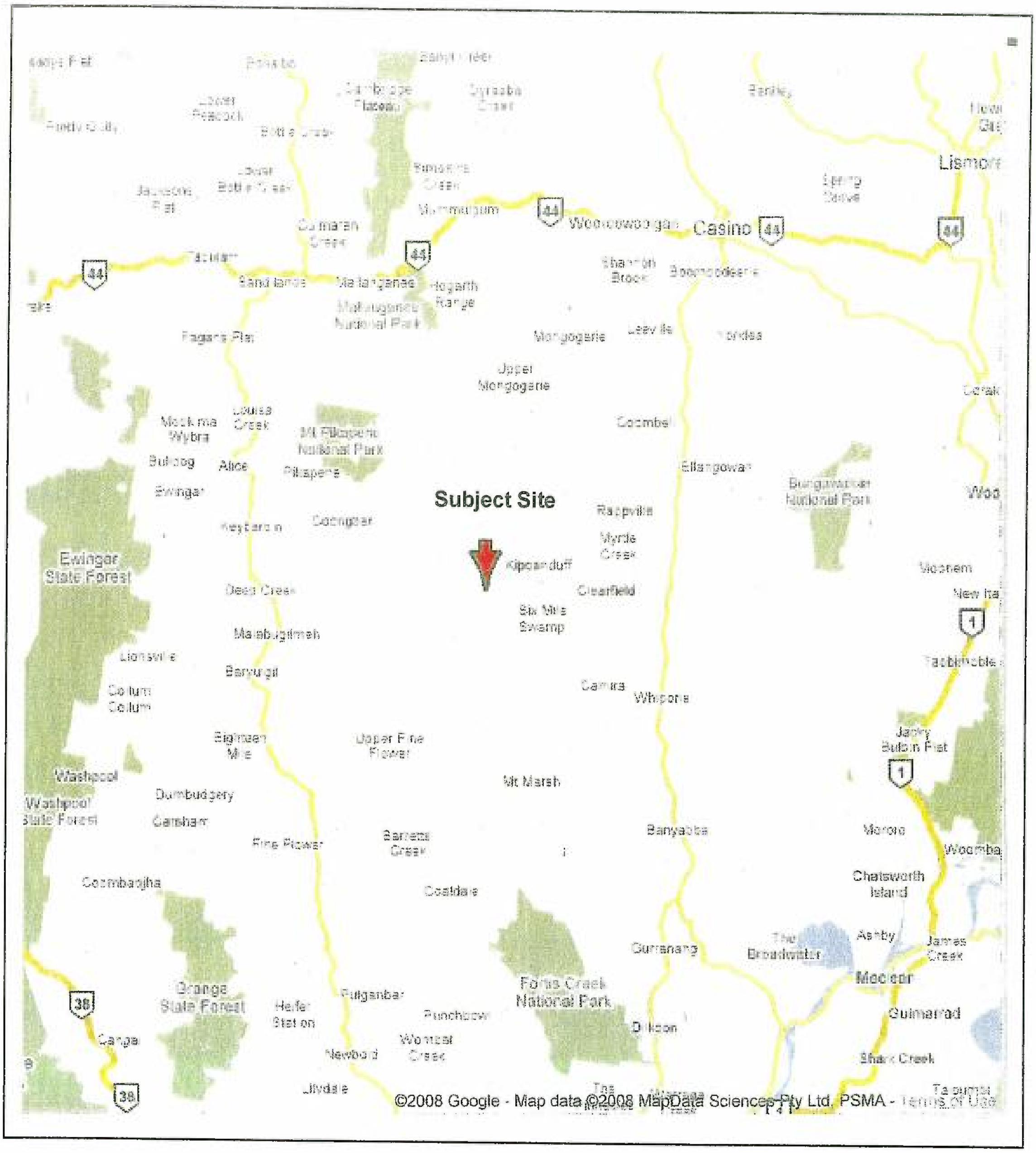

Figure 1- Regional Location

Source: Google Maps Australia, 2007

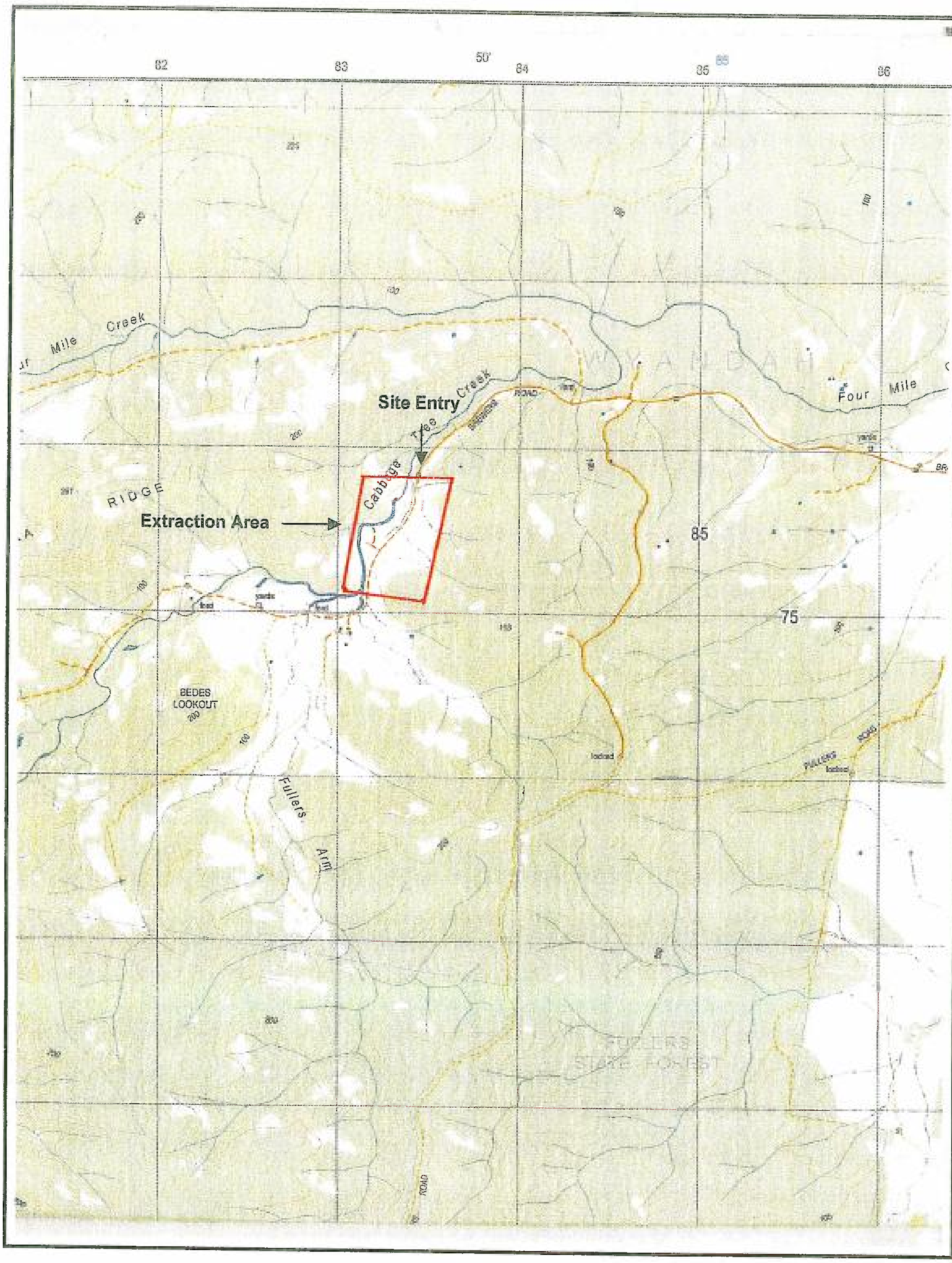

Figure 2- Locality Map

Source: Clearfield 9439-1S 1:25 000 Topographic Map

Department of Lands 2006

3.1.1 Brewers Road

Brewers Road extends from Old Tenterfield Road to the property boundary (approximately 4.5km), is unsealed, and generally has a gravel pavement approximately 4m wide with grassed verges of variable width. The pavement has some firm sandy sections and is uneven in places. Council has advised that Brewers Road is not located within the road reserve for much of the route. Limited opportunity for passing exists along the road.

The intersection with Old Tenterfield Road has a 35m long x 4.8m wide bitumen seal in Brewers Road, and a 5.7m wide seal in Old Tenterfield Road.

3.1.2 Old Tenterfield Road

Old Tenterfield Road has a bitumen seal of varying width from Wyan Road to its intersection with Brewers Road. The width of seal varies from 3.5-6.0m. Old Tenterfield Road is sealed for approximately 1.9km heading south from the Brewers Road intersection, then unsealed for approximately 1.4km, before reaching a new sealed section. Several single lane bridges and causeways are located on Old Tenterfield Road. Carters Bridge south of the Brewers Road intersection has recently been upgraded.

3.1.3 Wyan Road – Rappville Road

Wyan Road extends from Old Tenterfield Road to the village of Rappville, and Rappville Road continues through to the Summerland Way (a total distance of approx 16.5km). Both roads have a bitumen seal with a width varying from 3.5-6.0m. The narrower sections have adequate gravel shoulders.

The intersection of Wyan Road with Old Tenterfield Road is fully sealed and of a suitable standard, with adequate sight distance in all directions. The intersection of Rappville Road with the Summerland Way is a typical Austroads Type CHR intersection.

3.1.4 Summerland Way (MR No. 83)

The route audit of the Summerland Way has judged the section from Kyogle to Grafton to be of fair quality (Summerland Way Audit, Maunsell Australia/NRMA, July 2004).

Summerland Way from the Casino town limits to the Rappville turn-off is a two lane rural road with a 9-10m wide bitumen seal.

3.2 Existing Traffic Flows

Traffic survey results for Summerland Way and Centre Street, Casino (Bruxner Highway) are shown in **Table 1**.

Table 1. Existing Traffic Counts for Summerland Way and Centre St, Casino

Station	Road	Location	1990 AADT	1995 AADT	1998 AADT	2001 AADT
*04.672	Summerland Way	Whiporie	1376	1413	1374	1432
04.165	Summerland Way	Casino – sth of Rifle Range Rd	3200	3936	3415	3738
04.335	Summerland Way	Casino – sth of Hare St	-	5554	5796	5622
04.337	Centre Street (Bruxner Hwy)	Casino – sth of Johnston St	-	10565	10605	11107

Source: Traffic Volume Data for Northern Region 2001, RTA 2002.
(indicates a permanent survey station counting axle pair passes)*

No current traffic data is available for Rappville Road, Wyan Road, Old Tenterfield Road or Brewers Road, but these roads are considered to be not highly trafficked. Traffic volumes for Old Tenterfield Road in December 1994 were 85 veh/day (EIS for the Proposed Extractive Industry, Cabbage Tree Creek, Peter A. Jelliffe, August 1995).

3.3 Accident History

Crash analysis on the Summerland Way reveals a very slight downward trend in the total number of crashes and the number of fatalities and injuries between 1994 and 2003. The most common crash type between 2001 and 2003 was when a vehicle runs off the carriageway, which could be as a result of the poor shoulder provision (Summerland Way Audit, Maunsell Australia/NRMA, July 2004).

Since the 1995 audit, pavement condition has improved, together with additional signage and speed restrictions, which may have contributed to the decrease in the number of crashes and injuries in 2003.

3.4 Existing On-Site Parking and Access

Current site uses do not generate a need for on-site parking. Sufficient informal on-site parking is available for all situations.

Access to the site is gained via the unsealed Brewers Road which comes into the property approximately halfway along the northern boundary, as shown in **Figure 2.** Access to the channel area is by way of existing gaps in the trees along the creek bank.

3.5 Trip Distribution

A distributional split will occur once the trucks reach Casino and distribute either east or west. Most of the traffic will travel east along the Bruxner Highway to the centres of Lismore, Alstonville and Ballina.

3.6 <u>Public Transport</u>

Bus services do not currently pass the site or use Old Tenterfield Road between Wyan Road and Brewers Road.

Eyears Casino Bus Service operates a weekday service via Casino – Rappville – Wyan – Busby's Flat during morning and afternoon peak times. This service passes through Rappville at approximately 7:30am and 4:30pm. Eyears also operate a weekday service from Casino – Rappville – Whiporie via the Summerland Way, passing through Rappville at approximately 7:50am and 4:05pm.

Norm Kane operates a weekday school service from Casino – Camira Creek – Whiporie via the Summerland Way during morning and afternoon peak times. This service passes through Camira Creek at approximately 7:20am and 4:20pm.

3.7 <u>Pedestrians</u>

There is no measurable pedestrian traffic in the vicinity of the site.

3.8 <u>Proposed Developments in the Vicinity</u>

Ardill Payne & Partners consulted with Mr Jeff Brownlow of the Department of Primary Industries (DPI) to determine the extent and scale of similar activities within a 10km radius of the site.

The DPI's INDMIN database identified 15 construction material sites (including the subject site) within 10km of the subject site.

Of the 15 quarries only one (Brenners Quarry) was identified as being operational. Two of the quarries listed are those that have recently been approved by Richmond Valley Council, viz:

- DA 2006.0215 – endorsement date of consent 26 June 2006 – Lots 13 & 15 DP 755608 – No. 1600 Old Tenterfield Road, Rappville (Six Mile Swamp Creek) – 25,000m^3 per annum for 25 years
- DA 2007.0099 – endorsement date of consent 20 February 2007 – Lot 35 DP 755608 – No. 1380 Old Tenterfield Road, Rappville (Six Mile Swamp Creek) – 5,000m^3 per annum for 30 years

At the time of preparing this report, these two quarries had not commenced operation.

4.0 PROPOSED DEVELOPMENT

4.1 The Development

4.1.1 Overview of Operations

The operations involve the progressive extraction of medium dry river sand from the bed of the Cabbage Tree Creek. The floodout area proposed for extraction operations on the subject site is approximately 800m in length and 20m in width (average), which amounts to approximately 1.6ha. A maximum amount of 20,000m^3 is proposed to be extracted each year for a period of 30 years.

The sand is suitable for use in "ready-mix" concrete, nursery supplies, landscaping and other construction related purposes.

In summary, the proposed extraction involves the following:

- removal of unconsolidated sand via mechanical means (excavator)
- screening of the sand to separate organic matter via a dry sieve screen
- stockpiling the sand
- loading the sand into haulage trucks by an excavator or front end loader for dispatch to surrounding markets

The extraction works are proposed to be undertaken in stages, working progressively from the upstream to the downstream end of the site. Quantities of sand extracted within each stage will vary according to the surface area and depth of each section.

4.1.2 Site Layout

With the exception of the movement of haulage trucks to and from the site all other activities will be contained wholly within the site. Excavation, screening, stockpiling and loading onto haulage vehicles will all take place on the creek-bed and overbank areas adjacent to the flood-out. Fuel, lubricants and the like will be stored in appropriately contained and bunded areas that are well clear of the creek bed and banks.

4.1.3 Plant and Equipment

Equipment to be utilised at the site includes:

- 1 x Excavator
- 1 x Front end loader (7 tonne)
- 1 x portable screening plant operated by an auxiliary diesel motor
- Haulage trucks (8-20m^3 capacity)

Diesel fuel will be required for the operation of the excavator, front-end loader and screening plant. Fuel will be available on the site in a mobile or skid-mounted tank. No refuelling will be undertaken within the bed or on the banks of the creek. No haulage trucks will be refuelled at the subject site. They will be refuelled at appropriate fuelling facilities distant from the site.

4.1.4 Personnel

Only one on-site manager/operator will be employed at the site in conjunction with day-to-day operations. Additional personnel may be needed on a limited basis. Truck drivers will also be required depending upon demand.

Given the size of the proposed operation (maximum 20,000m^3 per annum) the site will only be operated on an intermittent basis. Proposed hours of operation will be 7:00am to 6:00pm Monday to Friday, 7:00am to 2:00pm Saturday, and access for machinery maintenance only on Sundays and public holidays.

4.1.5 Transportation

Sand extracted from the site will be screened and stockpiled at the designated locations and will be loaded onto haulage trucks that have a carrying capacity of 8-20m^3.

The quarry will provide material to the operators' depot at Casino and/or work sites at a number of locations throughout the region including Lismore, Alstonville, Evans Head, Casino, Tabulam and Ballina.

The principal haulage route follows Brewers Road, Old Tenterfield Road and Wyan Road – Rappville Road via Rappville and the Summerland Way (Main Road No. 83) to Casino. A directional split will occur once the trucks reach Casino. Most of the trucks will travel east along the Bruxner Highway to the centres of Lismore, Alstonville and Ballina. Some haulage may follow Old Tenterfield Road via Carter's Bridge to the Summerland Way at Whiporie, then south to Grafton. Carter's Bridge over Six Mile Swamp Creek has recently been upgraded.

Figure 3(a) depicts the proposed haulage route north on the Summerland Way to Casino. **Figure 3(b)** depicts the proposed haulage route south on the Summerland Way to Grafton.

A commitment to speed management, ensuring compliance with truck load limits and the implementation of a "covered load" policy will be implemented to ameliorate the impact of the development on other road users and the road network.

4.2 Access and Sight Distance

Site access is via Brewers Road and then by way of an existing track at the northern property boundary, as shown in **Figure 2**. The existing track was

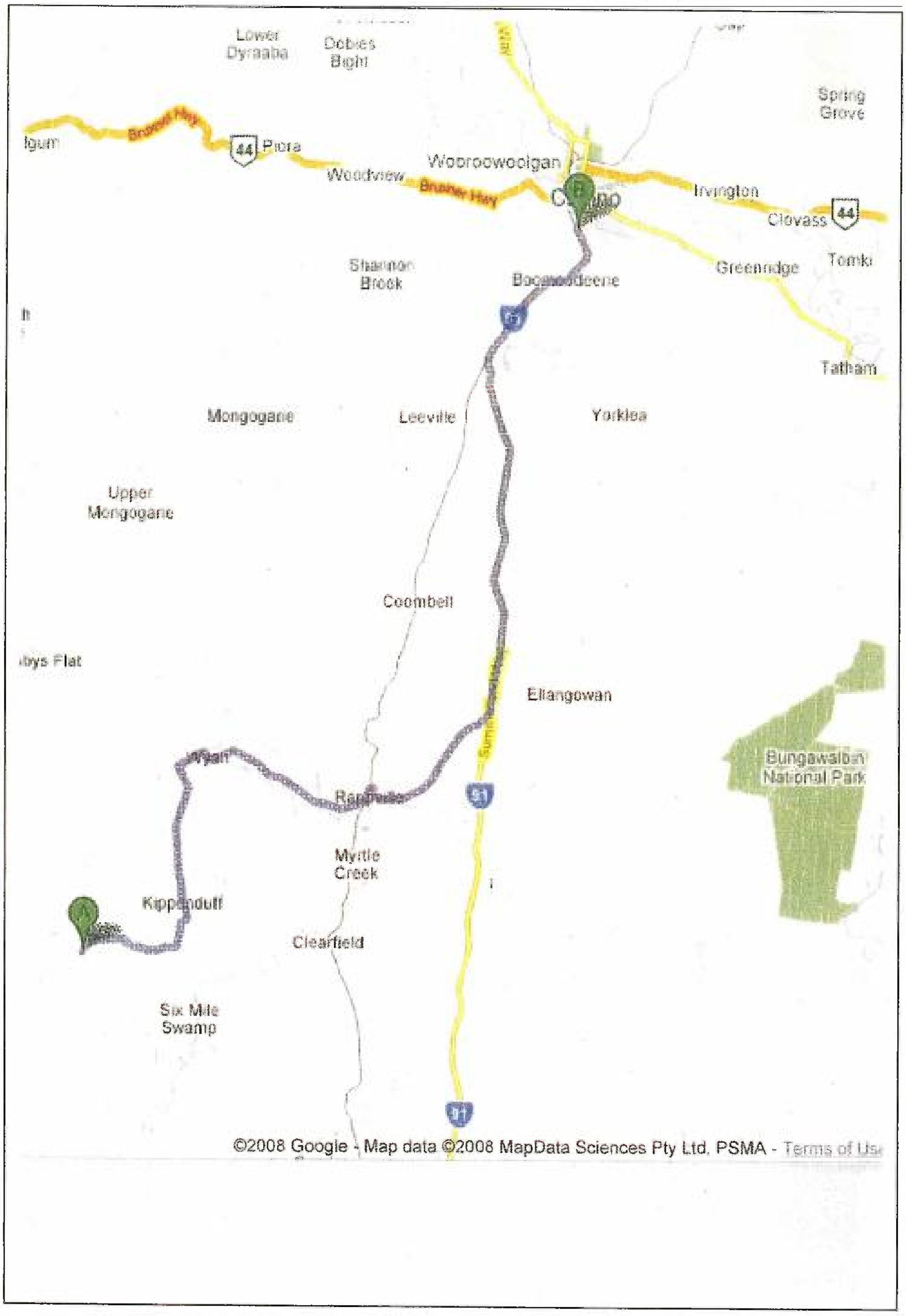

Figure 3(a) – Proposed Haulage Route North

Source – Google Maps 2008

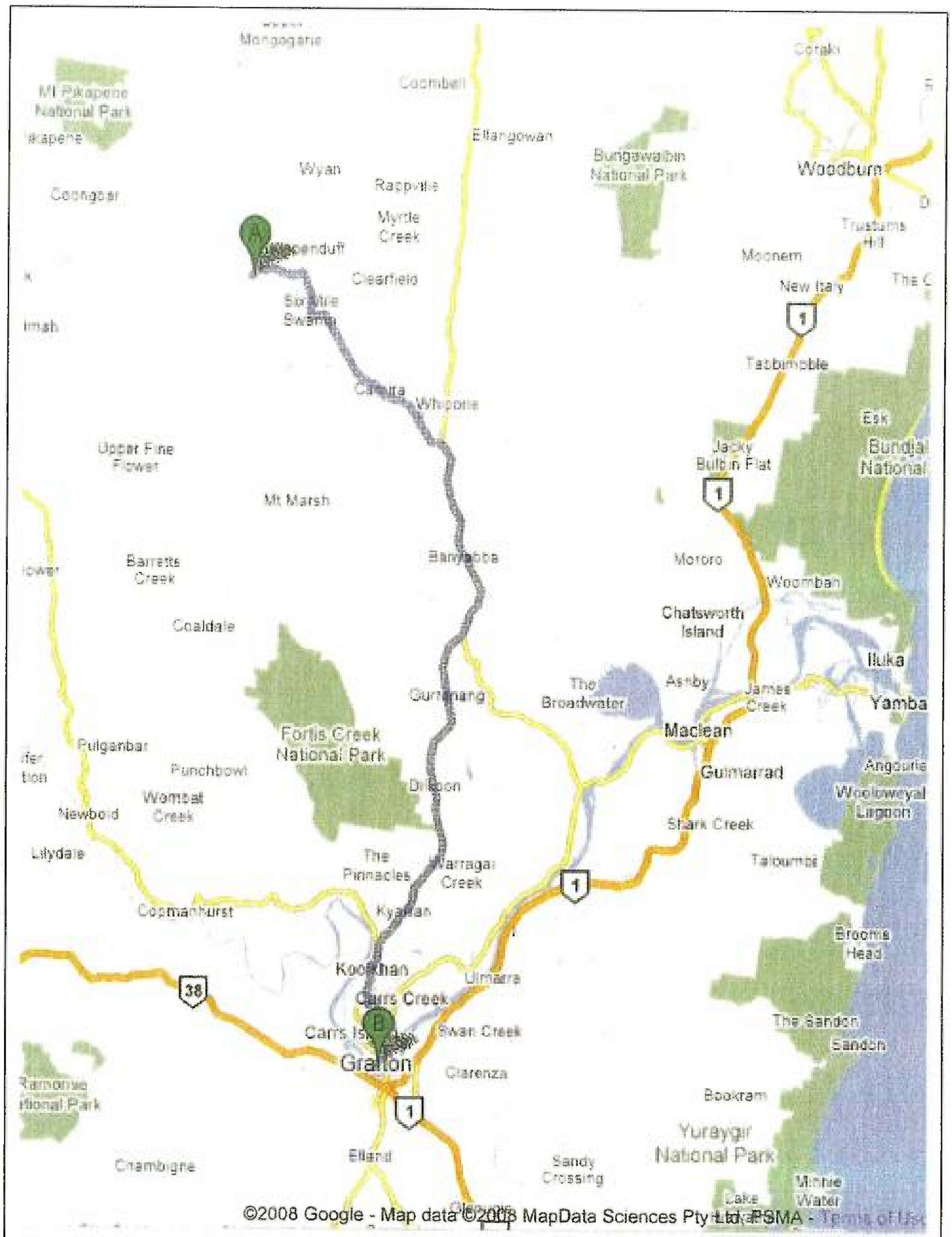

Figure 3(b) – Proposed Haulage Route South

Source – Google Maps 2008

previously utilised for the purpose of earlier sand extraction undertaken at the site.

Richmond Valley Council has confirmed that Brewers Road does not accurately follow the road reserve, and have advised that the road realignment would have to be rectified to prevent materials being transported through private land. Council has also advised that Brewers Road will require upgrading to a type 'B' road construction / intersection, and that there is a potential requirement for sealing of the road 100m either side of existing dwellings located along Brewers Road as a dust and noise mitigation measure (Council letter to APP, ref P1000997, 55/95, dated 18 Dec 2007).

Existing sight distance from Brewers Road north along Old Tenterfield Road (towards Rappville) is 120 metres and south (towards Whiporie) is 600 metres. In the 1995 EIS prepared by Peter Jelliffe, the sight distance to the north was reported as 200m. Vegetation regrowth on the eastern side of Old Tenterfield Road north of the intersection has reduced this available sight distance.

Based on a design speed of 80km/h for Old Tenterfield Road, a minimum safe intersection sight distance of 170m is required in each direction from Brewers Road (Austroads GTEP Part 5: Intersections at Grade, Table 6.3).

With the removal of some roadside vegetation north of the intersection, mainly native vegetation and regrowth, the sight distance will be improved. The sight distance is then considered to be adequate considering that Old Tenterfield Road is not highly trafficked and is of a standard that is sufficient to accommodate the expected vehicles and daily movements.

4.3 Circulation

The internal tracks were used in previous quarrying operations. Sites for processing plant, stockpiling, loading and storage facilities are already available.

4.4 Parking

The assessment of parking requirements has been based on:

- AS/NZS2890.1-2004 "Parking Facilities – Part 1: Off-street Car Parking"
- AS2890.2-2002 "Parking Facilities – Part 2: Off-street commercial vehicle facilities"
- RTA Guide to Traffic Generating Developments, 1993.

These requirements are summarised in **Table 2**.

Table 2. Parking Requirements for Proposed Development

Parking Generation Unit	No	Parking Requirement	Parking Spaces	
			Required	Provided
Employees [A]	1	1 per 2 employees	1	1
		Total Parking Spaces:	**1**	**1**

Note: A) The maximum number of employees on site at any time.

Substantial space is available on site adjacent to the access and circulation tracks for additional informal parking arrangements.

Deliveries will be relatively infrequent and will be limited to fuel for extraction and processing plant and plant service vehicles. These will occur mainly in off-peak times. Due to the small amount of supplies and materials required, the provision of additional formal parking is not warranted.

4.5 Traffic Generation

The project proponent indicates that target extraction rates will vary however consent is being sought for a maximum of 20,000m³ per annum. It is envisaged by the proponent that yearly extraction rates would more typically be in the order of 5,000 – 10,000m³ per annum.

Actual daily extraction will vary in accordance with a number of factors including:

- weather (particularly during rain events)
- resource supply
- fluctuations in demand

Notwithstanding the above, the total number of truck movements per year generated by the operations will be limited by the proposed yearly cap on extraction.

It is proposed to conduct work at the site six days per week, 52 weeks per year, however the above-referenced variations will likely reduce this to a maximum of 260 days per year, which equates to five working days per week.

Based on a typical annual extraction rate of 10,000m³ and 260 working days per year, average daily extraction rates of approximately 40m³ of sand would be transported from the site each day (2 truck loads per day). However, peak days may generate up to 100m³/day (5 truck loads per day).

Traffic generation has been estimated assuming the use of haulage trucks with a maximum capacity of 20m³. This equates to a maximum of 1250 truck loads per year, or 2500 truck trips per year, based on the maximum extraction rate of 20,000m³ (a return trip counts as two trips).

Table 3 is indicative of the average traffic rates that will be generated by the operations if the average daily extraction rate (40m³/day) is achieved.

Table 3 – Average Traffic Generation Rates

Truck Capacity	Loads/day	Truck Movements/day	Average vehicle movements/hr
$20m^3$	2	4	<1

Table 4 is indicative of the peak traffic rates that will be generated by the operations if the maximum daily extraction rate ($100m^3$/day) is achieved.

Table 4 – Peak Traffic Generation Rates

Truck Capacity	Loads/day	Truck Movements/day	Average vehicle movements/hr
$20m^3$	5	10	1

The site will be operated by one on-site manager, who will generate an additional two traffic movements per day.

The project will typically generate a minor increase in heavy vehicle movements on local rural roads. Such increases will not be excessive nor exceed the carrying capacity and capabilities of these roads. The level of impact on the Summerland Way and Bruxner Highway will be imperceptible.

5.0 IMPACTS OF PROPOSED DEVELOPMENT

The greatest impact of the additional traffic will be felt on Brewers Road, Old Tenterfield Road and Wyan Road – Rappville Road passing through Rappville.

5.1 Impact on Traffic Safety

Additional peak traffic movements of no more than 1-2 vehicles per hour are unlikely to raise any adverse safety issues for local transport and users of the local and regional road network.

5.2 Impact on Traffic Efficiency

This study indicates that the flows from the development will not change the level of service currently experienced in the adjacent roads.

To aid interpretation on the impacts on traffic flows, the RTA's "Guide to Traffic Generating Developments" provides acceptable ranges of peak vehicle flows for various "levels of service" experienced on rural roads. The intention is to at least maintain the existing "level of service" for the roads adjacent to the site. Road capacity "levels of service" are defined by the RTA for rural roads as shown in **Table 5**, with the highest level of service being Level A (free flow), with service deteriorating to Level F (forced flow).

Table 5. Two-way Peak Hour Flows on Two Lane Rural Roads

Terrain	Level of Service	15% Heavy Vehicles (veh/hr) – 100kph	15% Heavy Vehicles (veh/hr) – 80kph
Level	B	530	477
	C	870	783
	D	1410	1269
	E	2290	2061

The following performance standards are recommended:

Weekday Peak Hour Flows
Major Roads: Level of service C
Minor Roads: Level of service C (desirable)

Recreational Peak Hours (weekends)
Major Roads: Level of service D
Minor Roads: Level of service D (desirable)

As the "level of service" is currently Level B or better (Summerland Way south of Rifle Range Road, Casino – 374 veh/hr from Table 1; allowing for a compound growth factor of 2%pa over 7 years, peak hourly volume becomes 429 veh/hr), the anticipated additional peak traffic movements of 1-2 vehicles per hour will not alter the "level of service" currently experienced, nor impose any major social or physical detriment upon the local residents and road users. The additional traffic generated by the proposed development is relatively insignificant when compared to the existing traffic volumes. Further the traffic levels are still well within the prescribed RTA service guides. The level of impact on the Summerland Way and Bruxner Highway will be imperceptible.

5.3 Impact on Public Transport

Where using main roads, the haulage trucks will share these roads with public transport. This was also the case with prior extraction haulage activities, with no known problems. It is recommended that truck drivers be made aware of existing school bus routes, bus stop locations and timetables along the proposed haulage routes.

The proposal raises no demand for the provision of public transport as only one employee is engaged at the site. Private transport will be adopted for personal access.

5.4 Cumulative Impacts

In June 2006 a development consent was issued by Richmond Valley Council (DA 2006.0215) for the extraction of up to 25,000m³ per annum from Lots 13 & 15 DP 755608, located on Old Tenterfield Road approximately 2km south of the Brewers Road intersection. In February 2007 a development consent was issued by Richmond Valley Council (DA 2007.0099) for the extraction of up to

5,000m³ per annum from Lot 35 DP 755608, located on Old Tenterfield Road approximately 1km south of the Brewers Road intersection.

Tables 6 and **7** combine the traffic generation rates from the Traffic Impact Studies prepared by Ardill Payne & Partners for DA 2006.0215 and DA 2007.0099 and are indicative of the average and peak traffic rates that would be generated by the proposed quarries if they were to operate concurrently. The cumulative rates would apply on Old Tenterfield Road and Wyan Road.

Table 6 – Combined Average Traffic Generation Rates for DA.2006.0215 and DA.2007.0099

Truck Capacity	Loads/day	Truck Movements/day	Additional vehicle movements/hr
20m³	6	12	1

Table 7 – Combined Peak Traffic Generation Rates for DA.2006.0215 and DA.2007.0099

Truck Capacity	Loads/day	Truck Movements/day	Additional vehicle movements/hr
20m³	55	110	11

Tables 8 and **9** combine the traffic generation rates for both of the approved DA's with the subject proposal. The cumulative rates would apply on Old Tenterfield Road and Wyan Road.

Table 8 – Average Traffic Generation Rates for both approved DA's and the subject proposal

Truck Capacity	Loads/day	Truck Movements/day	Additional vehicle movements/hr
20m³	8	16	2

Table 9 – Peak Traffic Generation Rates for both approved DA's and the subject proposal

Truck Capacity	Loads/day	Truck Movements/day	Additional vehicle movements/hr
20m³	60	120	12

The subject proposal will result in an incremental increase to traffic in the project area, including traffic associated with DA 2006.0215 and DA 2007.0099. However, the cumulative peak traffic movements generated by the approved DA's and the subject proposal will not alter the "level of service" currently experienced on Summerland Way and Bruxner Highway (Refer Section 5.2).

6.0 RECOMMENDATIONS

The condition of Brewers Road is generally acceptable for the purposes of a haulage route. Several sections are uneven and will require regrading, and the table drain on the southern side of the road is either silted in the low areas or eroded in the steeper areas. General maintenance of the road surface and table drains should be undertaken prior to commencement of operations

The section 0.6km – 1.1km from Old Tenterfield Road is in poor condition and requires reconstruction to a minimum 4m gravel pavement with 1m shoulders, in accordance with the recommendations of the Northern Rivers Local Government 'Development and Design Manual', Version 2.

7.0 SUMMARY AND CONCLUSIONS

An assessment of a variety of traffic issues associated with the proposed development was undertaken by Ardill Payne & Partners. This assessment was to examine the impact that the proposed development will have on the local traffic flows and road network.

The issues addressed in this report and the associated conclusions are summarised below:

- **Access** – satisfactory access to the site will be provided. Brewers Road requires some minor works to improve the road standard. Intersection sight distances are considered adequate.
- **Parking** – adequate space for parking is available on site.
- **Traffic Generation** – will not alter the level of service currently experienced on adjacent roads, nor impose any major social or physical detriment upon the local residents and road users.
- **Traffic Safety** – with the recommended upgrade works in Brewers Road, additional traffic movements generated by the development are unlikely to raise any adverse safety issues for local transport and users of the local and regional road network.

In view of the above it is assessed that the safety and efficiency of the local road network will not be unduly affected due to the limited number of truck movements that will be generated by the proposal.

Please do not hesitate to contact the undersigned if you have any queries or require further assistance.

Yours faithfully

Tony Cromack
ARDILL PAYNE AND PARTNERS

Appendix G
Agricultural assessment

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AGRICULTURAL ASSESSMENT

Lot 38 DP 755635
543 Brewers Road
County of Richmond

Prepared by:

John Allen
20 December 2007

1 INTRODUCTION

1. Wilkie Fleming & Associates have been requested by Ardill Payne & Partners to undertake an agricultural land assessment for Lot 38 DP 755635 situated at No. 543 Brewers Road in the Parish of Wyandah. The assessment is to accompany a development application and environmental impact statement for sand extraction from the bed of Cabbage Tree Creek which is situated adjacent to Brewers Road. The development application is to be submitted by Ardill Payne & Partners on behalf of Kingsbrae Partnership Pty. Ltd.

2. The report will also address the agricultural quality and use of the adjoining lands, the effect of the proposal on existing and future agricultural production and any issues of rural land use conflict.

3. The site was inspected on the 22nd of October 2007 by the writer in order to prepare this report.

2 BACKGROUND

4. It is to be noted that prior to this current proposal, consent had been previously granted for sand extraction from the site by the, at that time Copmanhurst Shire Council (now Richmond Valley Council). Under the terms and conditions of that Development Application 55/95 the consent was valid for a period of 5 years and extended from the 23rd of November 1995 through until the 23rd of November 2000.

3 SITE DESCRIPTION

3.1 Location

5. The site is situated approximately 20 kilometres by gravel and sealed roads southwest from the town of Rappville. It is approximately 710 hectares in area and is irregular in shape. Entrance to the site is gained via the unsealed Brewers Road which comes into the property approximately halfway along the northern boundary. Refer to Appendix 1 that is an extract of the NSW Central Mapping Authority 1:25000 series maps for Clearfield 9439-1S that shows the site outlined in red.

6. Land within the site is zoned 1(a) General Rural under the provisions of the Copmanhurst LEP 1990.

3.2 Land Use

7. Land use throughout the site is a combination of low intensity cattle grazing and uncleared forest. Land use immediately surrounding the site is State Forest, Nature Reserve and uncleared forest. Fullers State Forest is situated to the south east of the site while the Mt. Neville Nature Reserve is situated to the west and south west. Uncleared scrub/forest is situated on private land to the north.

8. Cattle grazing within the site is on unimproved and generally poor quality native cooch grasses and this is restricted to the lower elevated and more gently sloping land that is situated adjacent to existing major drainage lines (including Cabbage Tree Creek). This existing grazing land is predominately located within the north western portion of the site.

horizons and the B subsoil horizons; that is they are duplex soils. In this instance there was approximately 15cm of grey brown light clay material overlying approximately 15cm of grey brown clayey sand below which dark grey brown heavy clay extended to at least 75cm. Orange mottling was evident throughout this subsoil clay horizon and this is indicative of poorer subsoil drainage.

15. With the exception of the isolated occurrence of the Grey-Brown Podzolic soil, soils throughout the majority of the sampled area were found to be Siliceous Sands. Siliceous Sands are uniformly textured sandy soils with extremely poor structure (massive or single grain). In this instance there was approximately 30 to 35cm of brown to grey brown sand overlying an orange to light brown sand that extended to beyond the limit of the soil auger (100cm). Soil structure was massive at the surface and single grain at depth. Refer to Appendix 5 that shows a profile of a Siliceous Sand at a road cutting (H8).

16. Siliceous Sands are recognised as being very poor quality agricultural soils that are only generally capable of supporting limited plant growth[1]. This is primarily due to poor water retention characteristics and very low levels of nutrient fertility. Refer to Appendix 5 Plate 3 that shows the quality of surface vegetation that was present in the vicinity of H5 and which was typical of the remainder of the sampled areas.

17. The sandy texture of these Siliceous Sand soils along with their extremely poor structure means that they are particularly vulnerable to the effects of soil erosion. Appendix 5 Plate 4 gives an example of surface soil exposure that was evident at a location half-way between H1 and H2. This is therefore a severe constraint to cultivation or any operation that removes protective ground cover from these particular soils.

3.3.3 Climate

18. The site enjoys a variable but favourable annual rainfall that is considered to be adequate for good pasture and crop growth. A significant matter in this report is that rainfall events of a high intensity are possible and the sloping nature of the land in conjunction with inherent soil properties already outlined predisposes the land to a very high risk of soil erosion if cultivated agriculture is undertaken.

19. Temperatures are warm to hot in summer and this allows a long pasture and crop-growing season when moisture levels permit. The lower lying lands that are present throughout the valley flat areas of the site may be subject to frosts however and these areas of land are therefore only suited to frost tolerant crops or frost susceptible crops in the no-frost period of the year. Generally however the climate is suitable for a large range of agricultural enterprises.

4 AGRICULTURAL LAND CLASSIFICATION AND POTENTIAL LAND USE

20. For the purposes of this report, the agricultural land classification of the site has been determined by using the Rural Land Evaluation Manual (RLEM)[2]. The relevant land classes identified in the RLEM are outlined as below.

---

[1] Charman P.E.V., Murphy B.W. ed (1991) Soils Their Property and Management. A Soil Conservation Handbook for New South Wales, Sydney University Press, Sydney.
[2] New South Wales Department of Planning (1988), *RLEM. Rural Land Evaluation Manual*, Sydney.

operation such as continuous or regular cultivation that will remove protective ground cover is strongly advised against. Furthermore these soils are known to be inherently infertile due to poor water holding capacities and low levels of nutrient fertility. In conclusion, these soils are very poor agricultural soils and it is considered that the highest and best agricultural land use that they are capable of sustaining is low intensity grazing; that is a Class 4 land classification and associated land use.

23. Soil profiles were not tested throughout the remainder of the site; that is the more steeply sloping areas although it is expected that the quality of the soils present within these areas would be of a similar standard. In any event the degree of slope that is present and that which fluctuates between 10 to greater than 40% represents a severe risk of soil erosion for these areas and on this basis the land is considered to be unsuitable for agriculture or at best suited only to light grazing; that is a Class 5 land classification and associated land use.

24. Analysis of topographical maps and also available soil data[3] indicates that the lands surrounding the site are of a similar quality; that is low hills landform pattern of gentle to steep slopes and poor quality soils that are identified as Siliceous Sands, Red and Brown Earths (sandy profiles). The agricultural land classification of these surrounding lands would therefore be very similar to that which is given for the site; that is Class 5 with isolated areas of Class 4 land. The site and surrounding lands are therefore identified as being of a poor quality for agricultural purposes and in no way are considered to be Prime Agricultural Land.

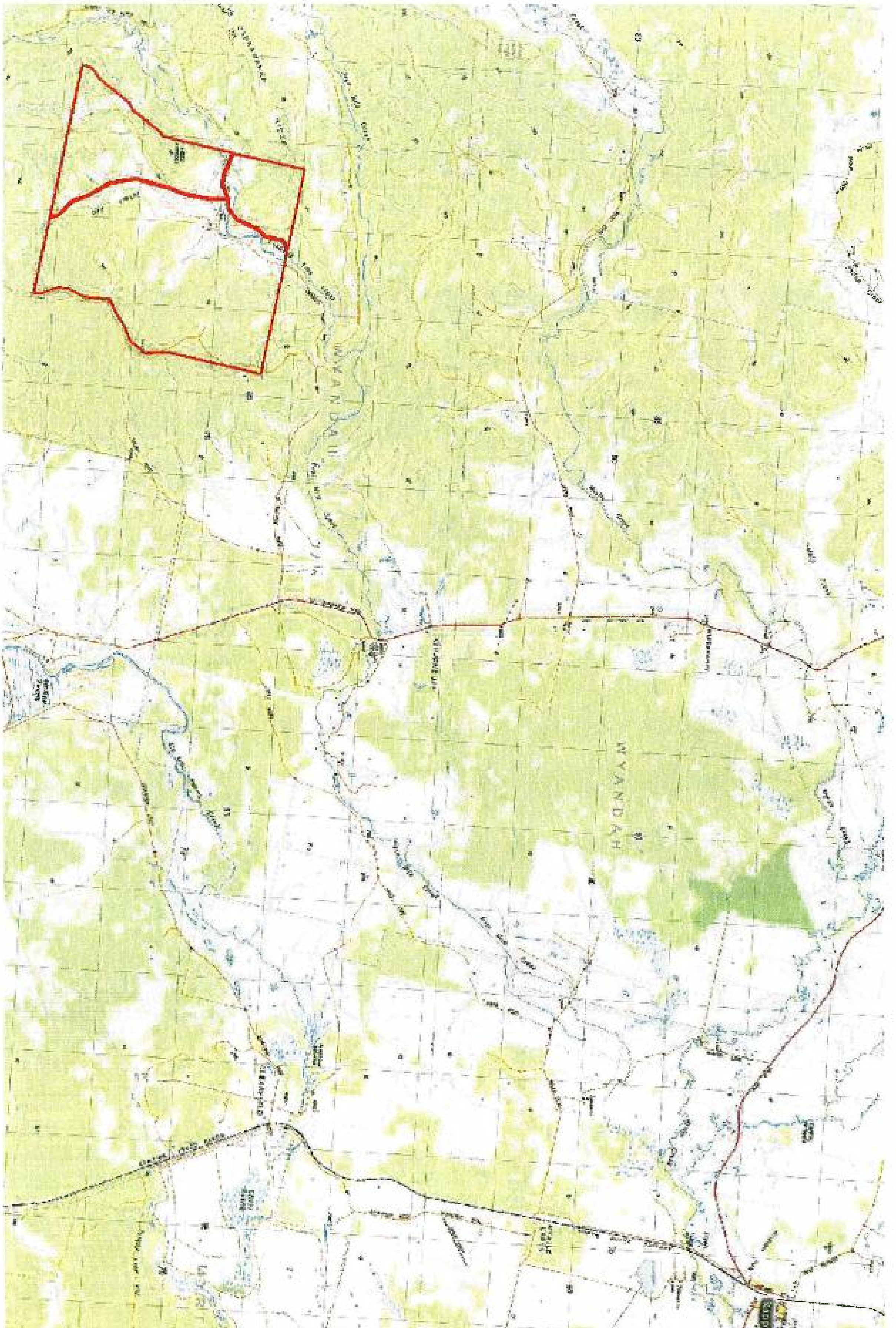
5 THE PROPOSAL AND LAND USE CONFLICT

25. It is proposed that sand is to be extracted from the bed of Cabbage Tree Creek. Appendix 2 shows the location of this zone of extraction. This zone of extraction is located within an area of Class 4 land (Appendix 4) which as has been previously discussed is essentially poor agricultural land with limited production potential. The existing agricultural operation that has been undertaken throughout these areas and that which is identified as low intensity cattle grazing is considered to be the highest agricultural land use that the land is capable of sustaining. Low intensity cattle grazing, due to inherent characteristics has a low level of production per unit area of land. Removal of this particular land from agricultural production will therefore in no way significantly reduce the agricultural production potential of the site which is already very low in any event.

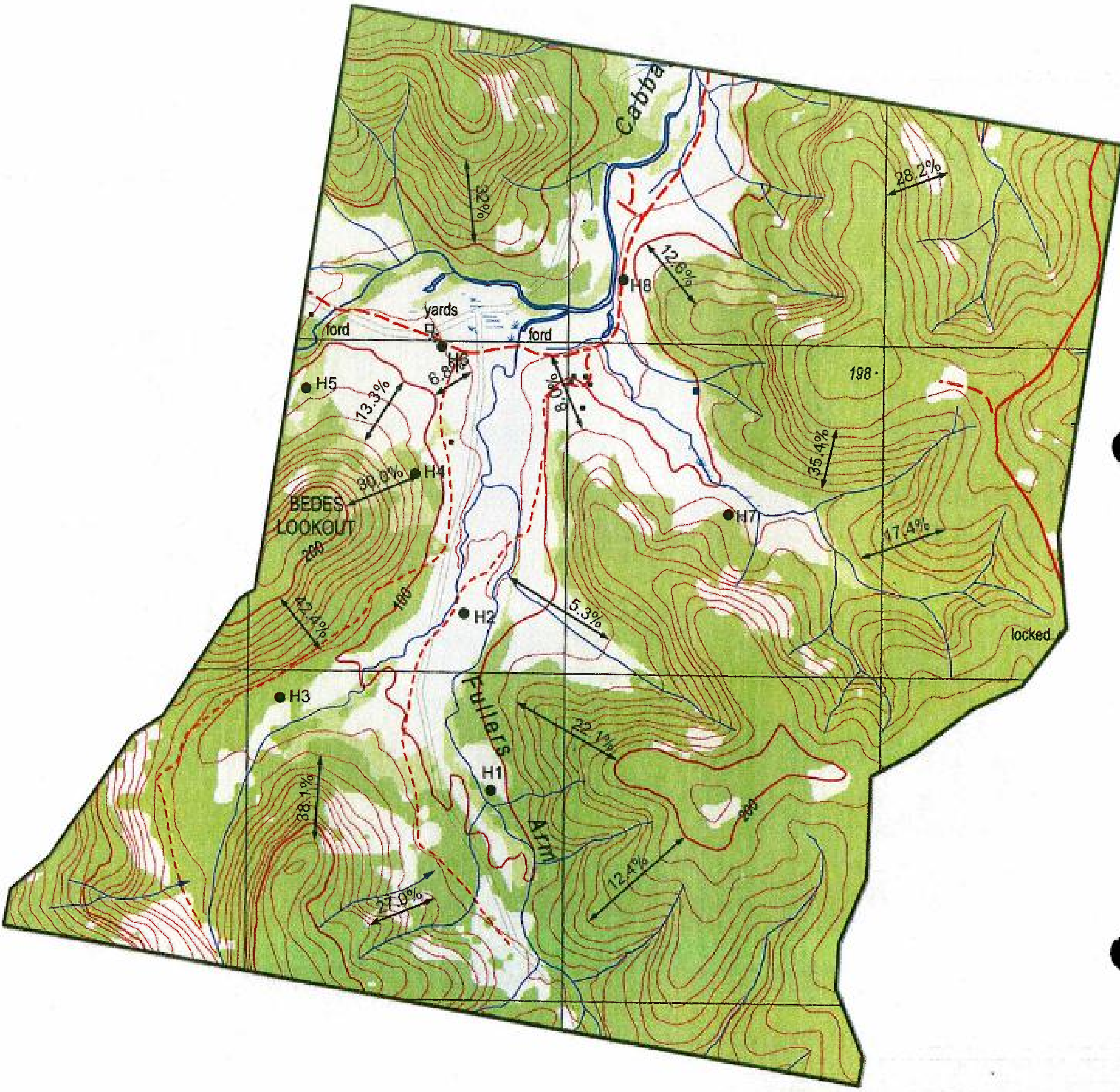
26. Land uses which immediately surround the site are identified as been unused scrub, Nature Reserve and State Forest. The proposal will in no way therefore conflict with these existing land uses. A neighbouring residential dwelling exists to the east of the Brewers Road as it enters the site and to the north of the site's northern boundary. This dwelling is situated on higher elevated land in relation to the zone of extraction and is separated from this point by a distance of approximately 500 metres. Furthermore uncleared scrub is situated between the dwelling and the nearby Brewers Road and also south of the dwelling to the site's northern boundary. From the site's northern boundary to the zone of extraction the land is occupied by a mix of cleared and uncleared scrub land. It is therefore considered that the spatial separation distance in addition to the higher location of the dwelling and intervening scrub is more than sufficient to provide an adequate buffer zone

[3] New South Wales Department of Natural Resources, SPADE NRAtlas, http://www.dnr.nsw.gov.au/soils/data.shtml

Appendix 1: Site Location



Appendix 3: Topography

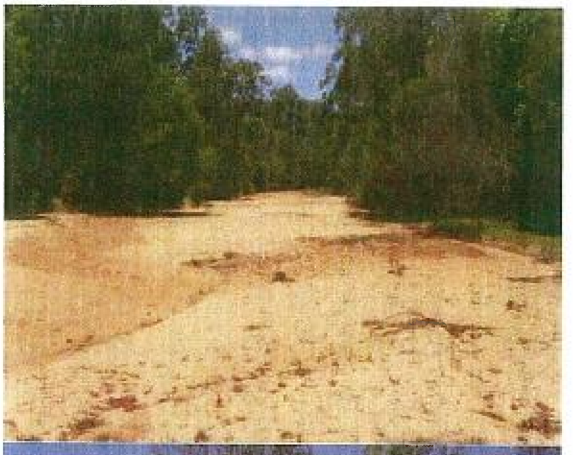
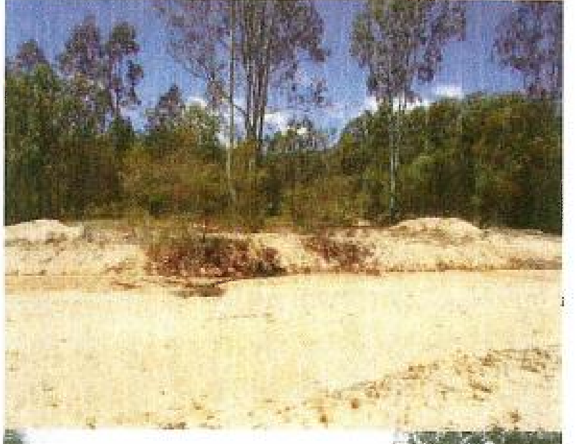


Appendix 5: Plates

Plate 1: Localised Escarpment

Plate 2: Profile Siliceous Sand H8

Appendix H
Site rehabilitation plan


CONACHER TRAVERS

SITE REHABILITATION PLAN

PROPOSED SAND EXTRACTION OPERATION

CABBAGE TREE CREEK WYANDAH

SEPTEMBER 2007
(REF: 7147SITE)

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PROPOSED SAND EXTRACTION OPERATION

CABBAGE TREE CREEK
WYANDAH

SEPTEMBER 2007

Conacher Travers

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PREFACE

This Site Rehabilitation Plan has been prepared by *Conacher Travers Pty Ltd* to identify matters in relation to the management of impacts and ongoing rehabilitation of land proposed for a sand extraction operation within Cabbage Tree Creek located at Brewers Road Wyandah.

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SECTION 1

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

This Site Rehabilitation Plan has been prepared to detail the ongoing management of impacts and site rehabilitation of a proposed sand extraction operation located at Lot 38 DP 755635, No. 543 Brewers Road, Parish of Wyandah.

This plan guides the progressive rehabilitation of the area proposed for activities and proposes measures for the completion of specific management actions.

The broad objective of the Site Rehabilitation Plan is to provide a communication document to inform all parties of the intended rehabilitation works and the basis on which any environmental impacts will be ameliorated during the life span of the extractive industry in managing and protecting the environmental values of the site and adjacent areas.

The specific objectives of this Site Rehabilitation Plan are as follows:

- Identify key site characteristics and potential impacts of the sand extraction operation
- Provide details for the minimisation of impacts during works
- Protect, and where possible, regenerate riparian vegetation
- Maintain bank stability and minimise bank erosion
- Manage and control the extent of weeds within riparian areas
- Provide a program for the completion of rehabilitation works
- Provide a framework for the monitoring and reporting of the long term results of the weed removal and vegetation management program.

1.2 SITE CHARACTERISTICS

The planning and cadastral details of the subject site are provided in Table 1.1, and geographical characteristics in Table 1.2.

TABLE 1.1 SITE DETAILS	
Location	Lot 38 DP 755635, No. 543 Brewers Road, Parish of Wyandah, County of Richmond
Topographic Map	Clearfield 1:25 000
Grid Reference (MGA)	483000E 6775000N
Local Government Area	Richmond Valley Council
Existing Land Use	Sand extraction site until 2000 and disused since/Cattle grazing
Proposed Development	Sand extraction from creek bed

TABLE 1.2 GEOGRAPHICAL SITE CHARACTERISTICS	
Elevation	Approximately 85m AHD
Topography	Flat creek bed
Slope	Less than 2%
Soil Type	Alluvial Sand
Catchment	Cabbage Tree Creek
Drainage	Cabbage Tree Creek flows in northerly direction through subject site
Vegetation	Riparian Tall Open Forest, Disturbed Swamp Low Woodland, Disturbed Regrowth Scrub, Grassland with Scattered Trees.

1.3 PROPOSED OPERATIONS

A sand extraction operation involving the removal of up to twenty-five thousand (25 000) cubic metres of materials per annum is proposed for the bed of Cabbage Tree Creek. The activities will occur along an approximately 700-800 hundred metre long section of Cabbage Tree Creek.

Sand replenishment within the creek bed will be via replacement from areas upstream of the site during times of flow. At this stage activities will be limited to the creek bed with access to the creek controlled to a single access point. As such the removal of any vegetation as part of the operations will be minimal.

Sand will be removed from the creek bed via an excavator and stockpiled on previously cleared/disturbed areas of the eastern bank. The sand will then be transported to an onsite screening plant for treatment then into trucks and transported off site.

As such the area affected by the proposed operation will be limited to:

- The creek bed – removal of sand
- Previously cleared areas of the bank – storage
- Access tracks – use tracks part of previous operation
- Screening plant – within previously disturbed area

Sand has been removed from the site previously via the above methods. Consent was granted for the removal of sand from Cabbage Tree Creek for a period of five years up until November 2005. Operations will continue as per those completed as part of the previously approved works.

This site Rehabilitation Plan has been prepared to accompany a development application for the recommencement of extraction operations.

1.4 POTENTIAL IMPACTS

Potential threats to native flora and fauna include:

- Removal of native remnant vegetation to widen or create new creek access points and sand storage areas.
- Damage to vegetation from the operation of machinery and movement of vehicles.
- Increased incursion of weeds due to increased vehicle access.
- Increased bank erosion at the access point and associated downstream water quality issues.
- Changes to hydrological regimes.

1.5 SITE REHABILITATION

The majority of the impacts will be limited to the creek bed as part of the sand removal process and to previously disturbed areas for storage, screening and transport. As such the following rehabilitation components will be addressed within the Site Rehabilitation Plan:

- Native vegetation management
- Weed removal
- Bank protection
- Monitoring and maintenance

SECTION 2

SITE REHABILITATION STRATEGY

2.1 NATIVE VEGETATION MANAGEMENT

The subject site contains vegetation typical of that of the riparian zones of the local area. The following vegetation communities are present within the subject site:

- Riparian Tall Open Forest (*Eucalyptus grandis*, *Lophostemon suaveolens* and *E. tereticornis*)
- Disturbed Swamp Low Woodland (*Melaleuca alternifolia*)
- Disturbed Regrowth Scrub (*Acacia fimbriata and Banksia integrifolia subsp. integrifolia*)
- Grassland with Scattered Trees

The native vegetation within the riparian areas and floodplain areas of the site will be retained as part of the proposal. Rehabilitation of degraded areas will occur within those areas previously disturbed as part of previous operations and those areas that may be disturbed inadvertently during future operations.

Areas to be targeted for replanting via tubestock will include those riparian areas previously disturbed by sand extraction and disturbed by any future operations. Site plantings will consist of endemic species as shown in Table 2.1.

TABLE 2.1
SPECIES RECOMMENDED FOR PLANTING

SPECIES	COMMON NAME
Trees	
Eucalyptus grandis	Flooded Gum
Eucalyptus tereticornis	Forest Red Gum
Lophostemon suaveolens	Swamp Turpentine
Lophostemon confertus	Brush Box
Angophora woodsiana	Rough Barked Apple
Allocasuarina torulosa	Forest Oak
Acmena smithii	Lilly Pilly
Acacia irorata subsp. irorata	Green Wattle
Acacia melanoxylon	Blackwood
Grevillia robusta	Silky Oak
Shrubs	
Trochocarpa laurina	Tree Heath
Breynia oblongifolia	Coffee Bush
Acacia fimbriata	Fringed Wattle
Callistemon salignus	Willlow Bottlebrush
Leptospermum petersonii	Lemon Scented Tea-tree
Leptospermum polygalifolium subsp. *cismontanum*	Lemon Scented Tea-tree
Melaleuca alternifolia	-
Banksia integrifolia subsp. *Integrifolia*	Coastal Banksia
Persoonia conjuncta	-
Duboisia myoporoides	Corkwood

Tubestock should be used and planted at suitable densities. It is recommended to plant a mix of suitable tree species at one per five m^2 and shrubs at two per m^2.

Due to the presence of cattle within the area it is recommended that replanting areas be protected by temporary fencing. This should consist of star pickets with ringlock or nylon mesh fencing typical of that used as "no-go" area fencing for bushland adjacent to construction sites. The condition of fencing should be checked regularly and maintenance carried out when required. Fencing should be removed when trees and understorey plants have reached a suitable age and condition.

2.2 WEED REMOVAL

The primary objectives of weed management are to protect remnant native vegetation and allow for regeneration of disturbed vegetation within and adjacent to the subject site. The removal of weed infestations and exotic species will allow the re-establishment of native species, by means of seed recruitment from adjacent bushland and other naturally occurring local dispersal mechanisms.

The subject site contains a number of weed species that are listed locally as noxious or environmental weeds (Table 2.2). The sand extraction operation has the potential to increase the numbers of weeds on site as a result of increased activity and potential for disturbance and transport of weed propagules through the site. It is recommended that all noxious and environmental weeds need to be removed from the site as part of the site rehabilitation strategies.

TABLE 2.2
NOXIOUS AND ENVIRONMENTAL WEED SPECIES TARGETED FOR REMOVAL

	Scientific Name	Common Name
Noxious Weeds		
	Cinnamomum camphora	Camphor Laurel
	Lantana camara	Lantana
	Ageratina riparia	Mistflower
Environmental Weeds		
	Pinus radiata	Radiata Pine
	Bidens pilosa	Cobbler's Pegs

There is currently a number of bush regeneration techniques used in bushland management for the removal of weeds. The *Bush Regeneration Process* is explained in more detail in Appendix 3. These methods include:

- The Bradley Method of minimal soil disturbance during weed removal
- Clearing and stabilising techniques
- The use of herbicides
- The use of fire
- Biological controls

The Bradley Method incorporates three basic philosophies:

- Work from areas containing less disturbed native vegetation towards more weed infested areas.
- Minimal disturbance to the soil and surrounding native plants. This is an important aspect especially in this situation as the topography of the site makes it susceptible to erosion once plant cover has been removed.

- Allow natural native plant regeneration to occur throughout the native plant community. In some cases it may be necessary to assist regeneration by replanting areas where weeds have been removed with locally occurring native (endemic) species.

Employing the Bradley Method for regeneration requires the removal of weeds in phases. Stages of weed removal can be broken into three components:

Primary Weeding
Primary weeding is the initial weeding. It is recommended that primary weeding should be carried out on the subject land to remove the majority of dominant weeds. This involves removal of weeds through herbicide use and hand removal. It is important to note primary weeding usually initiates new growth of both weeds and native species. Primary weeding of the site may take up to three months and it is recommended that a licensed bushland regeneration company under the direction of a qualified Bushland Regenerator carry out this work.

Secondary or Follow-up Weeding
Secondary or follow-up weeding involves intensive weeding in areas that have already received primary work to remove weed regrowth or overlooked weeds. It is recommended that secondary weeding be conducted 3-6 months after primary weeding. Secondary weeding of the site may take up to three months or progressively over 12 months and should be carried out by either a licensed bushland regeneration company or under the direction of a qualified Bushland Regenerator.

Maintenance Weeding
After primary and secondary weeding and natural regeneration of the bushland, the area should be able to resist most weeds. However, weeds will re-establish on the site from bird, wind, water transport and other seed or propagule dispersal mechanisms within the site. Maintenance weeding should be undertaken once or twice a year until such time as the resistance of the bushland to weeds increases, then only requiring hand-weeding every two to three years. Maintenance weeding of the site may take up to one week and should be carried out by either a licensed bushland regeneration company under the direction of a qualified Bushland Regenerator.

If required, regeneration of dominant natural plant species is expected to occur over a 2 year period provided ongoing management works are maintained. To allow regeneration to occur the majority of weed infestations need to be controlled within 2 years of commencing weed control works. Follow-up maintenance weeding is required on a needs basis from 2 to 10 years.

The use of herbicides is needed where hand removal of weeds is impractical. The use of Glyphosate based herbicides is recommended in accordance with the manufacturers labels. Within 5m of a drainage line only Roundup Bi-active ® or equivalent formulations can be used.

There are various categories of herbicides currently used (Buchanan, 1989), specifically those that kill on contact (contact herbicides), and those that must move through the tissue of the plant (systemic herbicides). Other herbicides include those that are non-selective and those that are selective. There are also those herbicides that kill all existing plants and those that prevent germination (Buchanan, 1989). The most commonly used herbicides by bush regenerators are Glyphosate 360 ®, Roundup ®, Bi-active ® and Weed Master ®.

Other regularly used herbicides include Garlon ®, Brushoff ®, Brush Killer ® and Starane 200 ®. These non-glyphosate based herbicides are not to be used adjacent to water bodies.

Please note, that Grazon DS is not considered to be a very safe chemical to use within high soil moisture zones and that significant off target kill of woody species has been tentatively linked to Grazon DS. If using Garlon on site, it should be used with caution in areas of wet soils.

An advantage of herbicide use is the low time taken to spray weeds as compared to physically removing them, particularly for large infestations of weeds. The disadvantage is that no single herbicide is effective on all weed species, thus the herbicide used needs to achieve an effective kill.

In general, *Conacher Travers Pty Ltd* recommends that the use of herbicides in non-ecologically sensitive areas should be considered when:

- there are small areas of dense weeds with few or no native plants to protect
- there are large areas of weeds
- weeds are growing too rapidly for physical removal

The potential for destabilizing soils and causing erosion as a result of spraying vegetation with herbicide needs to be considered prior to commencement of weed control works.

Only operators with Chemcert or equivalent training must undertake the spraying of weeds. The operator must evaluate the success of each treatment after a set period of time according to the labelled effectiveness for each herbicide. Care must be taken when applying herbicides near water bodies due to the sensitivity of the waterways, and flora and fauna, to runoff containing these herbicides.

All herbicides must be applied according to the herbicide usage label and provisions of the Protection of the Environmental Operations Act (NSW).

A full description of weed management techniques is attached as Appendix I.

Table 2.2 lists the noxious and environmental weed species observed on site and to be targeted for removal.

2.3 BANK PROTECTION

The works within the creek bed have the potential to destabilise the bank and lead to erosion, particularly at access points to the creek or where riparian vegetation is damaged leaving the sand soil within the bank prone. There are currently low levels of erosion occurring due to cattle gaining access to Cabbage Tree Creek. Access of vehicles and machinery to the creek has potential for the degradation of riparian vegetation and erosion of the bank.

Erosion of the bank will be controlled by limiting access to the creekbed. Access for operations will be limited to a single point on the eastern bank. This will be at a previously cleared disturbed point used as part of the former sand extraction operation.

Following the completion of operations it is recommended that the section of creekbank at the entrance point be regraded to the same shape and contours as the adjoining sections of creek bank. Where significant erosion has occurred and restoration is necessary it is recommended to use jute matting or geotextile fabric to strengthen the bank following regrading.

Planting methods as detailed within Section 2.1 will aid in the stabilisation of the bank and immediate areas and allow for long term stability.

2.4 MAINTENANCE AND MONITORING

Maintenance

Maintenance activities are aimed at providing a framework for the maintenance of the site in terms of replanting, weed removal, bank protection and other ongoing tasks. These activities will continue to operate for a period of a minimum of three (3) years following the completion of site works.

Maintenance activities include:

- Ongoing replanting
- Weed control
- Watering and revegetation maintenance
- Maintenance of protective measures

Maintenance activities should occur as required on a weekly basis during works and on a periodic basis following completion of works and dependent upon the identification of requirement for maintenance based upon the results of site monitoring.

Monitoring and Reporting

The long term environmental quality of the site and success of the rehabilitation strategies will depend partly upon the implementation of a suitable monitoring program. The following will be monitored as part of the program:

- Vegetation condition.
- Replanting areas.
- Weed removal areas.
- Bank stability.

It is recommended that monitoring occur on a quarterly basis during the operations and annually for three years following the completion of operations.

Reports will be supplied regularly to Richmond Valley Council in conjunction with the end of each monitoring period. At the completion of each monitoring period information will be supplied to Council on the following:

- details on monitoring methods
- results of monitoring
- comparison to previous monitoring results
- any corrective rehabilitation actions

Full details of the timing of monitoring and reporting are included within Table 3.1

SECTION 3

PROPOSED WORKS PROGRAM

The following table provides details on the implementation, responsibility and timing of the management actions.

TABLE 3.1
MANAGEMENT WORKS PROGRAM

Issue / Problem	Action	Responsibility	Timing
Native vegetation management	Identify and retain remnant native vegetation (including EEC's)	Operator	Pre-operational phase
	Replant disturbed areas	Bushland Regenerator	Operational and ongoing
	Erect temporary protective fencing	Operator	Operational phase
Weed Removal	Identify noxious and environmental weeds onsite	Bushland regenerator	Pre-operational phase
	Remove all noxious and environmental weeds	Bushland regenerator	Operational phase and ongoing
Bank Protection	Limit creek access to single point	Operator	Operational
	Use jute matting/geotextile fabric on eroded bank areas	Operator	Completion of operations
	Plant out eroded bank areas	Bushland regenerator	Completion of operations
Monitoring and Maintenance	Monitor native vegetation condition (particularly endangered ecological communities)	Bushland regenerator/Project Ecologist	Quarterly during operations and annually for 3 years following completion
	Monitor replanted areas	Bushland regenerator/Project Ecologist	Quarterly during operations and annually for 2 years following completion
	Monitor weed numbers	Bushland regenerator/Project Ecologist	Quarterly during operations and annually for 3 years following completion
	Bank condition/stability	Operator	Quarterly during operations and annually for 3 years following completion
	Maintenance as identified by monitoring	Operator	Ongoing as required and identified by monitoring
	Reporting	Operator/ Project Ecologist	Quarterly during operations and annually for 3 years following completion

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APPENDIX I

WEED MANAGEMENT TECHNIQUES

WEED MANAGEMENT TECHNIQUES FOR USE IN AREAS OF NATIVE VEGETATION RETENTION

Weeds are to be progressively removed in accordance with the following techniques recommended by the National Trust, NSW National Parks and Wildlife Service and Australian Association of Bush Regenerators. It is recommended that targeted swiping of the exotic species with herbicides is the most appropriate method for this site. This method will minimise the effects of herbicide overspray and will preserve the native species while effectively removing the exotic species.

Woody Weeds Removal Techniques:

Cut and Paint

- Make a horizontal cut close to the ground using secateurs, loppers or a bush saw; and
- Immediately apply herbicide to the exposed flat stump surface.

Considerations:

- Cuts should be horizontal to prevent herbicide from running off the stump, sharp angle cuts are hazardous;
- Herbicide must be applied immediately before the plant cells close (within 30 seconds) and translocation of herbicide ceases;
- If plants resprout cut and paint the shoots after sufficient regrowth has occurred; and
- Stem scraping can be more effective on some woody weeds.

Stem Injection

- At the base of the tree drill 10mm diameter holes at a 45 degree angle into the sapwood;
- Fill each hole with herbicide immediately; and
- Repeat the process at 5 cm intervals around the tree.

Frilling or Chipping

- At the base of the tree make a cut into the sapwood with a chisel or axe;
- Fill each cut with herbicide immediately; and
- Repeat the process at 5 cm intervals around the tree.

Swiping

- A herbicide applicator can be purchased, or a short rod with a compact wad of rag wired to the end is manufactured,
- The rag is wetted in a small container of herbicide and wiped on several fronds, leaves or other parts of the undesirable plants, replenishing the herbicide on the rag as needed from the container,
- The rag is to be kept wet but <u>not dripping</u> (to avoid poisoning other desirable plants nearby).

Considerations:

- Plants should be actively growing and in good health;
- Deciduous plants should be treated in spring and autumn when leaves are fully formed;
- For multi-stemmed plants, inject or chip below the lowest branch or treat each stem individually; and
- Herbicides must be injected immediately before plant cells close (within 30 seconds) and translocation of herbicide ceases,
- Care is to be taken while swiping that the rag is wet but not dripping so that the herbicide is not inadvertently dripped on plants to be retained.

Small Hand-Pullable Plants Removal Techniques:

Hand Removal

- Remove any seeds or fruits and carefully place into a bag;
- Grasp stem at ground level, rock plant backwards and forwards to loosen roots and pull out; and
- Tap the roots to dislodge any soil, replace disturbed soil and pat down.

Considerations:

- Leave weeds so roots are not in contact with the soil eg. hang in a tree, remove from site or leave on a rock.

Vines and Scramblers Removal Techniques:

Hand Removal

- Take hold of one runner and pull towards yourself;
- Check points of resistance where fibrous roots grow from the nodes;
- Cut roots with a knife or dig out with a trowel and continue to follow the runner;
- The major root systems need to be removed manually or scrape/cut and painted with herbicide; and
- Any reproductive parts need to be bagged.

Stem Scraping

- Scrape 15 to 30 cm of the stem with a knife to reach the layer below the bark/outer layer; and
- Immediately apply herbicide along the length of the scrape.

Considerations:

- A maximum of half the stem diameter should be scraped. Do not ringbark;
- Larger stems should have two scrapes opposite each other; and
- Vines can be left hanging in trees after treatment.

Weeds with Underground Reproductive Structures Removal Techniques:

Hand Removal of Plants with a Taproot

- Remove and bag seeds or fruits;
- Push a narrow trowel or knife into the ground beside the tap root, carefully loosen the soil and repeat this step around the taproot;
- Grasp the stem at ground level, rock plant backwards and forwards and gently pull removing the plant; and
- Tap the roots to dislodge soil, replace disturbed soil and pat down.

Crowning

- Remove and bag stems with seed or fruit;
- Grasp the leaves or stems together so the base of the plant is visible;
- Insert the knife or lever at an angle close to the crown;
- Cut through all the roots around the crown; and
- Remove and bag the crown.

Herbicide Treatment – Stem Swiping

- Remove any seed or fruit and bag; and
- Using a herbicide applicator, swipe the stems/leaves.

Considerations:

- Further digging may be required for plants with more than one tuber;
- Some bulbs may have small bulbils attached or present in the soil around them which need to be removed;
- It may be quicker and more effective to dig out the weed;
- Protect native plants and seedlings; and
- For bulb and corm species the most effective time to apply herbicide is after flowering and before fruit is set.

Exotic vegetation should be removed and stockpiled in a clear area away from adjoining bushland. This stockpile should be removed from the site at a convenient time. As part of the regular maintenance of the restored area any regrowth of the exotic plant species should be removed and disposed of appropriately.

Use of Herbicides

Herbicides should not be applied 0 to 12 hours prior to rain occurring. This reduces the herbicides effectiveness as well as being transported in runoff to creeklines and waterways.

An advantage of herbicide use is the low time taken to spray or swipe weeds as compared to physically removing them, particularly for large infestations of weeds where little or no native plants occur.

Buchanan (1989), recommends that the use of herbicides should be considered when:

1. there are small areas of dense weeds with few or no native plants to protect.
2. there are large areas of weeds.
3. the weeds are growing too rapidly for physical removal.
4. the weeds are located in areas with a high potential for erosion if vegetation is removed.

The swiping or spraying of weeds must only be undertaken by persons with Chem-Cert or equivalent qualifications. The success of each treatment must be evaluated by the operator after a set period of time according to the labelled effectiveness for each herbicide. Care must be taken when applying herbicides near drainage lines to avoid excess use due to the sensitivity of the wetlands and waterways into which runoff will eventually flow.

TABLE H5 NOXIOUS WEEDS OF THE RICHMOND VALLEY LGA			
	Scientific Name	**Common Name**	**Control Category**
Tree	*Cinnamomum camphora*	Camphor Laurel	W4(f)
	Celtis sinensis	Celtis	W2
	Baccharis halimifolia	Groundsel Bush	W2
	Acacia karroo	Karroo Thorn	W1
	Miconia spp.	Miconia	W1
	Salix spp.	Willows	W4(g)
Shrub	*Alternanthera philoxeroides*	Alligator Weed	W1
	Chrysanthemoides monilifera	Bitou Bush	W3
	Rubus fruticosus (agg. spp.)	Blackberry	W2
	Cenaurea nigra	Black Knapweed	W1
	Schinus terebinthifolius	Broad Leaf Pepper Tree	W2
	Ageratina adenophora	Crofton Weed	W3
	Cestrum parqui	Green Cestrum	W2
	Harrisia spp.	Harrisia Cactus	W4(f)
	Equisetum spp.	Horsetail	W1
	Kochia scoparia	Kochia	W1
	Lantana camara	Lantana (other than pink-flowered)	W3
	Carduus nutans	Nodding Thistle	W2
	Opuntia spp.	Prickly Pears	W4(f)
	Gymnocoronis spilanthoides	Senegal Tea Plant	W1
	Chromolaena odorata	Siam Weed	W1
Groundcover	*Xanthium spp.*	Burrs	W2
	Sorghum x almum	Columbus Grass	W2
	Sporobolus fetilis	Giant Parramatta Grass	W2
	Sporobolus pyramidalis	Giant Rat's Tail Grass	W2
	Sorghum halepense	Johnson Grass	W2
	Lagarosiphon major	Lagarosiphon	W1
	Ageratina riparia	Mistflower	W3
	Cortaderia spp.	Pampass Grass	W2
	Parthenium hysterophorus	Parthenium Weed	W1
	Cytisus scorparius	Scotch/English Broom	W2
	Cenchrus incertus	Spiny Burrgrass	W2
	Cenchrus longispinus	Spiny Burrgrass	W2
	Hypericum perforatum	St John's Wort	W2
Aquatic	*Cabomba spp.*	Cabomba	W4(g)
	Salvinia molesta	Salvinia	W2
	Pistia stratiotes	Water Lettuce	W1

APPENDIX II

REVEGETATION SPECIFICATIONS

REVEGETATION SPECIFICATIONS

1 Timetable of Work

The Contractor shall provide a preliminary planting schedule that incorporates a draft timetable of works for the planting activities. This shall be submitted at the time of tendering. A final planting schedule shall be prepared in consultation with the Project Manager, and approved by the Project Manager within 14 days of award of Contract. This schedule should be designed to minimise the time the sites are exposed and take into account seasonal factors, availability of tubestock plants, and timing of construction works.

2 Site Preparation

Site preparation activities for all planting sites will include preliminary weed control, rubbish removal and (where necessary) minor earthworks (levelling, ripping). It is expected that any bare soil areas will be sown with a nurse crop to provide temporary soil stabilisation, and (where applicable) soil erosion control measures installed.

3 Plant Material

Plant material used to revegetate within the project area shall be sourced only from local bushland areas (within 10km of the site). Contractors are responsible for obtaining all necessary permits and licenses.

All plants are to be provided in a healthy condition. They must have good root development and a sturdy shoot system. Plant with an elongated or yellowed shoot system shall not be accepted.

Planting shall be undertaken immediately after delivery. If this is not possible, the Contractor shall be required to provide appropriate storage to keep the plants in good condition on the site, adequately protected from frost, wind, sun and vermin, and secured from vandals.

4 Planting Guidelines

Planting Densities and Niche species

The Contractor shall be responsible for planting according to the Site Planting Plan prepared by the client. This Plan will detail the required species and their distribution across the bushland reconstruction and landscaping sites and will be supplied to the successful Contractor. The Contractor shall be responsible for ensuring planting densities and appropriate niche species.

Only locally indigenous plants will be used. Niche preferences shall be considered in planting, with plants being placed in the correct position with regard to soil type, moisture, aspect and slope.

Plantings should be at a density which will result in a near natural canopy density at all structural levels (strata). Plants will be placed at an average of 3-4 units/m^2 in order to achieve the following densities.

- Canopy Trees @ 1 unit / 6m^2 (5m centres approx)
- Sub-canopy (small trees / large shrubs) @ 1 unit / 3m^2 (2.5m centres approx)
- Shrubs @ 1 unit / 1m^2 (1m centres approx)
- Grasses and Ground Covers @ 3-4 units / m^2 (0.5m centres approx)

Planting Methods

Planting holes shall be excavated to a depth of 150 mm and a diameter of 200 mm. Slow-release native plant fertiliser (low phosphorous formulated native plant fertiliser tablet/granules) shall be placed into the planting hole. In poorly structured soils, approximately 200 cubic centimetres of native plant soil mix is to be placed and incorporated into the planting hole with fertiliser and water storing granules.

Plants must be placed into moistened soil preferably by soaking 1-2 litres of water into each hole. After planting the soil shall be replaced and carefully firmed, leaving a slight depression around each plant to allow for water collection. Soil is to be replaced in the hole so that the base of the stem is level with the soil surface, not set below the soil, or sitting above.

All plants are to be thoroughly watered before planting and again after planting. If the weather is hot, a third watering shall be carried out within two (2) days or a t-tape or drip irrigation system set up to water plants on a weekly basis.

Plant Protection

The Contractor shall be responsible for adequately protecting plant material from frost, wind, sun, vermin and animals. Two-litre cardboard guards (including 2 stakes) shall be placed around each plant and maintained throughout the maintenance period for a minimum three years. The use of Jute mats (mulch mats) is recommended where annual or grass regrowth is expected.

Mulching

After planting, exposed soils will be adequately protected by the re-spreading of stockpiled mulch to a maximum depth of 50-75 mm. A depth of approximately 75-100 mm and a diameter of 400 mm around each installed plant are recommended. No exotic plant material is to be used. Pine bark is not considered to be a suitable mulch material. The provenance of all mulch material must be known and approved by the Project Manager.

Mulch is not to be used in sand dunes ecosystems as the mulch inhibits plant establishment and provides a nutrient source for the growth of weeds in dune ecosystems.

Care should be taken to keep mulch material away from the stems of the newly planted tubestock. Alternatively, a light sowing of a suitable nurse crop (Rye Corn or Japanese Millet) can be made between plantings to provide a protective microclimate. Sowing rates to be used are those recommended by the supplier and agreed with the Project Manager.

Maintenance and Weed Control

Tube stock must be suitably maintained (watering and weeding) are to be maintained over a 2 year period on the following basis:

- 1-3 months post planting – weekly watering and maintenance.
- 4-12 months post planting – monthly watering and maintenance.
- 13-24 months post planting – quarterly watering and maintenance.

Site maintenance shall consist of the following tasks:

- Weeding throughout the planting area
- Watering tubestock
- Replacing lost plants (as required)
- Removing wind-blown or other rubbish from the planting area

Noxious and environmental weeds are to be controlled in accordance with specifications in Appendix 3 and 4. The Contractor shall provide a preliminary maintenance schedule that incorporates a timetable of works for each of the activities listed above.

Appendix I
Noise impact assessment

Ambience Audio Services
___________Acoustic Measurement and Analysis

15 Tamarind Close
Richmond Hill NSW 2480

Phone: 02 6625 1733
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Noise Impact Assessment of Proposed Sand Extraction and Transportation from Cabbage Tree Creek, 543 Brewers Road Kippenduff via Rappville

for

Kingsbrae Partnership Pty Ltd

by
Garry Hall
July 30, 2008

Table of Contents

1 INTRODUCTION

An acoustic impact assessment of sand extraction activities at 543 Brewers Road Kippenduff was requested by Mr Paul Snellgrove, Town Planner at Ardill Payne and Partners. This acoustic assessment is part of a development application and environmental impact statement for sand extraction from the bed of Cabbage Tree Creek at 543 Brewers Road Kippenduff for Kingsbrae Partnership Pty Ltd.

This acoustic assessment details noise monitoring procedures, provides results of measurements, determines predicted noise levels at the closest affected residential dwelling and assesses predicted noise levels with criteria in The New South Wales Industrial Noise Policy (INP). Noise impact due to transportation is assessed with guidelines in The New South Wales EPA Environmental Criteria for Road Traffic Noise (ECRTN).

To assist with the interpretation of some of the terminology used in this report, Appendix A provides definitions of acoustic terms. Appendix B is a chart of everyday sound pressure levels.

2 SITE AND DESCRIPTION OF OPERATION

The subject property is known as Lot 38 DP 755635, No. 543 Brewers Road, Parish of Wyandah, County of Richmond and is owed by Mrs M Smith of "Broadacres" , Kippenduff, in the Local Government Area of Richmond Valley Council.

The subject land is accessed via Brewers Road and is approximately 5km to the west of Old Tenterfield Road, 22km north-west of the village of Whiporie and 49km south-west of Casino. The land is zoned 1(a) (Rural (General Zone) under the provisions of the Copmanhurst Local Environmental Plan 1990.

The location of the proposed sand extraction is from a previous sand pit at 543 Brewers Road. Sand extraction occurred at the subject site between 1995 and 2000 under a previous consent (DA 55/95).

The adjoining locality is characterised by low intensity agricultural uses (predominantly cattle grazing) and stands of forest and woodland.

There are several residential dwellings located near the site and along Brewers Road. The closest affected residential dwelling is 700 metres north east from the excavation site at Lot 150 DP 811460. (*See location map – Appendix F*).

The processes on the site will involve:

- Extraction of sand from creek bed with excavator and stockpiling near creek bank
- Transfer of sand from creek bank and loading into screener with front end loader
- Screening of sand with screener
- Transfer of screened sand from screener to new stockpile
- Loading of screened sand from new stockpile to trucks
- Transportation of screened sand to final locations; Casino, Lismore, Alstonville and Ballina

The proposed hours of operation are Monday to Friday 7.00am – 6.00pm, Saturday 8.00am – 12 noon. No work on public holidays.

The main noise sources for potential noise issues with nearby residential dwellings are:

- Excavator near creek bank
- Sand screener operating
- Front end loader transferring sand
- Front end loader loading trucks
- Transportation of screened sand from site in trucks

3 MEASUREMENT PROCEDURE AND RESULTS

3.1 Instrumentation

Instrument	Serial #	Calibration Date
Brüel and Kjær 2260 Sound Level Meter	2305235	May 2007
Brüel and Kjær 2250L Sound Level Meter	2602785	November 2007
Brüel and Kjær Acoustical Calibrator model 4231	2292735	May 2007

The sound level meters used during the noise survey conform to Australian Standard 1259 "Acoustics - Sound Level Meters", (1990) as a type 1 precision sound level meter and have an accuracy suitable for both field and laboratory use.

The meters' calibrations were checked before and after the measurement periods with a Brüel and Kjær acoustical calibrator model 4231 (serial no. 2292735). No significant system drift occurred over the measurement periods.

The sound level meters and calibrator have been checked, adjusted and aligned to conform to the Brüel and Kjær factory specifications and issued with conformance certificates. The internal test equipment used is traceable to the National Measurement Laboratory at C.S.I.R.O., Lindfield, NSW, Australia.

3.2 Measurement Procedures

Measurements were made in general accordance with procedures laid down in:

1. **Australian Standard AS 1055.1-1997:** 'Acoustics - Description and measurement of environmental noise - General procedures';

2. **The NSW Government Industrial Noise Policy (2000) EPA 00/1.**

3.2.1 Background Noise Monitoring

A Brüel and Kjær UA 1404 Outdoor kit was fitted to the 2260 microphone for attended and unattended background noise monitoring and positioned at a height of 4.5 metres in a cleared paddock on the "Broadacres" property and approximately 30 metres from a large stand of trees. This location was chosen as it would be similar to the nearby residential dwellings in cleared areas amongst trees. The microphone was positioned on top of an unused portable shed to stop interference with cattle on the property.

Measurements were conducted from the 29^{th} of April to the 10^{th} of May 08. Noise level data was not recorded for the period between 2:30am on the 5^{th} of May to 7:00pm on the 7^{th} of May due to a battery failure.

A Kestrel 4500 Weather Tracker was positioned in a shaded position approximately 15 metres from the measurement microphone to log weather conditions every 5 minutes.

3.2.2 Noise Source Measurements

The 2250L was fitted with a Brüel and Kjær 90mm windsock and mounted on a 1.4m high tripod for the measurement of a sand screener, front end loader and excavator that would be similar to units that would operate at the proposed site at No. 543 Brewers Road, Kippenduff. Markers were utilised on the 2250L during noise monitoring to identify individual acoustic events for analysis.

Measurements of the sand screener and front end loader were conducted at an operating sand pit at Leeville. Measurements were conducted near the operating units and at various distances down wind of the operations while under load to determine noise propagation at locations away from the immediate site under down wind conditions. Noise measurements were conducted over 3 minutes as the noise levels were reasonably consistent and cyclic.

The excavator was measured at a site building a pad for a farm machinery shed working in clay soil. Measurements were conducted for 2 minutes at different distances from the operating excavator under calm wind conditions.

3.3 Weather Conditions

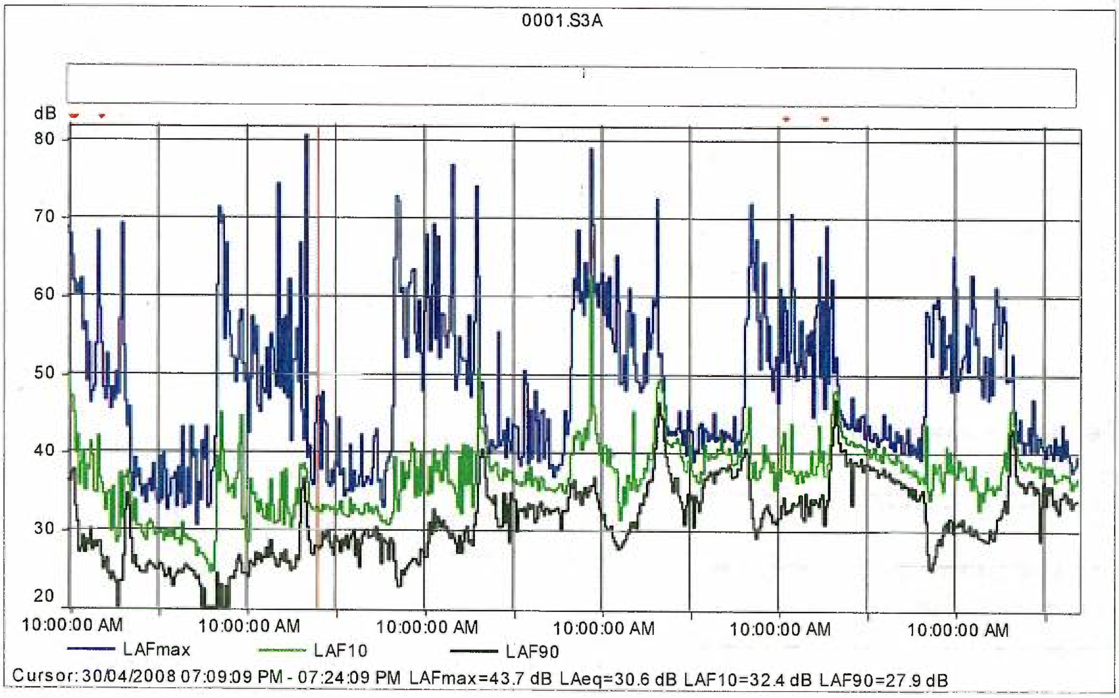
Weather conditions were generally good for acoustic measurements. The measurement microphone and weather logger for background noise monitoring were shielded from north easterly, easterly and south easterly winds by large stands of trees.

Weather conditions during the monitoring period are presented in Appendix D

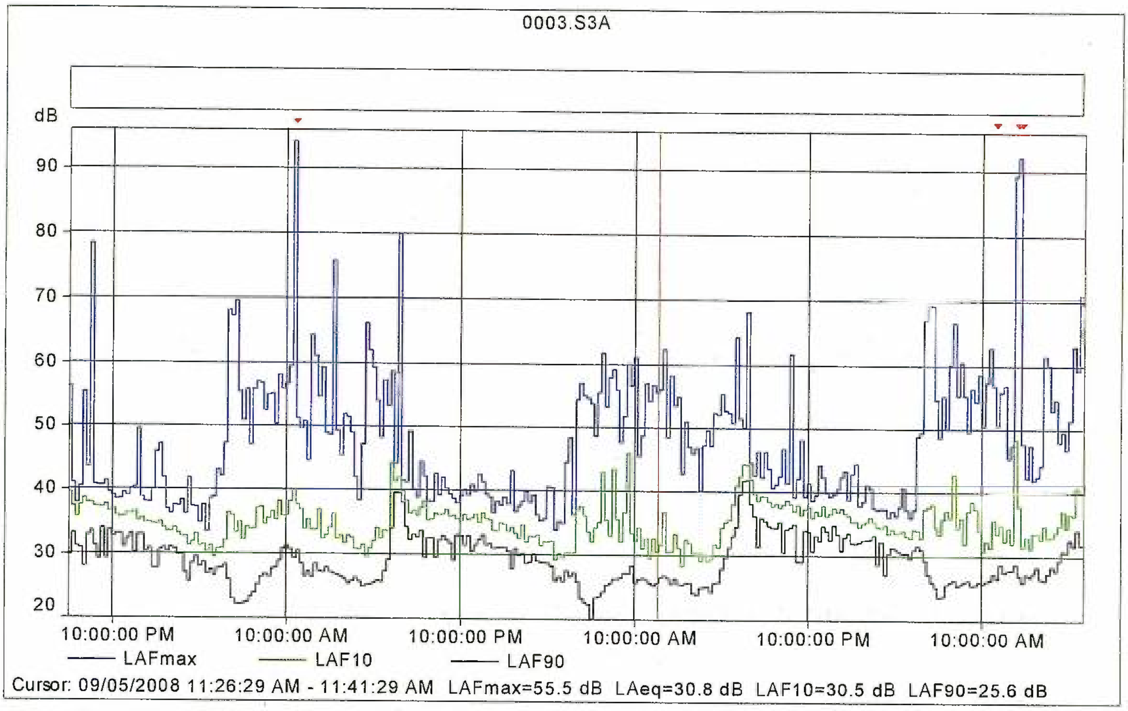
3.4 Measurement Results

3.4.1 Background Noise Levels

Graph 3.1 Measured Noise Levels 29/04/08 – 05/05/08
(*15 minute sampling periods- All levels in dBA*)



Graph 3.2 Measured Noise Levels 07/05/08 – 10/05/08
(15 minute sampling periods- All levels in dBA)



Daily Assessment Background Levels (ABL) and Rating Background Level (RBL) were calculated with the procedure outlined in section B1.3 in Appendix B of the INP. The results are presented below. Measured data is presented in Appendix C.

Table 3.1 Calculated Daily Assessment Background Noise Levels
(All levels in dBA)

Tues 29/04	Wed 30/04	Thur 01/05	Fri 02/05	Sat 03/05	Sun 04/05	Thur 08/05	Fri 09/05	Sat 10/05
23.7	26.8	28.9	29.6	31.4	29.1	25.2	24.1	25.5

The calculated RBL for the daytime period (07:00 – 18:00) for the monitoring period was 26.8dBA. Section B1.3 of the INP states that when the background level is found to be below 30dBA, the RBL is set to 30dBA. This assessment is based on an RBL of **30dBA**.

3.4.2 Measured Noise Sources Levels

Table 3.2 Measured Noise Levels of Screener and Front End Loader 02/05/08
(All measurement periods 3 minutes - All levels in dBA)

File #	Start Time	Observed Noise Sources	Measurement Location	L_{Aeq}
01	10:05am	F/e loader & screener	20m – feed side of screener	76.0
02	10:08am	F/e loader & screener	20m – feed side of screener	75.6
03	10:12am	F/e loader & screener	40m – feed side of screener	67.8
04	10:17am	F/e loader & screener	80m – feed side of screener	58.2
05	10:22am	F/e loader & screener	160m – feed side of screener	52.4
06	10:27am	F/e loader & screener	160m – feed side of screener - Downwind	54.4
07	10:32am	F/e loader & screener, distant overhead aircraft	300m – feed side of screener - Downwind	51.2
08	10:35am	F/e loader & screener, distant overhead aircraft	300m – feed side of screener - Downwind	51.3
09	10:48am	Screener only	20m – exhaust side of screener	75.2
10	10:53am	Screener only	3 m from output end of screener	77.8
11	10:57am	Front end loader	20m from front end loader loading truck	66.1

Table 3.3 Measured Noise Levels of Excavator 07/05/08
(All measurement periods 2 minutes - All levels in dBA)

File #	Start Time	Observed Noise Sources	Measurement Location	L_{Aeq}
1	9:36am	Excavator, vehicles	40 m from excavator	62.4
3	9:44am	Excavator, animal (8 sec)	40 m from excavator	60.2
4	9:50am	Excavator	80 m from excavator	52.2
5	9:54am	Excavator, birds	160 m from excavator	48.9
6	9:59am	Excavator, birds	320 m from excavator	43.1

3.4.3 Measured Noise Levels of Tipper Trucks

No tipper truck movements were available for measurements during the available time. Data from a previous traffic noise study at Three Chain Road Quarry Lismore will be used for assessment of traffic noise impact. The noise study at the Three Chain Road Quarry measured and assessed the noise impact of full and empty quarry truck and trailer combinations travelling along a rough gravel road on nearby residential properties. The calculated façade level at a dwelling 150 metres from the gravel road was 42.5dB L_{Aeq} for an empty truck and trailer combination for an exposure duration of 137 seconds over 15 minutes.

The closest residential dwelling to Brewers Road is 150 metres. Other dwellings range from 200 metres to 400 metres. Some of the residential dwellings are above the road and may be exposed to road traffic noise for up to 2 kilometres based on the topography. Based on a vehicle speed of 30 km/hr on Brewers Road, the exposure time for a one way trip over 2 kilometres would be 240 seconds.

The façade noise level for duration of 4 minutes (240 seconds) over 60 minutes at a location 150 metres from the gravel road is 41.6 dBA, L_{Aeq}, allowing for a 6 decibel reduction for the scattering and attenuation of the 150 metres of gum trees between Brewers Road and the closest residential dwelling to the road.

4 NOISE CRITERIA

NSW Industrial Noise Policy (2000)

The NSW Government via the Department of Environment and Conservation, (DEC) (formally EPA) provide criteria in the Industrial Noise Policy (INP) for industrial and commercial noise. These are generally in line with criteria given in other states of Australia. This covers noise in urban, suburban and rural areas.

4.1 Intrusive Noise Goals

For intrusive noise the goal is background noise level (L_{A90}) plus 5dB. The RBL is 30dBA. The intrusive noise goal is 30 + 5 = **35dBA, L_{Aeq}.**

4.2 Amenity Noise Goals

Amenity noise goals are set to prevent an increase in industrial noise. This area would be considered rural under the NSW Industrial Noise Policy. The Acceptable Noise Level for this site is given below in table 4.1

Table 4.1 Acceptable Noise Level.

Time of Day	* ANL L_{Aeq} (dBA)
Day 07:00 – 18:00	**50**

* From Table 2.1 NSW EPA INP Jan. 2000

4.3 Modifying Factors

When a noise source contains certain characteristics there is evidence to suggest that it can cause greater annoyance than other noise source at the same noise level. Table 4.1 of the NSW EPA Industrial Noise Policy (Jan. 2000) outlines the noise characteristics and the modifying factor corrections. The data for the noise sources was analysed for noise characteristics. No tonality or low frequency characteristics were observed. The occasional banging of the excavator bucket did produce LAIMax (Maximum Impulse response level) results approximately 3.5 decibels higher than the LAFMax (Maximum Fast response level). This would attract a 3.5 dB penalty for this noise characteristic. Intermittent noise was not assessed as the quarry will not operate during the night period (10:00pm – 7:00am).

4.4 Project Specific Noise Goals

Project or site-specific noise goals are set on the basis of the most stringent applicable criteria given above. The maximum noise level (L_{Aeq}) from sand extraction operations at the nearest affected residential dwelling, 700 metres from the site, is 35dBA – Intrusive Rule.

4.5 Road Traffic Noise

The New South Wales EPA Environmental Criteria for Road Traffic Noise (ECRTN) provides procedures and criteria for the assessment of road traffic noise for different categories of roads for different times of the day. Brewers Road would be classified a local road under the guidelines in the ECRTN. Table 1 of the ECRTN specifies recommended maximum levels for day and night periods. Section 13 of Table 1 specifies noise levels for land use developments with potential to create additional traffic on local roads. The day time (7.00am to 10.00pm) level is $L_{Aeq,1hr}$ 55 and night time (10.00pm to 7.00am) level is $L_{Aeq,1hr}$ 50.

5 DISCUSSION OF RESULTS

5.1 Noise from Excavation Site

The background noise levels are typical of this type of isolated rural area. Graphs 3.1 and 3.2 show background noise levels (L_{A90}) increase during the daylight hours and generally peak in the late afternoon with the increase in insect and bird activity. Noise levels are lower during the night period. Observed noise sources during attended noise monitoring were tree leaves rustling, birds, insects, distant cattle and distant overhead aircraft.

Measurements of the loader, sand screener and excavator were generally good at distances up to 80 metres. Other noise sources started to influence the measurement data for distant measurements.

The diesel motor on the sand screener was the predominant noise source during measurements of the loader and screener operations. The screener level was approximately 10 decibels higher than the font end loader.

A large stand of gum trees approximately 130 metres wide is located near the residential dwelling between the excavation site and the residential dwelling. This will reduce noise levels from the excavation site to the residential dwelling. Data available from overseas studies indicate a reduction of 8 to 10 decibels for traffic noise for a 100m wide pine forest. A reduction of 6 decibels will be used in this assessment for noise reduction due to the gum trees.

The predicted levels of the sand extraction operations at the nearest affected residential dwelling 700 metres from the site are presented in Table 5.1 below.

Table 5.1 Predicted Noise Levels at Nearest Affected Residential Dwelling
(*All levels in dBA*)

	Measured Level	Penalty	Adjusted Noise Level	Attenuation From Trees	Predicted Noise Level at 700m	Comply with Noise Goal of 35dBA
Excavator only	52.2 @ 80m	+3.5	55.7	6	30.9	Yes
Sand screener & loader	54.4 @ 160m		54.4	6	35.6	No
Sand Screener, loader & excavator		+3.5		6	36.8	No

5.2 Noise Control Measures

To comply with the project specific noise goal of 35dBA, L_{Aeq}, noise control measures will be required. It is proposed to reduce the noise level of the diesel motor on the sand screener by at least 10 decibels to be comparable with the noise level of the front end loader. This can be achieved by enclosing the motor and installation of a muffler on the exhaust.

Table 5.2 Predicted Noise Levels at Nearest Affected Residential Dwelling With Noise Control Measures on Sand Screener
(*All levels in dBA*)

	Predicted Noise Level	Penalty	Adjusted Noise Level	Attenuation From Trees	Predicted Noise Level at 700m	Comply with Noise Goal of 35dBA
Excavator only	52.2 @ 80m	+3.5	55.7	6	30.9	Yes
Sand screener & loader	47.4 @ 160m		47.4	6	28.9	Yes
Sand Screener, loader & excavator	57.7 @ 80m	+3.5 Included in Predicted Noise Level		6	32.9	Yes

The predicted noise level at the nearest affected residential dwelling will be 33dBA, L_{Aeq}. This will be 2 decibels below the project specific noise goal of 35dBA, L_{Aeq}.

Additional noise control can be achieved by locating the sand stockpiles at the site in the direction of the closest affected residential dwelling (north east) to act as a barrier. The sand stockpiles will be most effective when located as near to the noise sources as possible.

5.3 Road Traffic Noise

A Traffic Impact Study was conducted by Ardill Payne and Partners (March 2008). Table 3 in Section 4.5 (Traffic Generation) indicates that the average truck movements would be two $20m^3$ trucks per day (4 truck movements). Table 4 indicates that the peak truck movements would be five $20m^3$ trucks per day (10 truck movements.

The following table indicates the façade noise levels of road traffic at the closest residential dwelling, 150 metres from Brewers Road for different amounts of truck movements. Based on a vehicle speed of 30 km/hr on Brewers Road, the exposure time for a one way trip over 2 kilometres would be 240 seconds. A 6 decibel reduction for the 150 metres of gum trees between Brewers Road and the residential dwelling has been included in the calculations.

Table 5.3 Predicted Façade Noise Level at Closest Residential Dwelling to Brewers Road. (All levels in dBA).

Number of Truck Movements per hour	Predicted Façade Noise Level $L_{Aeq,1hr}$
1	41.6
2	44.6
4	47.6
6	49.4
8	50.6

Table 5.3 indicates that at the Traffic Impact Study's traffic generation of 10 truck movements per day (1 per hour), noise levels are well below The New South Wales EPA Environmental Criteria for Road Traffic Noise (ECRTN) recommended maximum levels of $L_{Aeq,1hr}$ 55 for day time (7.00am to 10.00pm) and $L_{Aeq,1hr}$ 50 for night time (10.00pm to 7.00am).

Traffic noise levels for residential dwellings along the haulage routes with bitumen will be less even though the dwellings are closer to the road as the road surface is smoother and the noise exposure duration less.

6 SUMMARY AND CONCLUSION

A noise study was conducted to assess the noise impact of sand extraction activities and associated haulage on residential dwellings at a proposed operation at 543 Brewers Road Kippenduff.

The noise study was conducted with calibrated noise monitoring equipment to measure background noise levels and the operating noise levels of machinery of similar capacity under field conditions. The Rating Background Level was determined to be 30dBA for the day time period (07:00 – 18:00). Results indicate that the excavator exhibited impulsive noise characteristics and a penalty of 3.5 decibels.

Calculations of predicted noise levels at the closest affected residential dwelling (700 metres to the north east) indicate that noise control measures will be required to meet The New South Wales Industrial Noise Policy criteria for intrusiveness. Installation of noise control on the diesel motor on the sand screener will give a combined plant operating noise level of 33dBA, L_{Aeq}, 2 decibels below the project specific noise goal of 35dBA, L_{Aeq}.

Road traffic noise levels at residential dwellings along Brewers road were calculated from results of data from a previous noise study of the noise impact of quarry trucks on residential dwellings near a gravel road. Calculations indicate that the façade noise levels at the closest residential dwelling to Brewers Road will be 44.6 $L_{Aeq,1hr}$ for 2 truck movements per hour. This level is 10 decibels below The New South Wales EPA Environmental Criteria for Road Traffic Noise recommended maximum levels for this type of road.

This assessment concludes that the proposed sand extraction operations at 543 Brewers Road Kippenduff will be in compliance with The New South Wales Industrial Noise Policy, January 2000, when recommended noise control measures outlined in this report are implemented.

This assessment concludes that road traffic noise levels generated by the trucks on haulage routes to and from the excavation site at 543 Brewers Road Kippenduff are below The New South Wales EPA Environmental Criteria for Road Traffic Noise recommended maximum levels.

Garry Hall

Sound Engineer
Ambience Audio Services

REFERENCED DOCUMENTS

Australian Standard AS 1055.1-1997: *'Acoustics - Description and measurement of environmental noise - General procedures'.*

The NSW Government Industrial Noise Policy (2000) EPA 00/1.

The NSW Government Environmental Criteria for Road Traffic Noise (1999) EPA May 1999.

Predicting Outdoor Sound
Keith Attenborough, Kai MingLi, Kirill Horoshenov
Published –Taylor & Francis, New York, 2007

APPENDIX A
Definitions of Terms

Sound pressure level (SPL): A measurable quantity of the size or amplitude of the pressure fluctuations (sound waves) above and below normal atmospheric pressure. Sound pressure levels are measured in decibels.

Decibels (dB): a ratio of energy flows. When used with sound measurement, it is the ratio between a measured quantity and an agreed reference level. The dB scale is logarithmic and uses the threshold of hearing of 20 μPa (micro pascals) as the reference level. This reference level is defined as 0 dB. One useful aspect of the decibel scale is that it gives a much better approximation to the human perception of relative loudness than the Pascal scale. This is because the ear reacts to a logarithmic change in level, which corresponds to the decibel scale where 1 dB is the same relative change every on the scale. *Refer Appendix B*

Frequency: The number of pressure variations per second (cycles per second) is called the **frequency** of sound and is measured in **Hertz (Hz)**. The rumble of distant thunder has a low frequency, while a whistle has a high frequency. The normal range of hearing for a healthy young person extends from approximately 20Hz up to 20 000 Hz (20kHz) while the range from the lowest to highest note on a piano is 27.5 Hz to 4 186 Hz.

Tonality: Noise containing a prominent frequency and characterized by a definite pitch.

Spectral characteristics: The frequency content of noise.

Octave and one-third octave bands: When more detailed information about a complex sound is required, the frequency range from 20 Hz to 20 kHz (range of hearing for a healthy youth) can be divided into sections or bands. This is done with electronic filters, which reject all sound with frequencies outside this band. An octave is a frequency where the highest frequency is twice the lowest frequency – a 2:1 ratio. For example, an octave filter with a **centre frequency** of 1kHz admits frequencies between 707 and 1414 Hz, but rejects all others. A third octave covers a range where the highest frequency is 1.26 times the lowest frequency.

"A" frequency weighting: The method of frequency weighting the electrical signal within a noise-measuring instrument to simulate the way the human ear responds to a range of acoustic frequencies. The symbols for the noise parameters often include the letter "A" (e.g., L_{Aeq}, dBA) to indicate that frequency weighting has been included in the measurement.

Fast, Slow and Impulse time weightings: Standardised response times to help define fluctuating noise levels. Impulsive noises have high peak levels with a very short duration (e.g., gun shot), or a sequence of such peaks. Slow helps average out the fluctuations and is used to for better visual indication of the noise source. Environmental assessment standards usually specify the time weighting (**F**, **S**, or **I**) to use.

L_{Aeq}: The A-weighted continuous noise level. A widely used noise parameter that calculates a constant level of noise with the same energy content as the varying noise signal being measured. The time in minutes, which the measurement was sampled, is indicated with a following number. e.g. L_{Aeq15} is a 15 minute sample.

L_{AN}: The A-weighted sound pressure level that is exceeded for N per cent of the time over which a given sound is measured. e.g. **L_{A90}** is the A-weighted sound pressure level that is exceeded for 90% of the time over which a given sound is measured. **L_{A90}** is commonly used to describe the **background noise level** for community noise assessments.

Ambient noise: The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.

Extraneous noise: Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods and by events such as concerts or sporting events. Normal daily traffic is not to be considered extraneous.

Background noise: The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the **L_{A90}** descriptor.

Intrusive Noise: Refers to noise that intrudes above the background level by more than 5 decibels.

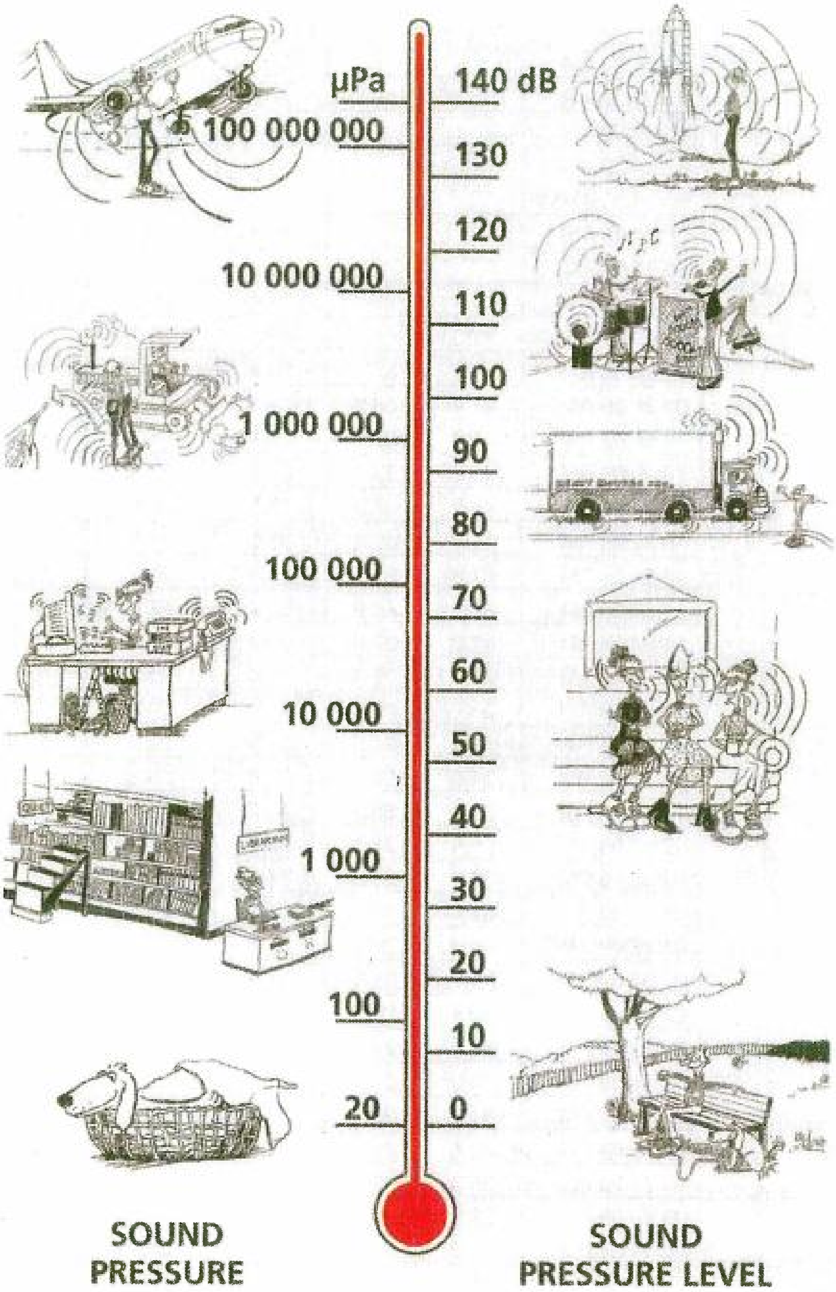
References:

Measuring Sound Brüel and Kjær Sound & Vibration Measurements A/S September 1984

Environmental Noise Brüel and Kjær Sound & Vibration Measurements A/S 2000, 2001

New South Wales Industrial Noise Policy NSW Environment Protection Authority January 2000

APPENDIX B
Comparison of Sound Pressure Levels



Our hearing covers a wide range of sound pressures – a ratio of over a million to one. The dB scale makes the numbers manageable.

Reproduced from
Environmental Noise Brüel and Kjær Sound & Vibration Measurements A/S 2000, 2001

APPENDIX C
Measured Noise Levels

	29/04/2008		30/04/2008		1/05/2008	
Start time	L_{Aeq}	L_{AF90}	L_{Aeq}	L_{AF90}	L_{Aeq}	L_{AF90}
07:09:09 AM			36.5	22.7	33.7	24.2
07:24:09 AM			32.5	---	34.5	24.9
07:39:09 AM			33.3	23.8	37.2	25.4
07:54:09 AM			33.0	23.9	38.4	25.7
08:09:09 AM			31.3	23.7	39.8	26.0
08:24:09 AM			32.4	24.7	40.4	26.3
08:39:09 AM			33.9	26.0	32.4	26.2
08:54:09 AM			38.6	26.7	34.2	25.9
09:09:09 AM			42.1	25.7	33.4	25.4
09:24:09 AM			29.4	24.4	36.5	27.4
09:39:09 AM	47.1	36.2	29.6	24.3	32.3	27.3
09:54:09 AM	45.3	36.1	27.9	24.3	33.4	26.5
10:09:09 AM	45.0	37.1	26.6	23.9	37.5	26.5
10:24:09 AM	44.2	37.5	33.1	25.9	33.7	28.3
10:39:09 AM	39.2	32.9	33.0	25.6	35.5	31.0
10:54:09 AM	41.6	31.0	31.3	25.3	35.5	29.4
11:09:09 AM	35.4	26.9	34.4	27.0	39.3	32.6
11:24:09 AM	37.2	27.5	30.7	26.1	35.1	29.9
11:39:09 AM	36.4	29.0	31.4	26.7	39.5	31.6
11:54:09 AM	33.5	26.9	31.1	25.8	35.0	31.0
12:09:09 PM	35.1	28.6	30.3	26.4	35.0	30.3
12:24:09 PM	34.8	28.0	29.8	26.3	37.0	31.1
12:39:09 PM	37.5	30.0	31.8	27.6	35.4	30.3
12:54:09 PM	35.6	27.3	29.7	26.4	37.3	30.4
01:09:09 PM	32.2	28.3	34.9	28.6	34.2	29.6
01:24:09 PM	32.4	27.7	31.5	26.8	34.9	28.9
01:39:09 PM	40.5	28.3	29.4	26.3	49.6	29.6
01:54:09 PM	34.6	28.3	28.9	25.4	33.5	28.9
02:09:09 PM	32.6	26.5	38.8	25.1	33.0	28.3
02:24:09 PM	31.5	24.9	30.9	26.1	30.5	27.1
02:39:09 PM	29.9	25.7	33.5	26.8	35.9	29.3
02:54:09 PM	31.5	26.2	29.4	25.9	30.5	27.0
03:09:09 PM	32.4	24.3	34.6	27.3	36.3	28.5
03:24:09 PM	28.0	23.4	30.9	25.6	33.7	29.8
03:39:09 PM	32.2	24.4	33.1	26.0	36.5	30.4
03:54:09 PM	28.0	23.7	28.1	24.7	33.8	28.3
04:09:09 PM	28.0	23.1	29.3	25.0	36.0	28.7
04:24:09 PM	26.9	---	30.5	25.0	31.3	28.0
04:39:09 PM	34.5	23.3	33.5	26.5	35.3	30.6
04:54:09 PM	35.3	23.3	31.1	26.1	44.3	32.3
05:09:09 PM	33.8	26.5	38.7	30.8	47.3	35.9
05:24:09 PM	35.0	32.4	36.4	35.1	41.4	39.4
05:39:09 PM	36.0	34.5	37.5	36.5	42.0	40.4
05:54:09 PM	34.3	32.9	51.3	33.5	41.3	39.3

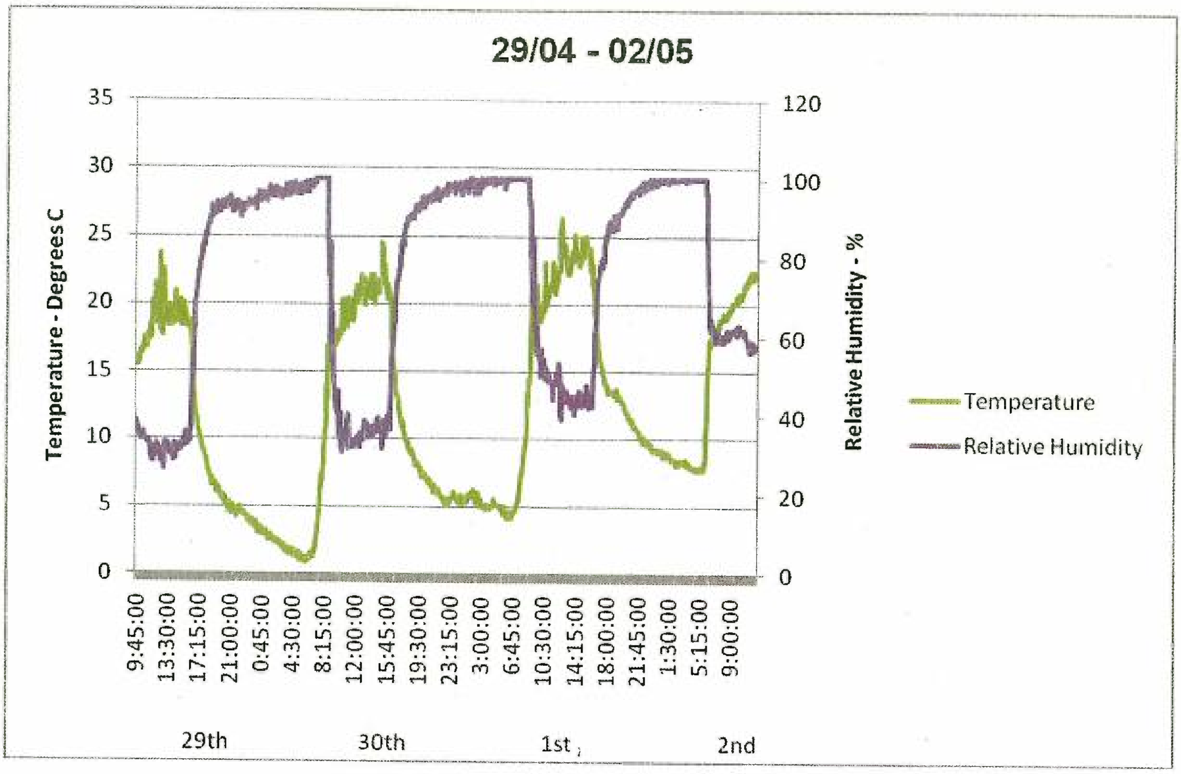
Measured Noise Levels

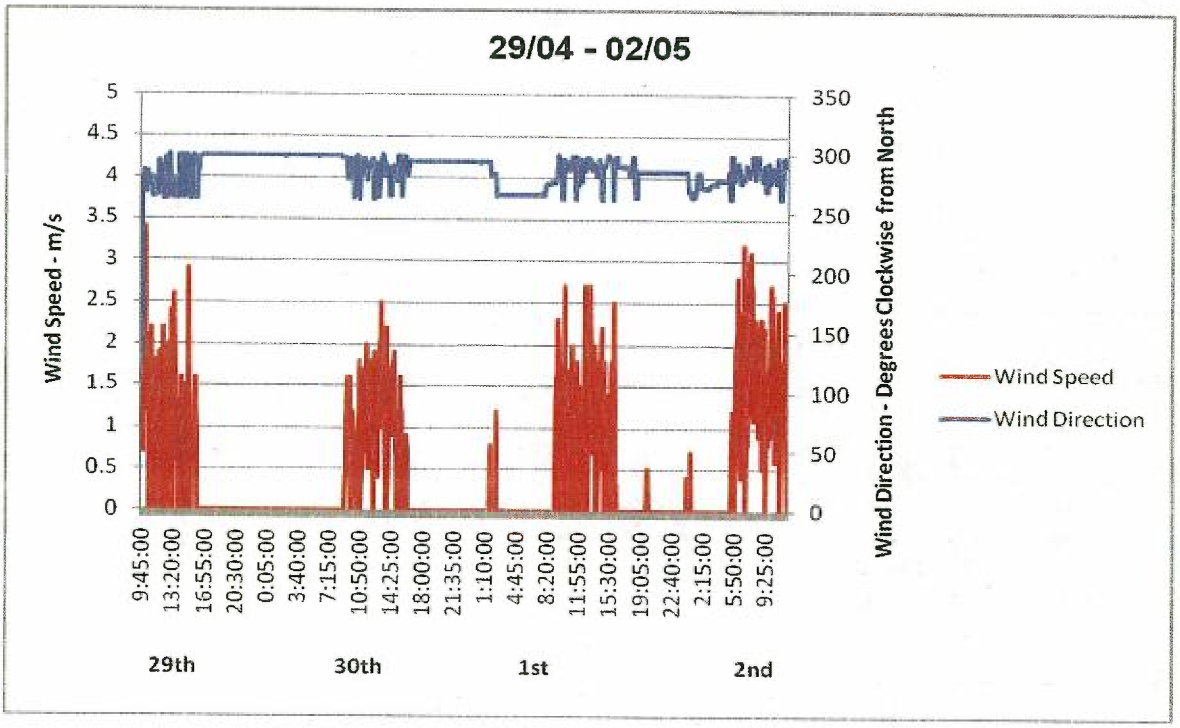
	2/05/2008		3/05/2008		4/05/2008	
Start time	L_{Aeq}	L_{AF90}	L_{Aeq}	L_{AF90}	L_{Aeq}	L_{AF90}
07:09:09 AM	39.1	33.3	35.3	29.9	35.5	26.8
07:24:09 AM	39.5	34.6	35.2	30.6	36.1	28.4
07:39:09 AM	41.8	35.5	36.1	31.7	36.5	29.1
07:54:09 AM	39.7	34.3	40.6	32.5	33.5	28.3
08:09:09 AM	41.9	35.0	37.9	33.0	33.9	29.5
08:24:09 AM	58.6	35.6	37.2	33.3	35.0	30.7
08:39:09 AM	44.9	35.7	37.0	32.6	37.9	31.1
08:54:09 AM	42.6	36.8	35.7	32.1	35.0	30.0
09:09:09 AM	41.4	34.7	36.0	31.2	37.2	31.6
09:24:09 AM	39.1	33.9	33.6	31.2	34.9	31.4
09:39:09 AM	37.7	32.7	35.1	30.9	42.0	29.8
09:54:09 AM	38.3	31.4	35.3	31.6	36.6	30.7
10:09:09 AM	38.6	32.2	36.5	31.6	34.2	30.8
10:24:09 AM	39.4	30.6	37.8	33.3	36.0	31.2
10:39:09 AM	37.0	30.1	39.8	34.2	36.0	30.8
10:54:09 AM	38.9	30.3	36.4	32.2	35.5	31.5
11:09:09 AM	36.3	30.6	36.0	32.7	35.6	30.1
11:24:09 AM	35.2	29.2	35.8	32.6	34.8	30.2
11:39:09 AM	34.7	28.6	46.0	32.8	34.1	30.0
11:54:09 AM	39.8	28.1	37.7	33.6	34.9	30.7
12:09:09 PM	33.5	27.6	36.1	33.3	35.7	29.7
12:24:09 PM	30.1	27.7	34.9	33.3	36.2	29.5
12:39:09 PM	32.4	28.0	35.6	33.6	35.0	30.2
12:54:09 PM	33.0	28.5	37.3	34.5	33.4	29.8
01:09:09 PM	31.9	28.8	34.9	31.9	31.7	29.2
01:24:09 PM	34.8	29.6	35.4	31.4	32.9	29.1
01:39:09 PM	34.6	30.1	36.8	34.7	31.8	29.0
01:54:09 PM	33.6	31.0	35.8	33.1	33.4	28.8
02:09:09 PM	40.0	30.4	35.5	32.1	34.0	28.7
02:24:09 PM	34.5	31.1	38.3	34.1	32.8	28.6
02:39:09 PM	33.2	30.3	35.7	33.5	33.7	30.2
02:54:09 PM	34.5	32.3	37.0	34.1	33.0	29.2
03:09:09 PM	35.2	33.4	36.9	33.6	33.4	28.9
03:24:09 PM	35.2	33.3	43.1	33.2	34.2	30.2
03:39:09 PM	36.8	34.6	36.9	34.2	34.8	31.7
03:54:09 PM	36.3	34.4	38.3	34.7	34.1	31.8
04:09:09 PM	38.4	36.1	34.4	30.9	36.0	32.0
04:24:09 PM	38.5	36.3	38.8	33.2	37.9	33.0
04:39:09 PM	38.4	36.4	37.1	34.0	38.6	34.0
04:54:09 PM	41.2	37.9	40.9	37.9	36.2	32.5
05:09:09 PM	43.2	40.6	43.9	41.2	40.7	37.3
05:24:09 PM	46.5	43.4	45.5	43.4	44.0	42.4
05:39:09 PM	48.1	46.4	47.4	46.8	44.4	43.1
05:54:09 PM	47.7	44.9	45.5	43.8	42.5	40.9

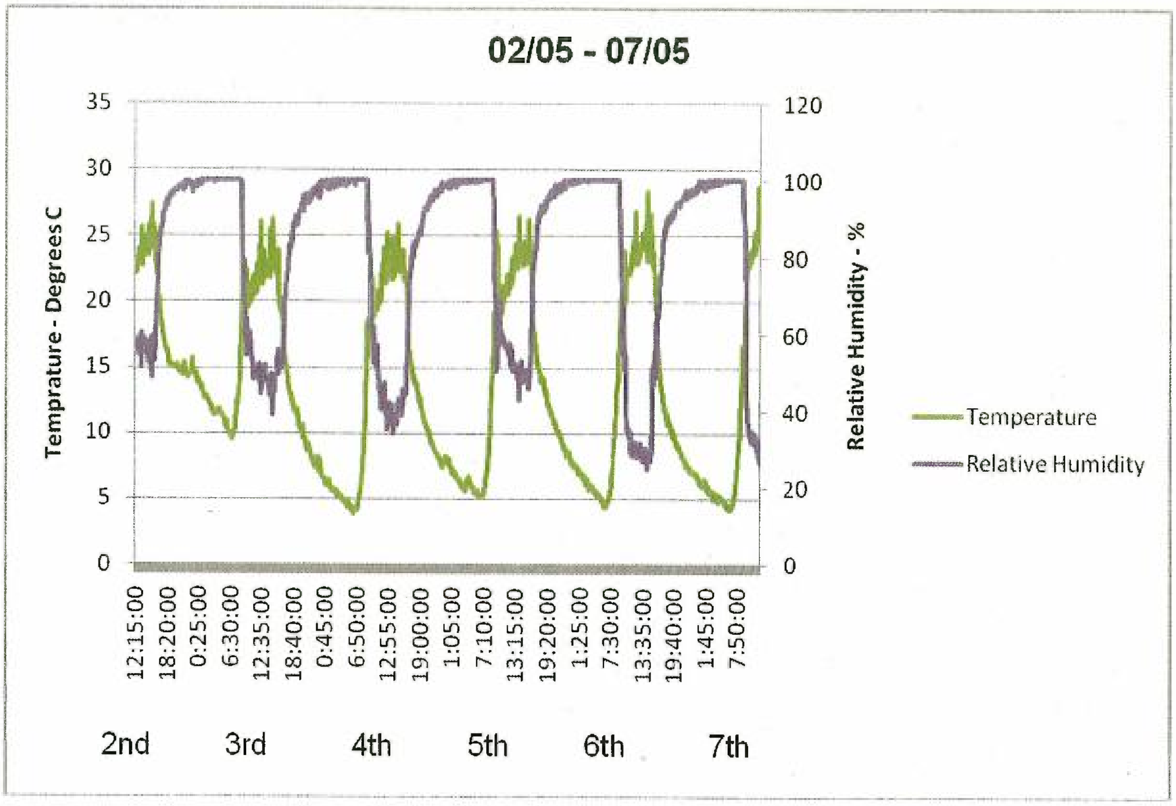
Measured Noise Levels

	8/05/2008		9/05/2008		10/05/2008	
Start time	L_{Aeq}	L_{AF90}	L_{Aeq}	L_{AF90}	L_{Aeq}	L_{AF90}
07:11:29 AM	33.0	22.4	31.5	23.3	33.2	23.7
07:26:29 AM	30.8	23.3	32.9	23.5	33.8	25.5
07:41:29 AM	32.4	23.9	40.4	24.1	35.2	25.9
07:56:29 AM	34.8	25.2	33.4	25.2	42.9	26.2
08:11:29 AM	34.4	26.3	32.2	25.6	33.3	25.3
08:26:29 AM	32.8	26.7	39.1	26.2	34.5	25.5
08:41:29 AM	33.4	26.4	34.2	26.2	31.5	26.0
08:56:29 AM	34.9	27.6	29.8	26.4	33.6	26.2
09:11:29 AM	33.2	27.8	33.2	27.1	37.3	25.4
09:26:29 AM	36.4	28.9	43.3	27.1	35.3	25.5
09:41:29 AM	34.1	30.7	32.2	28.3	34.2	26.0
09:56:29 AM	35.3	31.3	33.0	25.7	29.4	25.7
10:11:29 AM	36.8	30.6	31.1	26.2	31.7	26.1
10:26:29 AM	68.5	29.3	29.3	26.3	38.0	26.3
10:41:29 AM	35.1	30.4	31.3	26.1	36.7	27.1
10:56:29 AM	34.0	28.5	30.9	25.6	32.2	26.5
11:11:29 AM	31.4	26.4	32.1	25.2	33.0	28.6
11:26:29 AM	31.7	27.2	30.8	25.6	33.0	27.4
11:41:29 AM	33.3	26.3	31.5	26.5	31.7	27.7
11:56:29 AM	34.3	28.3	37.7	26.7	31.0	27.8
12:11:29 PM	35.8	27.3	29.4	26.4	58.6	28.6
12:26:29 PM	31.9	27.1	30.6	25.5	64.8	26.9
12:41:29 PM	30.9	27.8	31.2	26.3	29.7	25.9
12:56:29 PM	31.6	27.1	30.8	25.5	30.4	27.1
01:11:29 PM	46.1	26.9	27.2	25.3	29.9	26.8
01:26:29 PM	30.5	26.7	30.4	25.6	30.8	27.4
01:41:29 PM	30.2	26.3	29.6	25.7	31.0	28.2
01:56:29 PM	30.3	26.0	28.0	24.1	30.0	26.5
02:11:29 PM	30.2	25.4	28.8	23.8	41.6	26.3
02:26:29 PM	30.2	25.8	27.1	24.9	33.2	27.2
02:41:29 PM	29.1	26.2	28.0	24.9	32.0	28.3
02:56:29 PM	28.7	25.7	28.1	25.0	32.6	27.7
03:11:29 PM	29.7	24.9	28.7	24.3	32.7	29.2
03:26:29 PM	34.7	25.1	31.0	25.7	34.7	30.7
03:41:29 PM	36.3	25.3	30.9	25.8	32.8	30.6
03:56:29 PM	35.5	25.5	32.6	27.9	35.3	32.5
04:11:29 PM	32.9	25.9	34.4	29.7	35.9	31.6
04:26:29 PM	30.2	25.7	34.3	31.2	39.3	34.1
04:41:29 PM	32.0	27.3	36.1	33.0	43.0	31.7
04:56:29 PM	33.5	29.1	40.9	34.5		
05:11:29 PM	43.6	34.1	41.2	39.5		
05:26:29 PM	40.5	39.6	43.0	41.7		
05:41:29 PM	50.9	39.5	45.1	41.8		
05:56:29 PM	39.1	38.1	40.2	38.1		

APPENDIX D
Weather Data During Background Noise Monitoring






02/05 - 07/05
Temprature - Degrees C
Relative Humidity - %
Temperature
Relative Humidity
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
12:15:00
18:20:00
0:25:00
6:30:00
12:35:00
18:40:00
0:45:00
6:50:00
12:55:00
19:00:00
1:05:00
7:10:00
13:15:00
19:20:00
1:25:00
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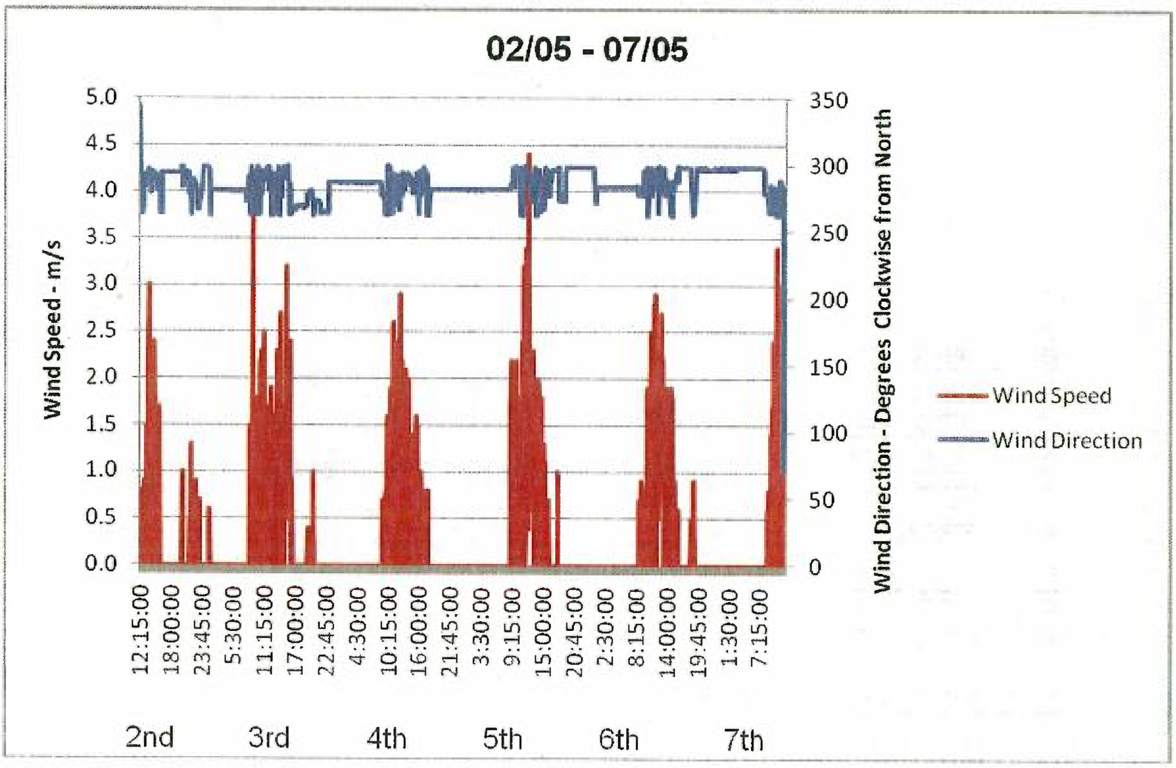
3rd
4th
5th
6th
7th


02/05 - 07/05
Wind Speed - m/s
Wind Direction - Degrees Clockwise from North
Wind Speed
Wind Direction
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
350
300
250
200
150
100
50
0
12:15:00
18:00:00
23:45:00
5:30:00
11:15:00
17:00:00
22:45:00
4:30:00
10:15:00
16:00:00
21:45:00
3:30:00
9:15:00
15:00:00
20:45:00
2:30:00
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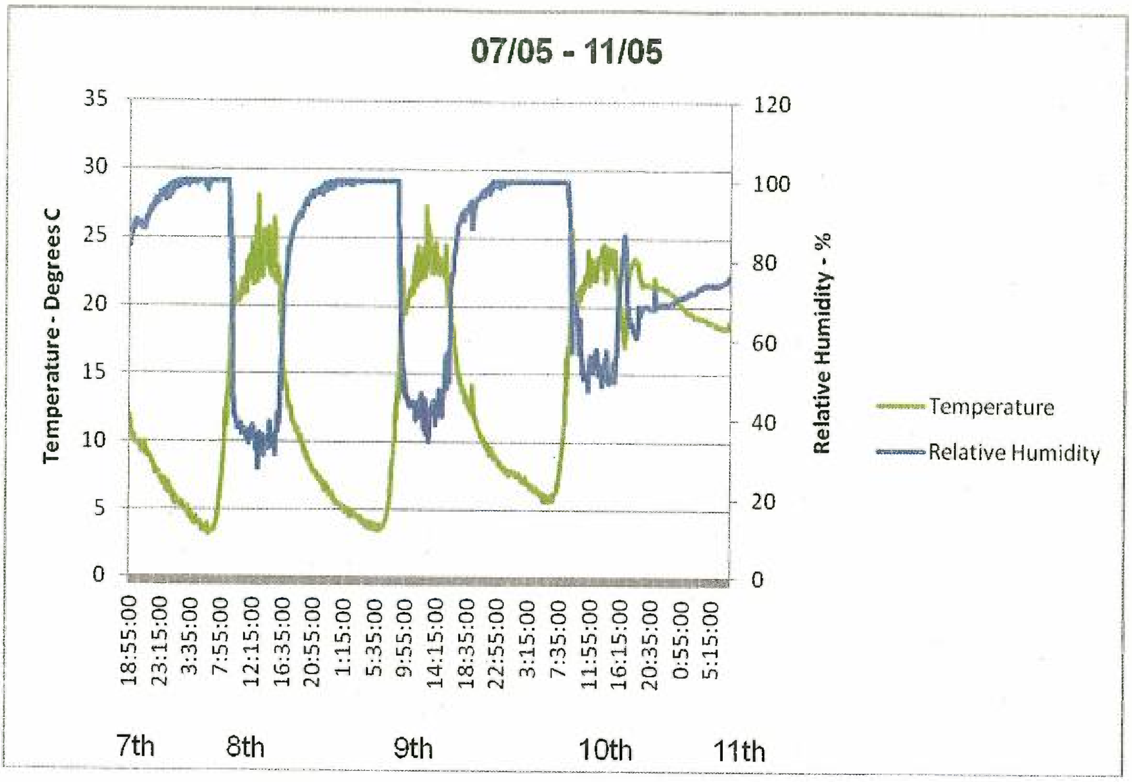
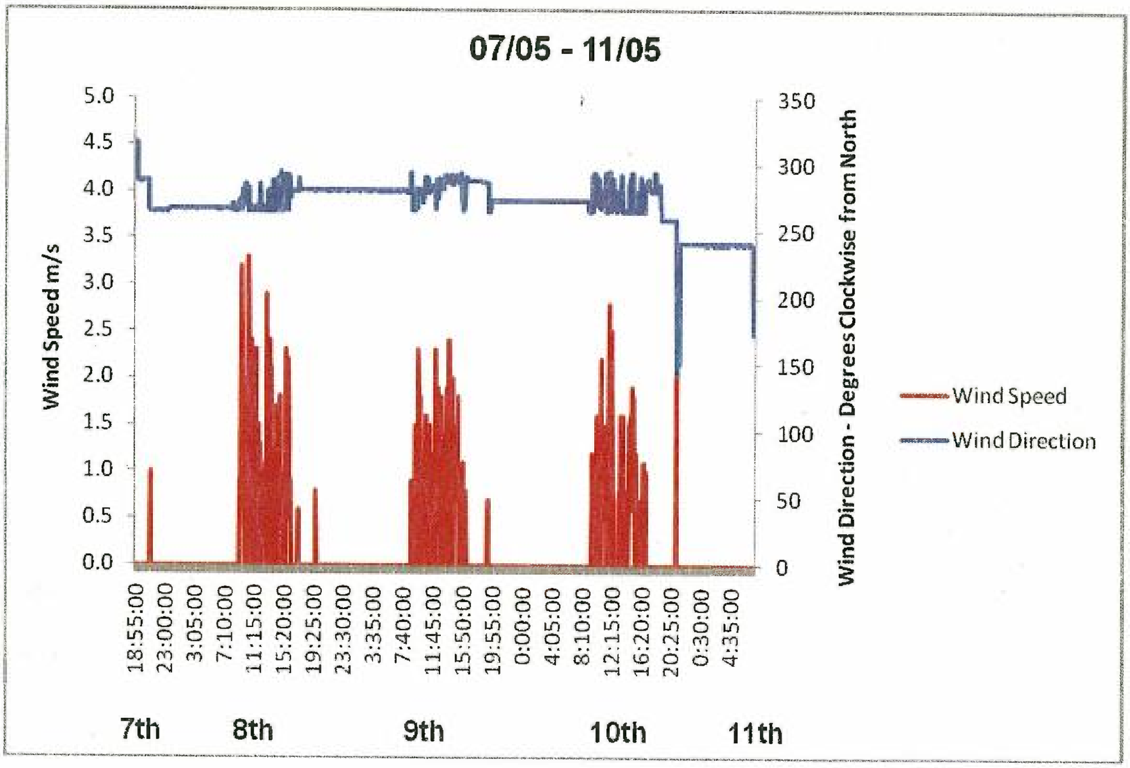
7:15:00
2nd
3rd
4th
5th
6th
7th


07/05 - 11/05
Temperature - Degrees C
Relative Humidity - %
35
30
25
20
15
10
5
0
120
100
80
60
40
20
0
18:55:00
23:15:00
3:35:00
7:55:00
12:15:00
16:35:00
20:55:00
1:15:00
5:35:00
9:55:00
14:15:00
18:35:00
22:55:00
3:15:00
7:35:00
11:55:00
16:15:00
20:35:00
0:55:00
5:15:00
7th
8th
9th
10th
11th
Temperature
Relative Humidity


07/05 - 11/05
Wind Speed m/s
Wind Direction - Degrees Clockwise from North
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
350
300
250
200
150
100
50
0
18:55:00
23:00:00
3:05:00
7:10:00
11:15:00
15:20:00
19:25:00
23:30:00
3:35:00
7:40:00
11:45:00
15:50:00
19:55:00
0:00:00
4:05:00
8:10:00
12:15:00
16:20:00
20:25:00
0:30:00
4:35:00
7th
8th
9th
10th
11th
Wind Speed
Wind Direction

APPENDIX E
Plant equipment

1. Model of sand screener: MSC MK11 Model No: SPS31
   Type of Motor: Diesel 3 cyclinder Lister
2. Model of Front End Loader: Halla 170
3. Model of Excavator: Komatsu 200

APPENDIX F
Location Map