ENVIRONMENTAL STUDY

FUTURE INDUSTRIAL LAND TUMUT & GILMORE

TUMUT SHIRE COUNCIL

Prepared by:

Habitat Planning

in association with

SJE Consulting
Ettamogah Research Consultants
TDA Consulting

JULY 2002

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ABBREVIATIONS

DCP	Development Control Plan
DLWC	Department of Land & Water Conservation
EPA	Environment Protection Authority
EP&A Act	Environmental Planning & Assessment Act 1979
ERC	Ettamogah Research Consultants
LEP	Local Environmental Plan
NPWS	National Parks & Wildlife Service
RTA	Roads & Traffic Authority
RVMP	Regional Vegetation Management Plan
RVC	Regional Vegetation Committee
SEPP	State Environmental Planning Policy
TSC Act	Threatened Species Conservation Act 1995

TERMS

“the Act”	Environmental Planning and Assessment Act 1979
“the Council”	Tumut Shire Council
“the DCP”	Tumut Shire Council Industrial Development DCP No 6
“the highway”	Snowy Mountains Highway
“the LEP”	Tumut Local Environmental Plan
“the Study”	The Tumut and Gilmore Environmental Study
“the Study area”	The subject land (as defined in Figure 2) and surrounds
“the subject land”	The area defined in the consultants brief

1. INTRODUCTION

This report is an Environmental Study commissioned by the Tumut Shire Council, in regard to land in Tumut and adjoining the Snowy Mountains Highway to the south (see Figure 1).

The aim of the Environmental Study is to provide sufficient and objective information to enable a decision to be made as to whether land in the Study area is suitable for industrial development. This assessment is made possible by identifying the following matters:

- all relevant constraints and opportunities; and
- any special character or functions associated with the Study area.

The brief for the Study was prepared by Tumut Shire Council (see Appendix A). Each of the matters to be addressed is indicated in the report within a frame at the head of each section. Where as a result of consultation with government agencies the brief needed to be modified or expanded, this is noted within the frame.

The Study report structure is based on the issues required to be addressed in the brief. The content of each section of the report is summarised as follows:

Section 1 Provides an introduction to the report, including the objectives of the Study.

Section 2 Describes the Study area, including its context within the surrounding area.

Section 3 Presents the statutory framework within which the environmental issues and outcomes are to be addressed.

Section 4 Is the key section of the report and provides an assessment of the environmental issues required to be addressed in the Study brief.

Section 5 Presents the outcomes of the Study.

Section 6 Makes recommendations to Council based on the outcomes of the Study.

The report has been prepared based on the information provided by Council and referral authorities, the resources of the lead consultant, and other specific technical data provided by sub-consultants. The result of this work is contained within this report and is presented to Council for its consideration and response.

2. STUDY AREA

This section describes the Study area, including its context within the surrounding area.

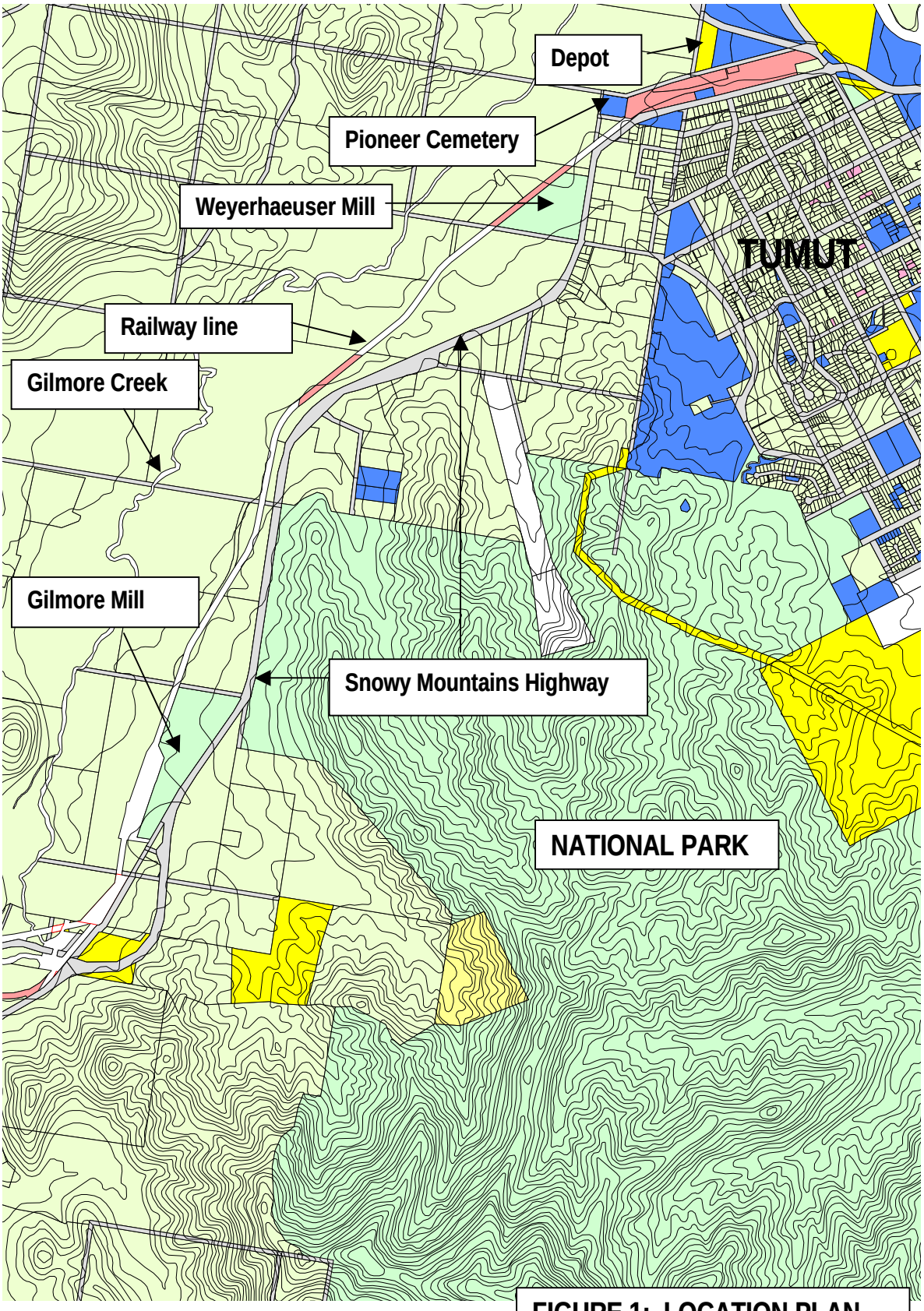


FIGURE 1: LOCATION PLAN

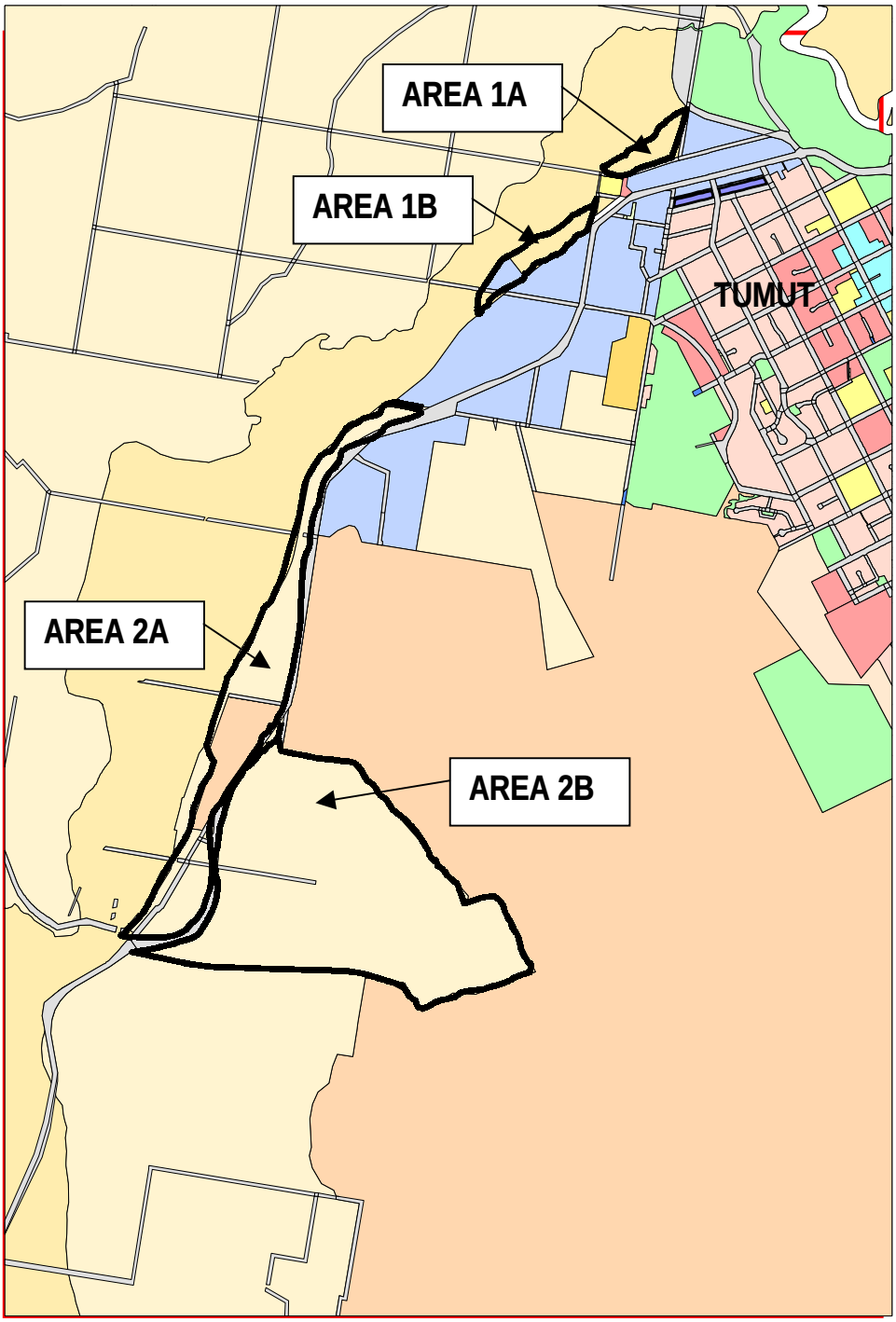


FIGURE 2: STUDY AREA

2.1 LAND DESCRIPTION & OWNERSHIP

Details of properties involved (land title details).

Details of properties and their owners within the Study area are recorded in Table 1.

TABLE 1: PROPERTY DETAILS FOR SUBJECT LAND

LOT NO.	DEPOSITED PLAN NO.	LAND OWNER	ADDRESS
AREA 1A			
Pt 124 & Pt 125	757252	R. B. Myers	'Old Wermatong', 1133 Blowering Road, Tumut
AREA 1B			
Pt 127	757252	R. B. Myers	'Old Wermatong', 1133 Blowering Road, Tumut
4	1014253	R. B. Myers	'Old Wermatong', 1133 Blowering Road, Tumut
1	217566	F. O. & M. I. Cullis	"Dandanshill', Oura Road, Wagga Wagga
1	513973	J. A. & J. G. Davey	109 Lambie Street, Tumut
AREA 2A			
30	829333	W. M. & L. M. Thatcher	Snowy Mountains Highway, Tumut
31	829333	F. O. & M. I. Cullis	"Dandanshill', Oura Road, Wagga Wagga
1 & 2	716504	D. A. & H. M. Whatman	'Bonnie Doon', Gilmore, Tumut
1 & Pt 2	500263	A. C. Kell	21 Gilmore Mill Road, Gilmore, via Tumut
Pt 41	757229	J. H. Whatman	'Briebrae', Gilmore
147	757229	A. & P. Pearce	53 Gilmore Mill Road, Gilmore, via Tumut
C	161592	Softwood Holdings Ltd.	P O Box 324, Tumut
Pt 2	500263	Weyerhaeuser Aust P/L	71 Ridge Street, Gordon
1	46590	P. J. & C. L. Rice	P O Box 405, Tumut
AREA 2B			
163 & Pt 41	757229	J. H. Whatman	'Briebrae', Gilmore
1	197308	Weyerhaeuser Aust P/L	P O Box 324, Tumut
61, 62, 94 & 140	757252	J. F. & G. E. Bellett	14 Kirra Street, Tumut

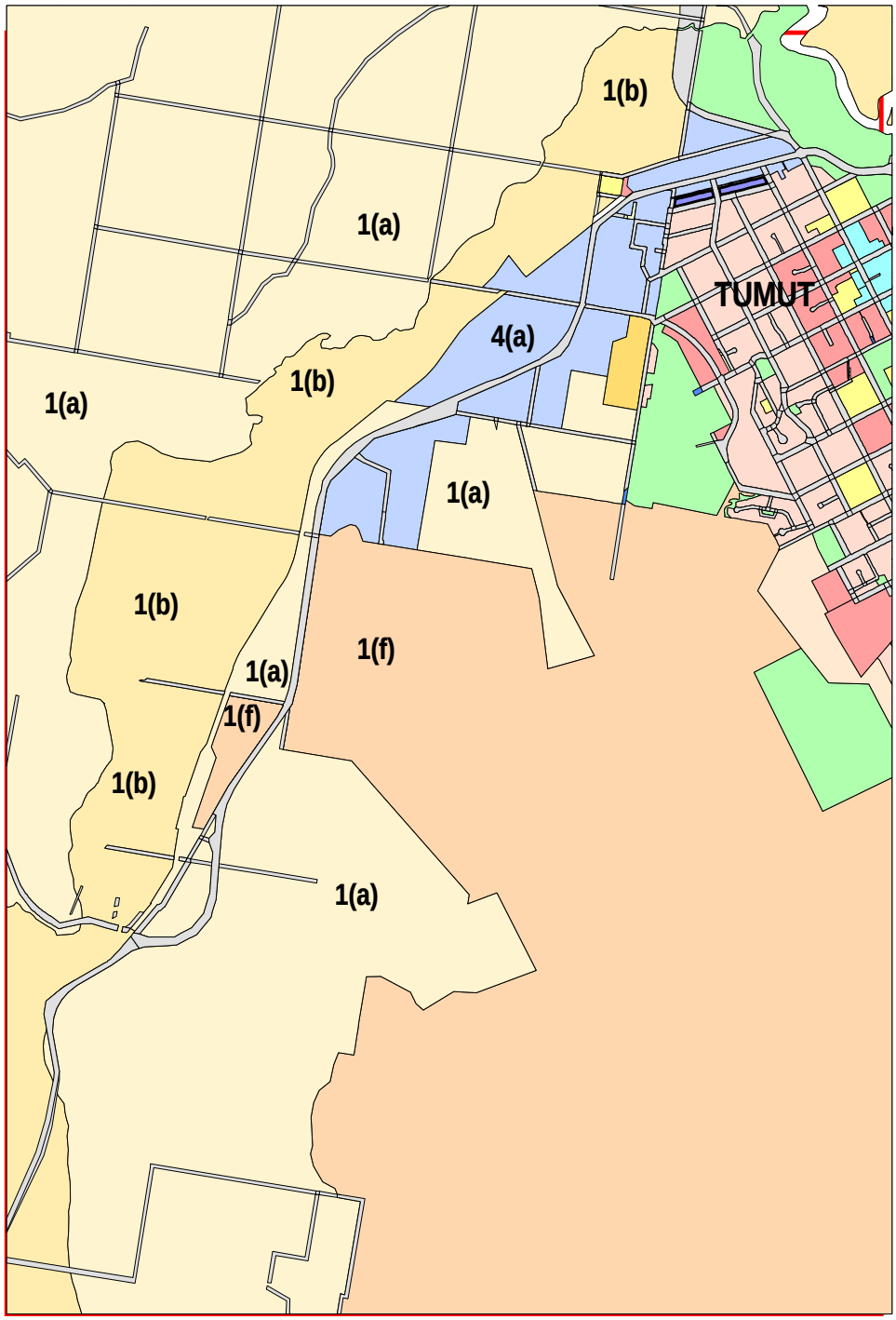


FIGURE 3: EXISTING ZONES

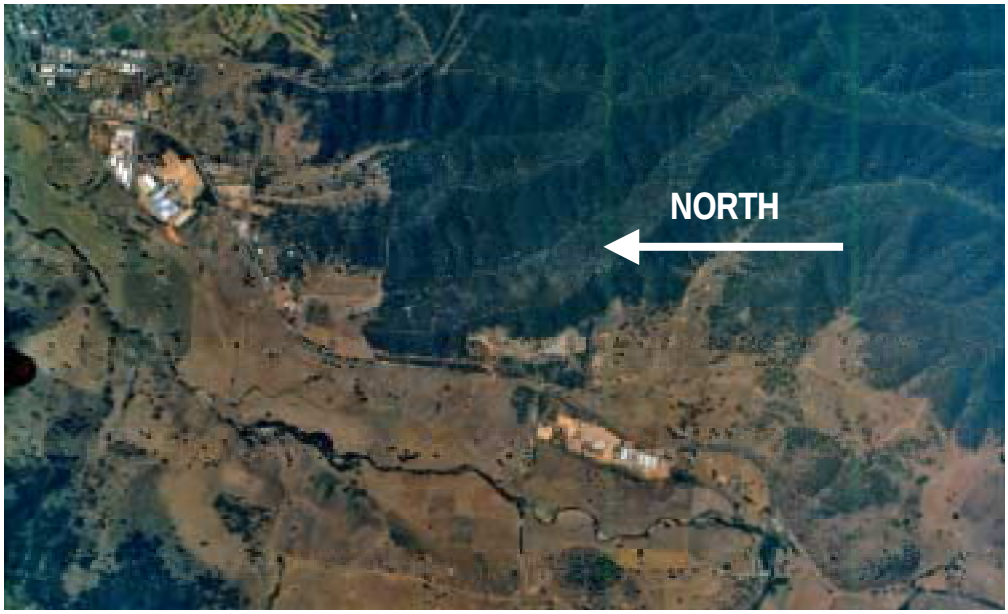


FIGURE 4: AERIAL PHOTOGRAPH OF LOCALITY

Location and general site plan.

The land the subject of the Study is divided into two main areas and each of these is considered in two parts for the purposes of the report (see Figure 2).

Area 1 contains approximately 23 hectares of land on the northwest fringe of the Tumut township. This land itself is in two parts with Area 1A being 7.5 hectares of land located in Yarra Road north of the Pioneer Cemetery and Area 1B being 15.5 hectares west of the disused railway more or less between Jepsen Avenue and the Pioneer Cemetery.

Area 2 features land commonly referred to as the Gilmore Mill and includes land on both sides of the Snowy Mountains Highway. Land to the west of the highway (Area 2A) is a long strip between the road and the disused railway line. Area 2B east of the highway (opposite the Gilmore Mill) contains the bulk of land in Area 2. Area 2 covers a total of approximately 45 hectares.

Names of all landowners and if possible signatures endorsing the Study.

Names of landowners are recorded in Table 1 above. The signatures of landowners consenting to the preparation of the Study is not necessary. All landowners will have the opportunity to comment on the Study when it is exhibited with the draft LEP.

Existing zoning.

Area 1 of the Study area is zoned *1(b) Special Agricultural* in the *Tumut Local Environmental Plan*, with the exception of a small parcel of land to the west of the disused railway and adjoining Jepson Avenue which is zoned *4(a) General Indus*trial and is currently being used for the storage of timber associated with Weyerhaeuser Timber Mill to the east.

Area 2 is zoned *1(a) Rural* with the exception of the land on the western side of the Snowy Mountains Highway currently occupied by the Gilmore Mill which is zoned *1(f) State Forest*.

The existing land use zones are shown in Figure 3.

Description of the locality.

The Study area is divided into two main areas and reflects a range of land uses and characteristics, which can be seen in the aerial photograph (see Figure 4) and series of photographs numbered 1 to 18 below.

Area 1 runs along the abandoned Cootamundra to Tumut railway line that adjoins the existing Tumut General Industrial 4(a) Zone. This area consists of open grassland sloping gently to the northwest, towards the Gilmore Creek floodplain. The site comprises approximately 23 ha that may be broken down into two distinct parcels of land. Apart from the Pioneer Cemetery, land use within this area is comprised of pastoral grazing. The area is in close proximity to Tumut town centre, the sewerage treatment works and two large timber mill operations.

Area 2 is composed primarily of the land within an area commonly referred to as Gilmore. This area includes land on both sides of the Snowy Mountains Highway, with the greater part found in the valley on the eastern side of the highway opposite the Gilmore Mill. The highway in this location separates the greater part of Area 2 from a smaller more elongated section along the western side of the highway. The total area of Area 2 is approximately 45ha.

Again this land is predominantly open grassland and used for grazing purposes. Much of the land manifests as gently undulating open grassland with some moderate vegetation cover. Currently some parts of this vicinity have been used as industrial, non-putrescible landfill. The far southeastern corner is marked by steeply sloping terrain with medium timber forest cover, bordering the National Park. Apart from past use of this area for 'paint ball' gaming this area remains well vegetated. The Gilmore Creek flowing from the west passes through the study area at the most southerly point.

Rainfall in the study area averages around 850mm per annum and is concentrated in the winter and spring months. The mean maximum temperature in Tumut in January is 30 degrees celcius and the mean minimum temperature in July is 0 degrees.

2.2 BACKGROUND

Land use history.

Areas 1A and 1B have been used for agricultural purposes although parts of Area 1B has and is being used for storage of prouct from the Weyerhaeuser Mill.

Area 2A also has an agricultural history although a significant part has been developed for the Gilmore Mill. A scattering of houses associated with the farming of the land is in evidence.

Area 2B has been used for grazing of cattle with some of the steeper parts retained in native vegetation. On the eastern side of this area is a small shed that appears to have been used as a residence at some stage in the past. The northern part has been used for landfill associated with an exsting waste disposal business (Belletts).

Much of the land use history of the Study area can be gleaned from the aerial photograph at Figure 4 and series of photographs above.

Circumstances that have resulted in this matter coming before Council.

The *Industrial Strategy* adopted by Council in 2001 recommended that Area 1 be rezoned to allow for industrial development in the short term and Area 2 also to be rezoned to accommodate future industrial development in Tumut. This recommendation has resulted in the commissioning of an Environmental Study to ascertain whether the land is suitable for this purpose.

The *Industrial Strategy* is discussed in more detail in the following section along with other relevant strategic planning documents.

PHOTOGRAPH 1

Area 1A looking west from Yarra Road.

Gilmore Creek in background.

PHOTOGRAPH 2

Yarra Road looking west.

Area 1A on right and railway land on left.

PHOTOGRAPH 3

Area 1B.

Note break in slope defining the edge of the Gilmore Creek floodplain on right.

PHOTOGRAPH 4

Land in Area 1B south of Jepson Avenue.

PHOTOGRAPH 5

Land west of disused railway in Area 1B used for storage of timber products from Weyerhaeuser Timber Mill.

PHOTOGRAPH 6

Northern end of Area 2A.

Subject land is the strip between the road reserve in the foreground and the disused railway line in the background (Gilmore Creek floodplain beyond).

PHOTOGRAPH 7

Northern end of Area 2A.

Subject land on left of fence and Snowy Mountains Highway to the right.

Note the relatively flat topography.

PHOTOGRAPH 8

Area 2A (on right) looking south along the Snowy Mountains Highway.

Note lack of remnant vegetation.

PHOTOGRAPH 9

Typical remnant vegetation and topography around the perimeter and higher parts of Area 2B.

PHOTOGRAPH 10

View to Gilmore Mill and Area 2A from highest point within Area 2B.

Floodplain of Gilmore Creek behind mill.

PHOTOGRAPH 11

Disused and overgrown railway defining western edge of study area.

Area 2A and Snowy Mountains Highway (not visible) on right.

Photograph taken from Whatman's Lane looking north to Tumut.

PHOTOGRAPH 12

Eastern boundary of Area 2B with National Park.

Note good cover of remnant vegetation in the Park.

PHOTOGRAPH 13

Eroded gully at rear of Area 2B.

PHOTOGRAPH 14

Floor of valley in Area 2B looking east from the Snowy Mountains Highway.

National Park in background.

PHOTOGRAPH 15

Gilmore Mill on western side of Snowy Mountains Highway.

PHOTOGRAPH 16

Snowy Mountains Highway looking south from the Gilmore Mill.

Area 2A on right and 2B on left.

PHOTOGRAPH 17

Intersection of Batlow Road (on left) and Snowy Mountains Highway.

Bridge over Gilmore Creek in background.

Defines southern edge of Study area.

PHOTOGRAPH 18

Gilmore Creek just downstream (north) of bridge on Snowy Mountains Highway.

3. PLANNING CONSIDERATIONS

This section presents the statutory framework within which the environmental issues and outcomes are to be addressed.

3.1 LEGISLATION & PLANNING INSTRUMENTS

State planning controls

Environmental Planning & Assessment Act 1979

Section 57(1) of the Act requires that where a Council decides to prepare a draft local environmental plan, it must first undertake an Environmental Study of the land to which the draft LEP applies (except where the LEP is insignificant).

The purpose of an Environmental Study is to undertake an independent and objective study of the land. The results of the study should determine whether Council supports or abandons the proposed LEP.

Part (4) of Section 57 of the Act requires that an Environmental Study be prepared with regard to such environmental matters that the Council specifies. Council has specified the environmental matters pertinent to the subject land in the brief to this Study (see Appendix A). Other matters to be addressed have been requested by planningNSW and other government agencies (see Section 3.4 below and Appendix B) as well as others that the consultants believe are relevant to the process.

Native Vegetation Conservation Act 1997

This legislation allows for the establishment of Regional Vegetation Committees (RVC's) to develop Regional Vegetation Management Plans (RVMP's). Under the Act, the Riverina Highlands RVC was formed in 1999 to develop a RVMP for the Riverina Highlands for which the subject land is part.

The goal of the RVMP is to stem and reverse the decline of native vegetation so that there is no 'net loss'. This goal will be achieved through a combination of regulatory measures for land clearing and incentives for landholders.

This Plan is now completed in draft form. If approved, the RVMP will have the status of a statutory environmental planning instrument (like an LEP) to be administered by the DLWC in consultation with the RVC.

The Plan identifies four Management areas or categories referred to as:

- Regional Protected Lands A – Steep and Erodible Lands
- Regional Protected Lands B – Streamsides
- Regional Linear Reserves; and
- all other lands to which the Plan applies.

"Steep and erodible lands" are mapped and include slopes greater than 18 degrees, highly erodible areas of sedimentary sourced parent material and highly to moderately erodible areas of granite (igneous) source parent material.

"Streamsides" are land within 20 metres from the banks of all 3rd order and larger streams (as mapped on latest 1:25000 topographic maps).

"Linear reserves" includes non-operational rail lines, travelling stock routes/reserves, crown and public roads, crown roads and commons.

For each of these Management areas, the Plan lists and defines the activities which:

- are permitted without development consent or those that are exempt from requiring development consent;
- may be permitted with development consent; and
- those which are prohibited.

If adopted, the RVMP may have some impact on the steeper lands in Area 2B that features a good cover of remnant vegetation. However, it is unlikely that these areas will be suitable for development in any case.

State Environmental Planning Policies

State Environmental Planning Policies (SEPP's) are development guidelines and standards applicable to issues of State significance. The following SEPP's are potentially applicable to the rezoning and development of the subject land for industrial purposes.

SEPP11 Traffic Generating Developments rationalises consultation procedures on traffic generating developments. It establishes the RTA as the sole traffic management authority to be consulted and ensures that it is given the opportunity to make representation on a development application before a Council makes a determination.

SEPP34 Major Employment-Generating Industrial Development aims to promote and coordinate orderly and economic use and development of land and the economic welfare of the State. It facilitates certain types of major employment-generating industrial development of State significance and the carrying out of labour intensive rural industrial development of State significance.

SEPP44 Koala Habitat Protection aims to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas. This will ensure that permanent free-living populations will be maintained over their present range. The policy provides that councils cannot issue consent, to affected development applications, without an investigation for core koala habitat. This SEPP provides a statewide approach to ensure that appropriate development can continue, while still ensuring the ongoing protection of koalas and their habitat.

None of these SEPP's are considered threatening to the development of the subject land. Council will need to satisfy itself that any koala habitat will not be threatened by the development of the land but once again, the land to which this SEPP may have influence would be on the steeper land that is less suitable.

Ministerial directions

The Minister for Urban Affairs and Planning may make directions under Section 117 of the EP&A Act, relating to the manner in which functions under this Act are exercised. Specifically, the Minister has issued directions to Councils in relation to matters which need to be taken into consideration in the preparation of draft LEP's.

Before a Council can formally exhibit a draft LEP it must demonstrate to the DUAP that the Plan does not conflict with any Section 117 Direction. The following Section 117 Directions are relevant to the rezoning of the Study area to industrial.

G8 Rural zones prohibits LEP's rezoning rural land to urban purposes without being justified by an Environmental Study. An industrial zone is regarded as an "urban" zone and therefore an Environmental Study is required in this instance. The recommendations of this study will determine compliance with this Minister's Direction.

G11 Industrial zones prevents LEP's from reducing the area of industrial zoned land. In this case the area of industrial zoned land is proposed to be substantially increased in Tumut and Gilmore. Consequently this Direction is technically irrelevant.

G20 Planning in bushfire prone areas requires Councils to consider whether land the subject of an LEP is at risk from bushfire. If it is then the LEP should address issues such as access roads and buffers as well as controls preventing inappropriate development on land subject to the hazard. An assessment of the bushfire risk is undertaken later in the Study.

G25 Flood liable land effectively prevents Councils from rezoning flood liable land to urban type land uses, including industrial. An assessment of the flood risk within the Study area is undertaken later in the report.

Environmental Planning & Assessment Model Provisions 1980

The Tumut LEP adopts most of the Model Provisions and the following clauses may be applicable to the industrial development of the land:

5. Consideration of certain applications

12. Land used for commercial or industrial purposes

13. Off street loading, etc, facilities

23. Industrial use of land

26. Junk yards and offensive or hazardous industries

27. Sawdust and sawmill waste

30. Services

31. Extractive industry, transport terminal

Many of the development matters raised by these clauses are addressed as environmental issues elsewhere in the Study (eg. services).

Effectively the Model Provisions provide development controls that complement those expressed in an LEP or DCP. None of these controls would have such implications for the subject land that its development for industrial purposes would be prohibitive.

Local Environmental Plans.

The *Tumut Local Environmental Plan 1990* is the principle local planning instrument within the Shire of Tumut. The general aims of the LEP are:

(a) to encourage the proper management, development and conservation of natural and man-made resources within the Shire of Tumut by protecting, enhancing or conserving:
  (i) prime crop and pasture land;
  (ii) timber, minerals, soil, water and other natural resources;
  (iii) areas of high scenic, recreational or nature conservation value; and
  (iv) places and buildings of archaeological or heritage significance, including Aboriginal relics and places; and

(b) to help facilitate growth and development of the Shire of Tumut in a manner which is consistent with the aims specified in paragraph (a) and which:
  (i) minimises the cost to the community of fragmented and isolated development of rural land;
  (ii) facilitates the efficient and effective delivery of amenities and services;
  (iii) facilitates a range of residential and employment opportunities in accordance with demand;
  (iv) facilitates farm adjustment; and
  (v) ensures that the efficiency of arterial roads is not adversely affected by development on adjacent land.

The particular aims of the LEP are:

(a) to divide land into the zones referred to in clause 8 and to achieve in respect of land within each of those zones the objectives specified for that land in the Table to clause 9;
(b) to protect the agricultural production potential of rural land, particularly where land is designated as being of prime crop and pasture potential;
(c) to provide for the continued needs of tourism;
(d) to encourage the provision of employment opportunities for local residents;
(e) to provide a variety of residential environments to cater for differing lifestyles and needs;
(f) to promote and enhance the viability of existing commercial and industrial centres within the Shire of Tumut;
(g) to recognise the financial constraints likely to be encountered by the Council in the provision, maintenance and augmentation of additional and existing services required for an expanding and relocating population; and
(h) to ensure that the Council gives due regard to the effect of natural hazards upon development.

The objectives of the 4(a) Industrial zone are:

(a) to enable the establishment of a broad range of industrial purposes;
(b) to encourage diversification of the industrial employment base;
(c) to permit limited commercial and retail development in association with industrial and warehouse development; and
(d) to regulate the location of industry to ensure that the amenity of nearby residential areas is not, in the opinion of the Council, unduly affected.

Essentially all development (except that which is prohibited) requires consent in the 4(a) zone. The following development is prohibited in the 4(a) zone:

Advertising structures (other than those permitted by clause 30); bed and breakfast establishments; boarding-houses; caravan parks; child care centres; clubs; cluster houses; commercial premises; dwelling-houses or dwellings (other than those used in conjunction with a permissible purpose); extractive industries; holiday cabins; hospitals; hotels; mines; motels; offensive or hazardous industries; professional consulting rooms; public buildings; recreation establishments; refreshment rooms; shops (other than industrial retail outlets); taverns; tourist facilities.

Clauses in the LEP relevant to the development of the subject land for industrial purposes include:

15. Development on land fronting an arterial road

(1) The Council shall not consent to the carrying out of development of land which has frontage to an arterial road unless

(a) access to that land is provided by a road other than the arterial road, wherever practicable; and

(b) in the opinion of the Council, the safety and efficiency of the arterial road will not be adversely affected by

(i) the design of the access to the proposed development;

(ii) the emission of smoke or dust from the proposed development; and

(iii) the nature, volume or frequency of vehicles using the arterial road to gain access to the proposed development.

20. Subdivision of land in Zone No. 4(a)

The Council shall not consent to the subdivision of land within Zone No. 4(a) unless the area of each allotment to be created by the subdivision is not less than 750 square metres and the frontage to any road is not less than 20 metres.

21. Buildings in Zone No. 4(a)

The Council may consent to the carrying out of development for the purposes of a building on land within Zone No. 4(a) only if

(a) the building will stand no closer than 7.5 metres to the front boundary of the land;

(b) the Council has taken into account the requirements for parking and manoeuvring of heavy vehicles and cars; and

(c) the floor space ratio of the building is not greater than 0.6:1.

Development Control Plans.

Tumut Shire Council adopted a Development Control Plan for Industrial Development (DCP No 6) on 21st December 2001. The purpose of the DCP is:

- *To encourage sustainable industries which use resources effectively and are working towards a sustainable position.*
- *To encourage economic development and job creation.*

- *To provide opportunities for investment, new enterprises and technological innovation in industrial development.*
- *To create practical but appealing designs which add to the streetscape and do not detract from the beauty and visual amenity of Tumut Shire.*
- *To create a positive work environment within the industrial areas of Tumut Shire.*
- *To encourage innovation in design for industrial development by allowing flexibility in terms of the prescriptive standards, subject to the performance standards.*

The DCP provides advice for developers in what needs to be submitted with a development application as well as development objectives and standards relating to:

- sustainability
- minimum size of lots
- setbacks
- parking
- landscaping
- building design
- storage areas
- fencing
- advertising signs
- dwellings
- industrial retail outlets
- bulky goods retailing

Any draft environmental planning instruments affecting the land.

There are no draft environmental planning instruments affecting the land at the time of the preparation of this Study.

An analysis of how the proposal would comply with any relevant aims and objectives contained in the Local Environmental Plan and relevant Development Control Plans.

Many of the objectives of the LEP are matters to be addressed within this Environmental Study and consequently, if they are found by the Study to be satisfactory then the objectives of the LEP can be considered to be satisfied.

All of the objectives of the 4(a) zone would be met through the rezoning of the subject land and in particular the provision of land immediately available for industrial development and the appropriate location of industrial development in and around Tumut.

This list of prohibited development in the 4(a) zone is considered fairly standard for industrial type zones although it is worth noting that Council has also chosen to exclude "offensive or hazardous industries". Whether this exclusion is warranted in the more isolated parts of the Study area (namely Area 2) is an issue Council may wish to consider as part of the LEP.

Clause 15 of the LEP relating to development along an arterial road effectively means that any development of land within Area 2 will require the construction of a service road unless access is available to the land from a side road such as Whatman's Lane in Area 2A. Area 1 does not have frontage to an arterial road and therefore will not be subjected to this clause.

The subdivision standards for the 4(a) zone expressed in Clause 20 of the LEP are appropriate for Area 1, however consideration may need to be given as to whether this minimum lot size and frontage is appropriate for Area 2 given that there is an preference in this location for large industry. Small industrial lots may prejudice the development of land within Area 2 for major industry if allowed to proceed, particularly if it is permitted along the Snowy Mountains Highway (the requirements of clause 15 notwithstanding).

Council should also note that the minimum lot size expressed in Clause 20 contradicts Clause 23 of the Model Provisions that imposes a minimum of 1,000m^2.

Clause 21 of the LEP for buildings is a relatively standard clause for industrial development but may be better expressed in a DCP rather than the LEP to provide greater flexibility and control by Council.

The Industrial Development DCP is an excellent planning document that clearly defines Council's goals for industrial development and what is expected of developers. The DCP would immediately become applicable to the subject land once rezoned to 4(a) and this is appropriate. If the intention of Area 2 is for major industrial development, an additional set of performance objectives and development standards for this type of development would be a useful modification to the DCP.

To avoid confusion (eg. minimum lot sizes), it may also be worthwhile for Council to rationalize its controls for industrial development in either the LEP and DCP, with the DCP considered to be the appropriate vehicle for this purpose because the control rests exclusively with Council.

How the proposal relates to Council's Industrial Strategy.

Council's Industrial Strategy was adopted in April 2001. The aim of the Strategy is "t*o adopt a framework that guides Council in the future provision of industrial land."*

The objectives of the Strategy are:

- *To provide additional industrial land to that available in 2001 to support the needs of the Visy Pulp and Paper Mill and the community generally.*
- *To provide the mechanisms for development of industrial land that enables a satisfactory mix of cost effectiveness, environmental appropriateness, and an end product that is visually acceptable.*

The stimulus for the Strategy would appear to be the establishment of the Visy Mill that has had a positive impact on the local community and created demand for all types of land, including industrial. The application to rezone the subject land to 4(a) Industrial is seen as an appropriate response to achieve the aims and objectives of the Strategy.

The proposed LEP is generally consistent with the Industrial Strategy because:

- it provides additional industrial land;
- Area 2 is suitable for large industry;
- Area 2B in particular will create an industrial node at Gilmore and consequently proximity between industrial activities;
- it provides incentive for existing industries to relocate in order to expand;
- Areas 1A and 1B correspond with the preferred location for industrial development in the short term; and
- Area 2B corresponds with the preferred location for industrial development in the longer term.

The Strategy expresses a desire to avoid so-called 'ribbon development' along the main approaches to Tumut. The rezoning of Area 2 to allow industrial development creates a scenario where this type of outcome might evolve because of the extent of land along (both sides) the Snowy Mountains Highway and the convenience this offers industry. However, it is possible to avoid the undesirable consequences of 'ribbon development' through planning controls and this has been addressed to some extent in the Industrial Development DCP although the controls could be made more specific for the Snowy Mountains Highway. Building setbacks and landscaping treatments are considered to be the two most effective means of minimising the detrimental visual impacts created by industrial development along main roads and particularly on major entrances to urban areas.

The issue of infrastructure is addressed elsewhere in this Study.

Any other likely concerns of Council in terms of any other relevant local planning policies and guidelines.

There are a number of other local planning documents that are relevant to the Study and these are considered below.

Tumut Shire Rural Local Environmental Study & Urban Strategy 1988

In 1981 Council resolved to undertake an Environmental Study principally for the rural areas of the Shire. The Study was in response to an identified need to address rural planning issues and principally land fragmentation (subdivision). In 1986 Council resolved to include the urban areas of the Shire in the Study.

The Study identifies land to the south and south west of Tumut as being "… *available for medium sized industries, however large industries could be located in suitable rural areas*" (p.66). Based on this evidence, the proposed rezoning can be viewed simply as a consequence of an adopted planning strategy.

Recommendations Report for the Tumut Shire Industrial Land Study 1998

This report is an outcome of a "Scoping Workshop" conducted to consider the first stage of the Industrial Land Study. The workshop identified a range of "Policy Statements" to guide future industrial development in Tumut, including to "*develop a new industrial park based around industries supporting timber industry in the Gilmore/Gadara area."*

The workshop also recognised the importance of protecting the entrance to towns from development that would be detrimental to visual amenity.

The Industrial Land Study recommends under the heading of "General Industry" to investigate the potential of land in proximity to the Gilmore Mill for future industrial development. The "detailed site assessment" recommended for this land is being undertaken courtesy of this Environmental Study.

The Industrial Land Study is therefore considered to generally support the proposed LEP the subject of this Environmental Study.

Tumut & Industry Planning Directions Study 2000

This study reviews the need for industrial land in Tumut following the establishment of the Visy plant. In the context of the area the subject of this Environmental Study, the Planning directions Study concluded that:

- *Short-term provision of land could be made, to add to the existing 45 hectreas of available land. The site that best meets the planning assessment criteria is that land shown as Area 6 on the study Map.*
- *Longer-term provision of land could be made in the form of "Reserved Industrial Land". The land that best matches the planning assessment criteria is Area 3.*

The Area 6 referred to corresponds with Area 1B in the Environmental Study and Area 3 with Area 2. Consequently the Directions Study would also appear to strategically support consideration of the land the subject of this Environmental Study for industrial development through its rezoning.

Draft Alpine Region Settlement Strategy 2001

The draft Strategy has been prepared by the Alpine Region Settlement Working Group The Working Group describe the work as a:

"Strategy addressing the issues of maintaining the integrity of the environment for natural values, tourism and primary production, while accommodating the shifting distribution of population in the region."

The Strategy provides the following summary of Tumut based on recent trends and the outlook for different "drivers" and constraints and the role they play in each area.

"Tumut, the nearby town of Adelong and rural residential areas Brungle and Wondalga have a relatively strong and diversified base in forest products processing. This is unlikely to provide significant further employment growth on its own, but provides a foundation for developing related industry and potentially further value adding. The foundations of a forest industry cluster have been established.

Further growth requires a deepening of technical skills and research to establish leadership in selected areas, value adding and maintaining significant control of the value chain in one or more value added products. Significant growth is possible if these areas are aggressively and effectively pursued. Without this the town's population is likely to remain essentially static.

There are relatively few physical or environmental constraints on Tumut to achieving growth. The town has access to adequate water, gas and electricity. It is near the Hume Highway and there is a possibility of the rail line being reinstated. Should its industrial base grow, the setting and service levels should be sufficient to attract and hold the required labour force.

The town will remain the main service centre for the north west of the Alpine Region although it has more competition for this role than Cooma in the east (residents of Tumbarumba Shire are more likely to look to Wagga Wagga and Albury for this role). It may attract and hold population from some adjacent towns with declining population.

Should the economic base of the town grow, additional land that has been identified will have to be serviced to accommodate a growing population and industry. While the town is hemmed in by a flood plain on two sides and the KNP on another, opportunities for in-fill within the existing residential areas and redevelopment in inner areas provide opportunities for further dwellings within the town. Growth in the satellite towns and rural residential areas will also occur as they are also within easy driving distance of the industrial parts of the town. Additional industrial land has been identified but has not yet been serviced."

Under the heading of "forestry", the Working Group draws the following conclusions for the Alpine Region:

"The western side of the mountains has a large and still growing resource base and a complex of 11 forest products processing plants (sawn timber, panel products, paper, etc.) that use a high proportion of forest products locally with little waste. Further growth in plantations will mostly be outside of the region. Limited growth in forest processing employment is expected as production has increased with the same work force. Any future developments are likely to focus on the Tumut area."

Having regard for the Strategy and its general conclusions that Tumut is best positioned to become a focus for the timber industry, it lends support to the creation of additional industrial zoned land to cater for any industrial development opportunities that may arise in the future.

3.2 LAND USE ISSUES

Objectives of the proposed rezoning.

The objective of the rezoning is to make sufficient land available in Tumut for future industrial development.

The quality of the land and the effect of the proposed rezoning on any existing uses of the land.

Land in the Study area is classified as either Class IV or V by DLWC in terms of land capability. Both these classes are suitable for grazing but not for regular cultivation (ie. cropping) "*owing to soil erosion, shallowness or limitations of slope, gradient, rockiness, climate, or a combination of these factors*." Based on this classification, the subject land is not 'prime' agricultural land (generally regarded to be Classes I and II) which weakens the argument to retain the land for agricultural production. In other words, the subject land is of no significance from an agricultural perspective.

The effect of the rezoning will be to allow the land to be developed for industrial purposes. Once the development occurs, the land will be removed from agricultural production. However, for the reasons stated above, the land is not highly productive (or has the potential to be highly productive) in terms of agriculture. So although there will be some loss of agricultural land it is not considered to be significant at the local, regional or state level.

It is also unlikely that all of the land proposed to be rezoned will be taken up in the short term. Indeed Area 2B has been identified by Council as suitable for a major industry requiring a large site (such as Visy). Until such time that an industry of this scale appears on the horizon, this land in particular is likely to remain as rural and in agricultural production (most likely cattle grazing). Area 1 is more likely be developed in the short term because of the vailability of services and proximity to Tumut although the scale of industry that could be accommodated may be constrained.

Whether the land contains recoverable minerals of extractive materials.

Although the Tumut region has a history of gold extraction in varying degrees, it is concluded that the study area contains no minerals of economic importance. Borehole drilling and examination of available geological literature have confirmed this (see Appendix D).

Indication of lot yields based on land capability.

Unlike residential development where lot yields are easily derived, it is difficult to arrive at such figures for industrial development. This is because there is no 'standard' size lot for industry. Lot sizes for industry can vary from 1,000m^2 to tens of hectares depending on the scale of the activity. Lot sizes will generally be determined by market needs and although some speculative lot development may occur at the lower end of the scale, larger industries are more likely to custom design a lot or lots to suit their specific needs.

Suffice to say that the areas nominated for assessment in this Study could cater for a range of industries on a range of lot sizes. Area 1 could be developed as a number of smaller lots ranging from 0.1 to 1 hectare to cater for local industries or industries ancillary to the large timber mills already present in Tumut and Gilmore. As stated above, Area 2 is capable of accommodating much larger industries on large lots and it

is not beyond possibility that all of say area 2B could be taken up by just one industry, particularly if there was a need to incorporate buffers in the development.

Area 2A would be suitable for the establishment of medium sized industries that are unable to secure a site within or closer to Tumut. The length of highway frontage to this area and availability of relatively unconstrained land (services notwithstanding) would allow a number of these industries to establish with excellent access and exposure.

General suitability of the site for the proposed rezoning.

The response to this issue is provided in the summary and conclusions of the Study.

What impact if any, the release of this land will have on other land releases in the Shire.

Council advises there are no other planned releases of industrial land in Tumut or Gilmore. If the rezoning proceeds, it is likely that the amount of zoned industrial land created will cater for the future needs of Tumut in the short and medium terms. It is unlikely there will be a need to rezone further land for industry during this period. The exception to this would be if an industry on a scale similar to Visy sought to establish in Tumut in which case the supply of zoned land might be consumed far sooner than anticipated. Council can only respond to this scenario if and when it occurs.

Whether the proposal will prejudice the orderly expansion of the existing zoned General Industrial area in Tumut.

The existing industrial zoned areas in Tumut are constrained from expansion, particulary on any great scale. The recent establishment of Visy Pulp and Paper Mill in the area has stimulated industrial development in Tumut and provided the catalyst for Council to investigate the need for additional industrial zoned land. Previous planning studies have established the need for the additional land.

Area 1A is adjoining existing industrially zoned land between Yarra and Gocup Roads on the western side. This area is constrained by the floodplain of the Gilmore Creek but is a logical extension of the industrial zone in this location where clearance of the flood level can be obtained. Area 1B is likewise constrained and simply proposes to make use of what land remains between the existing industrial zoned land and the edge of the Gilmore Creek floodplain.

Area 2 is remote from the existing industrially zoned land in Tumut and therefore will not prejudice its “orderly expansion”.

The appropriate staging of development.

The proposed rezoning is in response to strategic planning rather than a specific development proposal. Consequently there is no staging as such. The timing of the

development of the subject land is largely going to depend on the demand for the land and the type of industrial development proposed. If there is a need for smaller industrial lots then it would be appropriate to provide for the development of Area 1.

The development of land in Area 2 will require greater consideration by Council because of the infrastructure requirements. Consequently the issue of making the land available is a consideration Council is more likely to make at the time of a development proposal rather than ahead of development, particularly in the short-term.

3.3 SURROUNDING PROPERTIES

Details of the use of surrounding properties.

Area 1A is surrounded by a depot, unused railway land, the Pioneer Cemetery and the floodplain of Gilmore Creek (used for grazing).

Area 1B adjoins the Pioneer Cemetery, existing industrial land and the floodplain of Gilmore Creek (used for grazing).

Area 2A is adjoining existing industrial development (the Gilmore Mill), a railway reserve (which also defines the edge of the Gilmore Creek floodplain), and the Snowy Mountains Highway. Apart from the industrial use, the land is used for grazing purposes.

Area 2B is bordered by the Alpine National Park and Snowy Mountains Highway. Across the highway is the Gilmore Mill around which the land is used for agriculture (grazing).

How the proposal may affect these properties.

The development of the subject land for industrial purposes will have the following impacts on the various adjoining land uses:

- Industrial land use is compatible with the use of land for a services depot and no conflicts would be anticipated.
- Industrial development may have some detrimental impacts on the cemetery in terms of aesthetics, noise and possibly odour. However, given the low level of usage of the cemetery, it is not unreasonable to allow the proposed use. Council may need to pay extra attention to development applications on land close to the cemetery to minimize these potential impacts.
- The floodplain is used for cattle grazing when the Gilmore Creek is not in flood. Industrial development has the potential to have detrimental impacts on the floodplain but this would occur only if Council allows development on the land without imposing the appropriate safeguards or the industrialist breaches consent or other licence conditions. Developers of land in proximity to the floodplain need to be made aware of their responsibilities in terms of the implications of off-site impacts.
- The use of land for grazing would not be affected by industrial development.

- A state highway is compatible with industrial development.
- The National Park adjoins the eastern boundary of Area 2B and could be detrimentally affected if development is allowed to occur in close proximity. However this part of Area 2B is severely constrained for industrial development and it is unlikely that any development of this type will occur close to the National Park.
- Future industrial development is compatible with existing industrial activities within and adjoining the Study area. This is particularly the case when it is likely that future industry will be of a similar type to that existing such as the Gilmore Mill.

Any other compatibility issues with surrounding land uses.

There are no other compatibility issues.

3.4 CONSULTATION

This section records the responses received from government and other agencies to notification that the Environmental Study was to be undertaken on the subject land. Copies of agency responses are provided in Appendix B.

planningNSW

The Department has requested the following issues be addressed in the Study:

- supply and demand for industrial land;
- topographical constraints;
- subdivision pattern;
- flora and fauna survey;
- road circulation;
- adjoining land uses issues;
- road approaches to Tumut;
- 'ribbon development'; and
- development costs.

These issues are all addressed in the Study.

National Parks & Wildlife Service

The NPWS has requested the following issues be addressed in the Study:

- native flora and fauna; and
- Aboriginal sites and relics.

The Service advises that it considers there is a high probability of aboriginal sites and the presence of two threatened species.

These issues are addressed in Sections 4.6 and 4.8 of the Study.

Department of Land & Water Conservation

The DLWC requests the following issues to be addressed in the Study:

- Crown land;
- native vegetation;
- surface drainage;
- landscape limitations;
- soil qualities and constraints;
- land capability;
- land use/existing degradation;
- waste disposal; and
- groundwater.

These issues are all addressed in the Study.

Department of Agriculture

The Department did not respond to the consultation.

Local Aboriginal Land Council

The Study area was walked by a local Aboriginal Sites Identifier who concluded that:

"There were no visible signs of any Aboriginal occupancy within these areas. There is no evidence of any artifacts, campsites or scared trees."

Environment Protection Authority

The EPA have requested that the Study be aware of and address:

- air quality;
- noise impacts;
- cumulative impacts with existing industries; and
- surface run-off.

Some of these issues are development based. Those issues relevant to the Environmental Study have been addressed in the report.

Roads & Traffic Authority

The RTA have requested that the Study addresses:

- type and potential number of vehicles that would need to access the area;
- Traffic Impact Statement addressing the potential effects on the road network including key intersections;
- proposed access locations to the Snowy Mountains Highway including type of intersection treatments;

- the possible use of service roads to limit the number of access points; and
- possible hours of operation.

Some of the detail the RTA are requesting is unnecessary for the purposes of a Environmental Study such as access points and intersection treatments. These are issues more related to specific development proposals. Until such time as a development is proposed for the land, the actual traffic generation is not known. However, these issues are addressed in the body of the Study (see Section 4.1) in the general context of what impacts the change of land use may have.

4. ENVIRONMENTAL CONSIDERATIONS

The Section contains an assessment of environmental issues within the Study area. The environmental considerations to be addressed were specified in the consultant's brief (see Appendix A).

4.1 TRAFFIC NETWORK & TRANSPORTATION

An analysis of the traffic implications of the proposal for the immediate area and surrounding road network.

The main traffic artery into and out of Tumut is the Snowy Mountains Highway. The highway links with the Hume Freeway to the southwest near Gundagi. At Tumut the highway carries some 3200 vehicles per day (vpd).

Each component of the Study area is in near proximity to the highway and Area 2 is bisected by it. In each case access to the highway will need to be provided to an appropriate standard.

For Areas 1A and 1B access will be via existing roads that are partly constructed, partly partially constructed and partly or wholly unmade. In the case of Area 2 access will be required via new service roads and/or strategically located intersections with new internal and/or partially constructed existing roads.

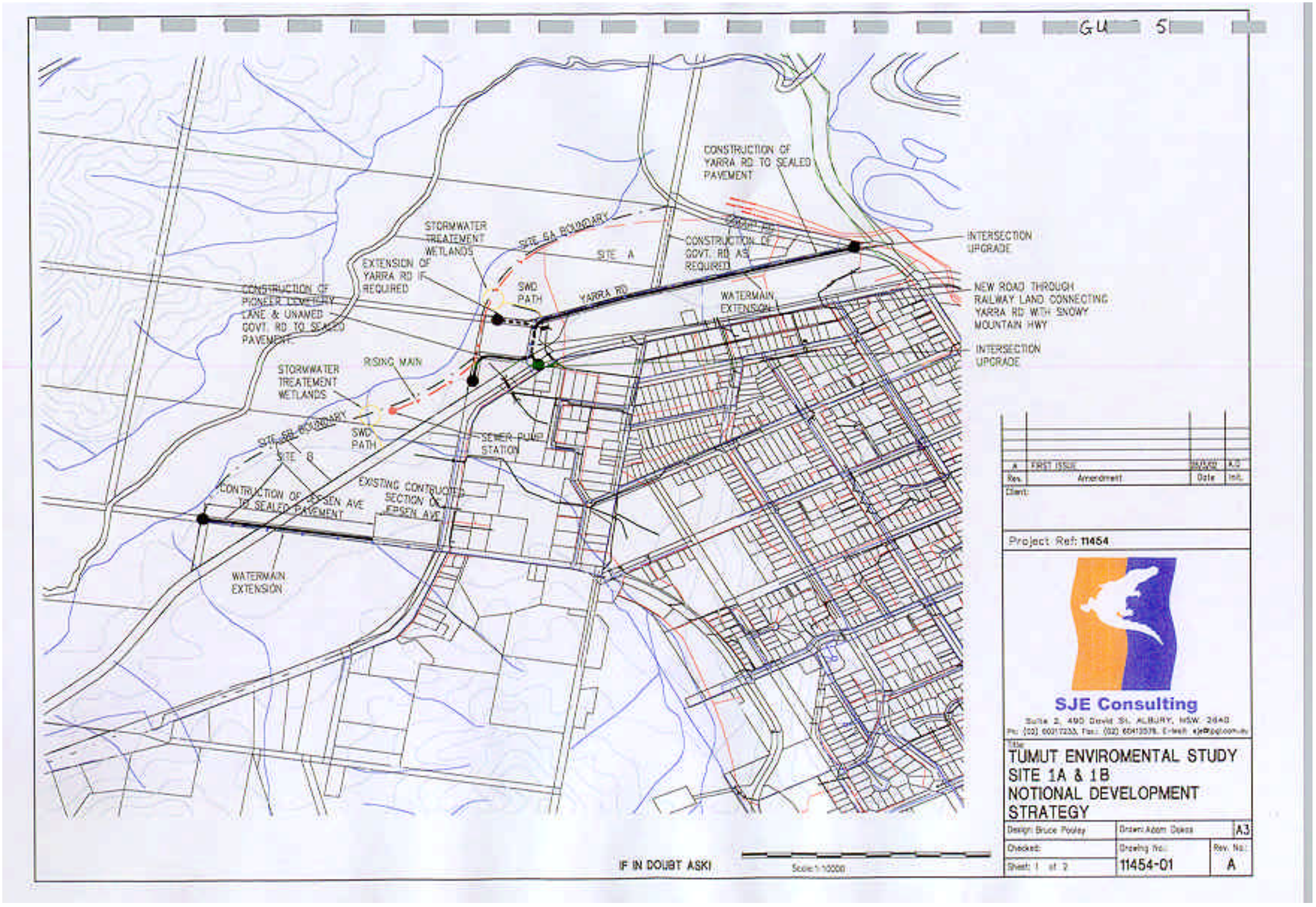
Area 1A

Area 1A has frontage to Yarra Road along the south and an un-named government road on the east connecting between Yarra and Gocup Roads.

Yarra Road is a formed and sealed road for approximately 100 metres of its length commencing from Gocup Road. The sealed pavement is a relatively narrow and showing signs of distress. It is not expected that it would have a very long life under industrial traffic conditions. The balance of the road to Pioneer Cemetery Lane, approximately 800 metres length, is an unmade dirt track (see Photograph 2).

The un-named government road is unmade and presently is not accessible to traffic.

In association with development of the Area (refer also Notional Development Strategy Plan at Figure 5) the following road construction works will be necessary to provide adequate access:


GU 5
CONSTRUCTION OF YARRA RD TO SEALED PAVEMENT
STORMWATER TREATEMENT WETLANDS
SITE 5A BOUNDARY
SITE A
EXTENSION OF YARRA RD IF REQUIRED
CONSTRUCTION OF GOVT. RD AS REQUIRED
INTERSECTION UPGRADE
SWD PATH
YARRA RD
WATERMAIN EXTENSION
NEW ROAD THROUGH RAILWAY LAND CONNECTING YARRA RD WITH SNOWY MOUNTAIN HWY
CONSTRUCTION OF PIONEER CEMETERY LANE & UNNAMED GOVT. RD TO SEALED PAVEMENT
RISING MAIN
INTERSECTION UPGRADE
STORMWATER TREATEMENT WETLANDS
SITE 5B BOUNDARY
SWD PATH
SEWER PUMP STATION
SITE B
CONTRUCTION OF EPSEN AVE TO SEALED PAVEMENT
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Client:
Project Ref: 11454
SJE Consulting
Suite 2, 493 David St, ALBURY, NSW 2640
Ph: (02) 60317233, Fax: (02) 60413578, E-Mail: sje@sjeconsulting.com.au
Title:
TUMUT ENVIROMENTAL STUDY
SITE 1A & 1B
NOTIONAL DEVELOPMENT
STRATEGY
Design: Bruce Pooley
Drawn: Adam Dykes
A3
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Drawing No.: 11454-01
Rev. No.: A
Sheet: 1 of 2

i) The construction of Yarra Road as a sealed road from Gocup Road to the north east corner of Pioneer Cemetery. Included in this would be the reconstruction and widening of the existing sealed section.

ii) The progressive upgrading of the Yarra and Gocup Roads intersection to NASRAA Type 'B' standard. This would be a staged construction process over a period of time as determined by traffic growth and needs.

This work being necessary to:

a) improve the angle of approach of Yarra Road to Gocup Road; and

b) provide left and right hand turning lanes for traffic entering Yarra Road from Gocup Road.

iii) Construction of the un-named government road between Yarra Road and Gocup Road would be desirable. The timing and necessity of this however, is likely to be influenced by the progress of development, subdivision layout having lots with frontage to this road or other access needs to service lots with frontage to Yarra Road.

Access to Area 1A would be improved by linking Yarra Road to Pioneer Cemetery Lane/Snowy Mountains Highway intersection. This connection enables access to the southern end of Yarra Road from the Snowy Mountains Highway and could be provided by:

i) utilising the existing road reserves around the north, west and south sides of the cemetery; or

ii) via a new link between Yarra Road and Pioneer Cemetery Lane, through railway land, along the eastern side of the cemetery (the preferred option).

Area 1B

Area 1B has two road frontages. These being, an unmade and un-named government road off Pioneer Cemetery Lane at the northern end and Jepsen Avenue at the southern end.

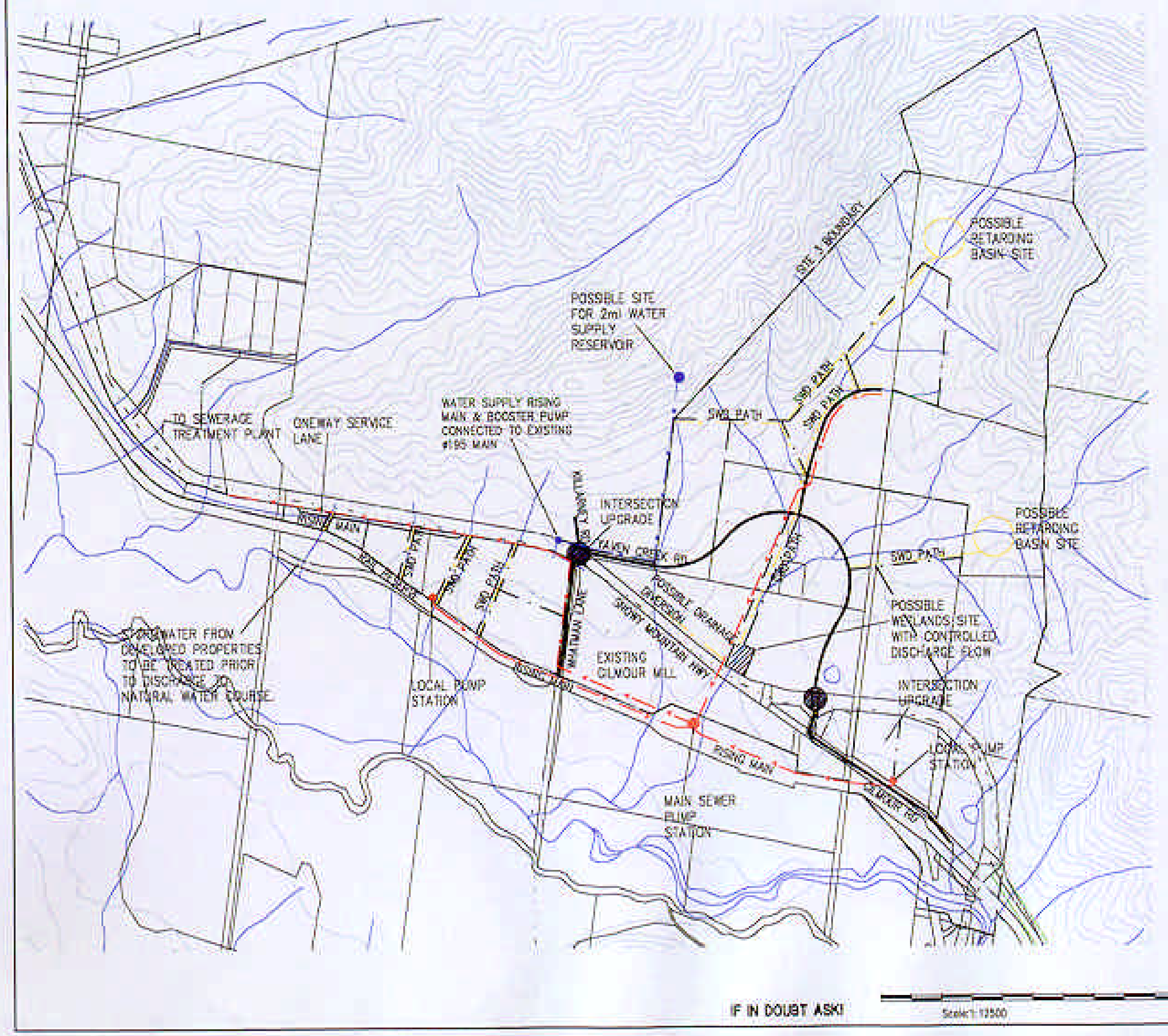
Pioneer Cemetery Lane is a lightly formed and graveled road.

The unmade un-named government road is partly encumbered with electricity poles and stays that would need to be taken into account in road design and construction works (see Photograph 3).

Jepsen Avenue is a kerbed and sealed road for approximately 150 metres from the Snowy Mountains Highway intersection with the balance, approximately 600 metres in length, being formed and graveled pavement. It currently carries some 230 vpd. The gravel pavement section has a dust problem and is continually watered by the Weyerhaeuser Mill in an effort to minimise the impact of dust.

In association with development of the Area (refer also Notional Development Strategy plan at Figure 5) the following road construction works will be necessary to provide adequate access:

i) Pioneer Cemetery Lane as a sealed pavement from Snowy Mountains Highway to the south west corner of Pioneer Cemetery;


POSSIBLE SITE FOR 2ml WATER SUPPLY RESERVOIR
SITE 1 BOUNDARY
POSSIBLE RETARDING BASIN SITE
SWD PATH
TO SEWERAGE TREATMENT PLANT
ONEWAY SERVICE LANE
WATER SUPPLY RISING MAIN & BOOSTER PUMP CONNECTED TO EXISTING #195 MAIN
INTERSECTION UPGRADE
TAYEN CREEK RD
RISING MAIN
POSSIBLE DRAINAGE DIVERSION
SNOWY MOUNTAINS HWY
POSSIBLE WETLANDS SITE WITH CONTROLLED DISCHARGE FLOW
WHATMAN LANE
EXISTING GILMOUR MILL
STORMWATER FROM DEVELOPED PROPERTIES TO BE TREATED PRIOR TO DISCHARGE TO NATURAL WATER COURSE
LOCAL PUMP STATION
MAIN SEWER PUMP STATION
IF IN DOUBT ASK!
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Rev.	Amendment	Date	Init.
A	FIRST ISSUE	08/7/02	A.D

Client:

Project Ref: **11454**

SJE Consulting

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Title:

TUMUT ENVIROMENTAL STUDY
SITE 2A+2B
NOTIONAL DEVELOPMENT
STRATEGY

Design: Bruce Pooley	Drawn: Adam Dakos	A3
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Sheet: 2 of 3		

ii) the un-named government road as a sealed pavement; and

iii) Jepson Avenue as sealed pavement from the end of the existing sealed pavement for a distance of approximately 600 metres to the west.

The Snowy Mountains Highway/Pioneer Cemetery Lane intersection is sited approximately midway between the southern end of Area 1A and the northern end of Area 1B. It is ideally situated to provide good common point of access to both areas from the highway. The highway at this intersection carries in excess of 3,200 vpd. Traffic volumes through this intersection will increase substantially as development of the two areas could generate between 60 and 1,000 vpd Upgrading of the intersection to a Type 'C' intersection in accordance with NASRAA standards will be necessary at some stage.

Even if the northern portion of Area 1B is developed as a single use site (eg. extension of existing mill) the connection of Yarra Road to Pioneer Cemetery Lane and upgrading of the Snowy Mountains Highway/Pioneer Cemetery Lane intersection is considered desirable to provide appropriate access to both areas.

Area 2

Area 2 straddles the Snowy Mountains Highway between Gilmore and the southern fringes of Tumut township. Access to the land in Area 2 is from the highway. There are a number of existing roads accessing the area from the highway. These being:

i) An un-named umade government road to the east and west of the highway.

ii) Gilmore Mill Road to the west of the highway (sealed pavement).

iv) Killarney Road/Yavens Creek Road to the east of the highway (sealed pavement).

Yavens Creek Road runs south off Killarney Road approximately 25 metres east of the Killarney Road/Snowy Mountains Highway intersection to access property adjacent to Area 2B.

Killarney Road runs north east from the highway to access an adjacent property.

iv) Whatman's Lane to the west of the highway (gravel pavement).

This roadway runs west from the Snowy Mountains Highway through Area 2A and provides access to land beyond the railway reserve.

Councils' record of traffic on the highway at Gilmore of July 2001 indicates the current volume to be of the order of 3,200 vpd. Thus direct access to and from the highway for individual properties should not be permitted. Property access then should be confined to service roads along the highway and/or internal roads within the development area.

In association with the development of the area (refer also Notional Development Strategy Plan at Figure 6) the following road construction works will be necessary in part or whole. The extent to which they will be necessary will be influenced by subdivision lot layout and sizes, the nature and type of development and traffic generated by development.

i) Access points to internal roads at selected locations along the highway so as to minimise the impact of development on the operation of the highway. Two locations as follows would be sufficient:

a) At Gilmore Mill Road, retaining existing access to the west of the highway and to provide access to an internal road network east of the highway. Because of an existing cutting embankment on the east side of the highway directly opposite Gilmore Mill Road the point of entry to the Site east of the highway may need to be offset approximately 30 metres to the south of Gilmore Mill Road to avoid the embankment.

b) At Killarney Road/Yavens Creek Road/Whatman's Lane, retaining existing access to Killarney Road/Yavens Creek Road and Whatman's Lane respectively.

In each case, ultimately, a Type 'C' intersection in accordance with NASRAA standards allowing access to both sides of the highway would be appropriate. Upgrading maybe achieved progressively with changing circumstances in traffic conditions and development needs demand.

iii) Service roads

The extent to which and the location of service roads will be required will be influenced by the types of industry development that occurs, the layout and sizes of the lots the land is subdivided into and opportunities along the highway to position safe entry and exit points.

iv) The reconstruction and widening of the north-south section of Gilmore Mill Road.

This section of Gilmore Mill Road will serve as access to the portion of Area 2A on the west side of the Highway to the south of Gilmore Mill. The existing road has been constructed to meet the needs of rural access to the adjoining land. To withstand the rigors of industrial traffic pavement strengthening and widening to accommodate two lanes of traffic will be necessary.

v) The reconstruction and widening of Yavens Creek Road

Yavens Creek Road is available as a secondary access point to Area 2B. Should it be used as such then reconstruction and widening will be necessary. The existing construction services a single property from which light industrial vehicles operate. It is not likely to withstand the rigors of heavy industrial traffic for any significant period of time.

Whether or not this work will ultimately prove necessary is dependent upon how Area 2B is developed and the nature of the development.

vi) The construction of Whatman's Lane to sealed pavement between Snowy Mountains Highway and railway reserve.

Construction of Whatman's Lane as a sealed pavement will provide good access to the southern end of Area 2A to the north of Gilmore Mill.

The timing and staging of this construction will be dependent on the need generated by the development.

4.2 SEWERAGE & WATER

Details of how reticulated sewer and water will be provided to the land, location of mains and the ability of the network to take on the proposed load.

Sewerage

Tumut township is serviced with a reticulated sewerage system. Currently, Council advises that the Treatment Plant is over loaded on two fronts – hydraulically and biologically. Thus prior to any additional effluent flows of note are added to the system augmentation/upgrading works will be necessary at the Treatment Plant. It is understood that Council is presently working towards increasing the Treatment Plant capacity.

Estimates of employment generation in each of the areas have been adopted from the 1998 *Tumut Shire Industrial land Study Issues and Options Paper* (page 35). These are summarised Table 2.

TABLE 2: ESTIMATED EMPLOYMENT GENERATION IN THE STUDY AREA

TYPE OF INDUSTRY	TYPICAL EMPLOYEES PER GROSS HA	AREA 1A (7.5 HA)	AREA 1B (15.5 HA)	AREA2 (45 HA)
Intensive employment industry	50 – 70	375 - 525	775 – 1,085	2,250 – 3,150
Intermediate intensive employment industry	25 – 50	188 - 375	388 – 775	1,125 – 2,250
Intermediate extensive employment industry	15 – 25	113 – 188	233 – 388	675 – 1,125
Extensive employment industry	5 - 15	38 – 113	78 – 233	225 – 675

Effluent generation has been adopted at 0.00018 litres/second/capita/day (ie. 15 litres/capita/day) for the employment population. Additional effluent will be generated from industrial processes carried out on each of the areas.

Estimates of process effluent flows that maybe generated from a particular area of industrial development cannot be made in the absence of the knowledge of the types and sizes of industry to develop in the area. The generation of effluent is dependent upon the processes carried out by the industry and the level of employment required to operate the industry. Industry process flows are variable between wet and dry industries and from industry to industry. Wet industries are at the high end of the scale (eg. processing peaches could generate upto 11,000 litres of effluent per tonne of peaches processed) whilst dry industries are at the low end of the scale (eg. a timber processing industry may have no process effluent).

Consequently to minimise impact on the existing sewerage treatment plant, industry with no or low process effluent would be preferred at any of the areas until the plant augmentation/upgrade is achieved.

Area 1A

Area 1A is traversed by an existing sewer with pipe sizes of 250mm and 300mm diameter connecting directly to the Sewerage Treatment Plant. A fully developed site has the potential to produce the following effluent flows:

ADWF 0.007- 0.095 l/sec plus industry process flows.

PDWF 0.2- 0.28 l/sec plus industry process flows.

There are three options for the collection of effluent from this area (refer also Notional Development Strategy Plan at Figure 5) as follows:

i) Direct connection to the existing sewer utilising spare capacity in the sewer not required for future development upstream of the area.

ii) Should existing sewer have insufficient capacity under peak flow conditions the sewer could still be used with discharges to it being regulated to periods when its flow is low.

iii) Construct a new sewer connecting directly to the Sewerage Treatment Plant.

Area 1B

Area 1B is not serviced by existing reticulated sewer. A fully developed Area 1B has the potential to produce the following effluent flows:

ADWF 0.014 - 0.195 l/sec plus industry process flows.

PDWF 0.042 - 0.59 l/sec plus industry process flows.

Effluent collected from Area 1B (refer also Notional Development Strategy Plan at Figure 5) will need to gravitate to a central collection sump and be pumped via a rising main into the existing reticulation at a selected location from which the downstream network has the capacity to carry the additional flow or directly to the Sewerage Treatment Plant.

Where there is limited capacity available in the existing reticulation network downstream of the rising main entry point the rate of discharge from the rising main will need to be limited to the available spare capacity.

Area 2

Area 2 is remote from the existing reticulated sewer. A fully developed Area 2 has the potential to generate the following effluent flows:

ADWF 0.0405 – 0.567 l/sec plus industry process flows

PDWF 0.122 – 1.70 l/sec plus industry process flows

There are two options for the provision of sewer services:

i) A reticulated system servicing the area draining to a central sump for pumping to the Sewerage Treatment Plant. This will entail a pump station and rising

main (probably 150mm diameter minimum) of 6km length (refer Notional Development Strategy Plan at Figure 6).

ii) On site treatment and disposal by individual developments.

Of these, the reticulated system is preferred as it is more acceptable environmentally than many types of onsite treatments and is a proven acceptable collection system. Notwithstanding however some industries may need to undertake some form of initial onsite treatment of effluent prior to discharge to a reticulated system to minimise impact on the system and Treatment Plant.

Initial decisions taken in respect of the pumping system installation will have a significant bearing on the types of industrial processes undertaken within the area. For example the maximum capacity of a 150mm diameter rising main with a flow velocity of 4 m/sec (maximum desirable velocity of flow for uPVC pipe) is 70 l/sec. This places limits on the quantity of effluent that can be pumped through the main in any given time period. Dry industries maybe preferable to wet industries as they will generate less effluent therefore place less demand on the system and be more manageable.

Area 2 is divided into two parts by the Snowy Mountains Highway. The part to the east of the highway (Area 2A) is largely a single drainage catchment. The part to the west of the highway (Area 2B) has several drainage catchments which for sewerage collection purposes can be treated as two catchments with their own pump stations and rising mains feeding intto the main collection and pumping system.

A typical sewerage collection system layout is shown in the Notional Development Strategy Plan at Figure 6.

Water

Areas 1A & 1B

Areas 1A and 1B are in close proximity to existing water supply reticulation network. Water supply to each of these areas can be effected by extensions to the existing reticulation system as shown on the Notional Development Strategy Plan at Figure 5.

Area 1A and the northern portion of Area 1B can be serviced by a new main constructed along Yarra Road and Pioneer Cemetery Lane. The southern portion of Area 1B can be serviced by a main extension along Jepsen Avenue.

The controlling factor for determining the size of the main extensions is most probably going to be fire fighting demand (100 l/sec). This is commonly greater than usage demand for industrial areas, though not exclusively so. Some wet industries command a higher usage demand, but these need to be treated on an individual basis as they arise.

It would be expected that a 150mm diameter main along Yarra Road and Pioneer Cemetery Lane and a 100mm diameter main along Jepsen Avenue would be adequate to meet the water supply requirements for Areas 1A and 1B.

Area 2

Area 2 is remote to the existing reticulated water supply system, though the Gilmore Mill has a 195mm diameter supply main terminating at the Whatman's Lane end of its site.

This main is not adequate to service all of Area 2 without the provision of adequate storage facility.

As for Area 1, fire fighting demand is the likely critical design criteria for water supply to Area 2. A previous study in 2000 titled *Tumut and Industry* indicated (in Appendix 7) that a new storage of 2 megalitre capacity located in near vicinity of the area would be adequate to service the land. This is concurred with as a minimum capacity. The storage would be connected to the existing 195mm diameter main near Whatman's Lane and be filled through a booster pumping system during periods of low demand on the town system. Area 2 would then be serviced via reticulation mains from the storage.

To gain sufficient elevation to maintain satisfactory pressures throughout the Area 2 the storage will need to be located on the hill range to the east of the Snowy Mountains Highway. The base of the storage would need to be at or above the 390m AHD contour. A potential location is shown on the Notional Development Strategy Plan at Figure 6.

Relative costs to provide these services and what proportion of the cost will be borne by the community.

Sewerage

Cost estimates for the provision of sewerage services to the respective areas is summarised as follows:

Area 1A	$nil (sewer currently available)
Area 1B	$60,000
Area 2	$610,000

Water

Cost estimates for the provision of water supply services to the respective areas is summarised as follows.

Area 1A	$90,000
Area 1B	$70,000
Area 2	$350,000

Impact on the capacity of the existing sewer reticulation system.

As pointed out earlier the existing sewerage treatment plant is over loaded both hydraulically and biologically. Whilst Council is addressing this there is no immediate plans for commencement of augmentation/upgrading works at this time. Consequently any additional discharges to sewer will only exacerbate the current situation.

However, with augmentation/upgrading taking account for extended development areas new developments will have no impact on the treatment plant.

The existing reticulation will cater for discharges from Area 1.

4.3 DRAINAGE & STORMWATER MANAGEMENT

Overland drainage routes and approximate sizes of any retention areas (existing and proposed).

Area 1

Areas 1A and 1B are relative uniform in slope, generally falling from south east to north west towards the Gilmore Creek flood plain. The slopes are such that construction of underground drains will not be difficult or of particularly large sizes.

Area 1A has one drainage courses through it at the southern end. This course also serves as an outfall drain for portion of the existing urban area and will need to be retained. There is also a portion of the Site in the northeast corner, which is lower lying land forming part of the Gilmore Creek floodplain. For this area to be suitable for development, it may need some special development controls placed upon it limiting the extent and type of development that occurs below the 1 in 100 year flood event.

Wetlands for the treatment of stormwater prior to discharge to Gilmore Creek should be considered – particularly at the southern end of the area where drainage from the existing urban area outfalls. Stormwater from development in the area could be diverted through the wetlands also.

Area 1B has two distinct drainage courses through the northern portion. The northern most of these is an outfall for part of the urban area east of the Snowy Mountains Highway. This outfall will need to be retained and any development of the subject land will be obliged to take account of it. As the outfall enters onto the floodplain an opportunity could be created for the provision of a small wetland through which stormwater flows would pass and receive treatment prior to discharge to Gilmore Creek. Stormwater from development in this area could be diverted through the wetlands also.

The potential wetlands sites are shown on the Notional Development Strategy Plan at Figure 5.

Area 2

Area 2 contains numerous defined drainage courses throughout. These fall generally from east to west across the area.

Area 2A has a long tapering shape from south to north running between the highway and the railway reserve. This area is traversed by numerous distinctive drainage courses that do not come together until on the west side of the railway reserve. Each drainage course will need to be considered for its impact on development and dealt with separately within the area as required. Their location will influence the positioning of allotment boundaries within Area 2A.

For Area 2B east of the highway, the drainage courses form a single drainage system over most of the area. The system comprises a spinal course with one major subsidary course and several smaller lateral courses. The spinal course is central to the developable area of this area. The course rises in steep hill country and would be subject to 'flash' flooding.

The upper reaches of the drainage courses are heavily timbered on steep hillside slopes. The lower reaches are through open pasture land having a very good grass cover.

The drainage courses are not perennial streams and flow only according to rainfall and catchment conditions at the time of rainfall. They are generally free of any significant erosion activity and appear to be stable.

There is potential to capture flows on the two main water courses upstream of development in retarding basins to control flows through the lower reaches of these water courses where flooding would be detrimental to development – particularly through the existing Gilmore Mill where the drainage course is constrained already by development.

Indication of potential flooding.

Enquiries reveal there is no detailed flood information available for the Gilmore Creek.

Council's GIS mapping system shows parts of Areas 1A, 1B and 2A as "*alluvial, possible flood prone*". Council advises that this designation is not confirmed (hence use of the word "possible") and this is confirmed by a visual assessment of the subject land where the edge of the floodplain is clearly discernible (see Photograph 3 as an example).

Anecdotal evidence suggests that the railway line provides a good indicator of flood level and all of the subject land in Areas 1A, 1B and 2A is to the east of the railway line and rising to the Snowy Mountains Highway (see photographs 6, 7, 8 and 11 and contours in Figure 1). It is highly probable therefore that the subject land is above the major flood level of the Gilmore Creek and that flooding does not represent a significant constraint to future industrial development.

Drainage corridors required for this development as well as Best Practice Techniques for the management of surface water from the site and surrounding land within the catchment area.

Area 1

For each of Areas 1A and 1B consideration should be given to the treatment of stormwater collected from the land prior to discharge to Gilmore Creek. Wetlands, as earlier indicated, would be a suitable form of treatment.

Stormwater drainage from development within the area should be collected in a piped underground drainage system designed to cater for the 1 in 10 year rainfall event. Where external areas drain through the area the drainage system must also cater for these flows. The piped system would discharge into the wetlands.

Stormwater runoff from events exceeding the 1 in 10 year event would pass by surface flow along selected paths as determined appropriate during design to discharge to Gilmore Creek.

Area 2

Generally across Area 2 the main drainage system should incorporate grassed floodways over low flow piped underground drains protected by appropriate easements.

The low flow drains should be designed to cater for the 1 in 1 year rainfall event and the floodway system, with the exception of the spinal floodway, designed to cater for the 1 in 10 year rainfall event. The balance of the 1 in 100 year rainfall event being contained as surface flow along selected paths to discharge at appropriate locations into the spinal floodway. The spinal floodway would contain an underground low flow pipe (1 in 1year event) and grassed channel designed to cater for the 1 in 100 year rainfall event in the catchment.

Prior to any stormwater entering Gilmore Creek some form of treatment should be provided to remove gross pollutants, sediments and reduce nutrients. An appropriate system would be wetlands in conjunction with gross pollutant and sediment traps. The drainage system for Area 2B lends itself very much to such a treatment facility.

The natural drainage pattern of Area 2A contains several individual drainage courses crossing the site and there is little or no interconnection of these. The treatment of all stormwater from these drainage courses is not considered to be achievable at reasonable cost. However an attempt should be made to treat, at the minimum, the flows carried in the low flow piped systems through a central treatment facility. This requires the interconnection of the low flow drains with the treatment facility.

4.4 WASTE COLLECTION

Proposed method of waste collection (kerbside or private).

Tumut Shire Council conducts a kerb side waste collection system for residential properties. The collection does not extend to industrial properties for the collection of industrial wastes. Council has no plans to extend its waste collection services beyond the present service.

The collection of wastes from developments within the study area would be by either by private contractors or self collection.

4.5 OTHER INFRASTRUCTURE

Whether the proposal and any other subsequent development will create demands for the provision or extension of services provided by the Council or other infrastructure providers including Country Energy (electricity and gas), Telstra, Australia Post, Department of Transport etc..

Other utility services that will be needed within the study area include:

Electricity	supplier/responsible authority	Country Energy
Gas	supplier/responsible authority	Country Energy
Telephone	supplier/responsible authority	Telstra

Each of the services are available in near proximity to the Study area(s) and can be extended and/or upgraded to service each as required though the extent of such works is not known at this stage and will be determined by actual developments as they occur.

Relative costs to provide other necessary infrastructure services and what proportion of the cost will be borne by the community.

The cost to extend and/or upgrade electricity, gas and telephone services to each of the study areas has not been assessed. Developer costs can be expected to be associated with these works – particularly in respect of electricity.

4.6 NATURAL ENVIRONMENT ISSUES

The physical characteristics of the land including drainage patterns, erosion, geological hazards and landscape features.

Drainage patterns

The surface water flow in area one exists primarily as sheet flows interspersed with shallow ephemeral gullies and some regular and irregular spring fed creeks.

Because the eastern boundary of this area is the Snowy Mountains highway and the natural gradient of the land is sloping gently to the northwest (5%-8%) culverts have been developed to carry surface flow away from the road. This has concentrated the flow into the shallow ephemeral gullies as has stormwater pipes allowing flow from the east side of the road to flow west. These flows encounter the western boundary of Area 1 at the now disused Tumut - Cootamundra railway line, which directs flow into pipes or creeks to pass under the railway and then into the Gilmore Creek.

The central drainage pattern of Area 2 is the flow from the far southeastern corner. This feature manifests itself as a dendritic system of closely spaced stream channels that runs into an open depression. A forking creek at the base of the depression bisects both valleys enclosed within the area. After crossing the Snowy Mountains highway the creek runs adjacent to the southern Weyerhaeuser Mill, before entering the Gilmore Creek. Most of the slopes in the area of proposed development range between 2% and 33%. The slopes of the far southeastern corner may be vary up to 56% and remain well forested.

Laboratory Emerson Dispersion Tests were carried out on typical 'B' and 'C' horizon soils (the most likely to be built upon) and show the soils to have a potential to slake but not to disperse, which is consistent with the observed erosion on site.

Geology

The Tumut geological map (1:100 000), indicates that the area in question is comprised of mainly middle Silurian quartz rich shale, siltstone and to a lesser extent fine sandstone, laid down as part of the Bumbolee Creek formation. It is open folding in structure and of the lower greenschist facies metamorphism. There are local steeply

to moderately dipping beds, part of the greater Tumut synclinorial zone, which trends in a north-northwest fashion.

Quaternary alluvium is found in the significant drainage areas, namely the Gilmore Creek and relevant tributaries. In the southern extreme of area two, a small outcrop of volcaniclastic slate and siltstone exists, with minor sandstone and rare marble.

The assessment of land capability in accordance with Best Practice Principles established by the Department of Land and Water Conservation.

Both Areas 1 and 2 have been identified in accordance with best practice principles established by the DLWC as Class IV or V (as classified in the land capability handbook and capability mapping by the DLWC). This matches with our analysis and recommendations in regards to earthworks to manage the sheet and rill erosion.

Further evaluation of 'Best Practice' principles will only be available once the details of the proposed activity are generated. This will allow a further understanding of specific impacts on the geo-technical and greater environment.

An assessment of the salinity and how to manage any affected areas.

The assessment of salinity in both Areas 1 and 2 has been gauged via field investigations, and subsequent laboratory analyses. On visual inspection, no evidence of vegetation dieback or salt crusting was found. Laboratory results revealed extremely low electrical conductivity in water collected, indicating salt levels are negligible. It is concluded that the salinity hazard across the Study area is low.

Soil and groundwater testing.

Soils

The main soil types found are clay derivatives. These have been formed from the breakdown of the mudrock and shale. Some horizons, particularly in Area 1, and the northern part of Area 2 were classified as heavy clays, with a very high plasticity, and deep red colour. These types of horizons are seen to be highly impervious, and hence display slow percolation rates.

Above this horizon of heavy clay, it was common to see a gradation into silt, characterised by a markedly lower plasticity, and faster percolation rates. The change into silt was seen to be both stark, and gradual with a progression from heavy clay through light clay and upwards to the silty horizon (See Appendix D - Soil Profile).

In the southeastern region of Area 2, a massive stonelayer horizon was observed, consisting of poorly sorted angular clasts (5mm - 10cm) in a silty matrix. This layer is considered to have been deposited in a singular geomorphological event. It was also noted in areas where this stonelayer was exposed, particularly channel banks, erosion hazard was high. The stonelayer provides a significant fabric contrast to the light clays

generally found above it. Erosion will preferentially occur laterally removing the light clay rather than incising vertically into the stonelayer.

Site classification Area 1

Given that the slope wash derived clay soils exhibited medium to high plasticity and that the depth of these soils was for the most part greater than 2 metres over the bedrock. Most of this area in accordance with AS 2870-1996 will be regarded as "Class M" sites. Some areas with more pronounced topography may only manifest a soil covering only 1.5m and less over the bedrock, these sites will be classified as "Class S". For all of area one prior specific classification of sites should be carried out prior to construction.

Site classification Area 2

For the most part of area two the slope wash clay soils of medium to high plasticity are over 1.5 metres deep over the bedrock. This means that again, most of the site is classified as "Class M". The most dependable measure for this is proximity to the main drainage line with increased proximity giving deeper soil depths. On some of the surrounding hills and below their peaks the soil depth may be less than 1.5m and hence will be classified as "Class S".

Again it is strongly recommended that prior to any construction individual parcels be independently classified.

Groundwater

The regional groundwater system was inferred from the NSW Assessment of Pollution Risk Map (1:2,000,000). This indicates groundwater flowing through a network of fractured bedrock, joints and bedding planes. The storage of groundwater is subject to considerable fluctuation, as recharge by rainfall is limited due to slow infiltration rates and prevailing climatic conditions.

From initial topographic map interpretations, a number of springs were identified in Area 2. During field investigation it was revealed that these springs were dry.

Rating on groundwater vulnerability and how this will be addressed.

There are a series of bores located near the Weyerhaeuser Mill (approx. 088926 - Map of Area 1), which can be utilised in any further investigations. Bellets landfill operation monitors groundwater of their private bore and this information can be obtained upon request. It is understood that at present reading from the bore roughly correspond to the results obtained in this investigation.

An assessment of soil erosion problems and how these will be managed.

Area 1 does not present any major erosion problems. Any development proposed for this area should consist of parcels of well-drained land, giving a berth around the spring fed streams and tending away from the ephemeral gullies. If necessary remedial drainage protocols, such as bank stabilisation, can be used to manage these gullies

Area 2 contains an erosion hazard area in its southern portion. Dams have been constructed along small natural depressions. Some form of earthworks and re-vegetation may be required in order to reduce the impact of flow along the shallow gullies, if the dams are removed for development.

The creek in this area has been heavily eroded, with much of its banks being vertical or undercut to a height of 1 or more metres. The lower portion of the study area has been untreated and the erosion there will only become more of a problem without rehabilitation.

The up slope section and the northern tributary has been planted with trees and braced with concrete blocks as part of a 10 year landcare project. This strategy appears to be successful in the areas where stands of trees have been developed and fenced off. In the less rehabilitated section erosion is still severe and requires extensive work.

A measure of the water quality and quantity leaving the site now.

Surface water samples were taken from a variety of sources, including dams, creeks, and surface manifestations of groundwater. All samples displayed very low total dissolved solid readings, varying from 30 ppm up to 154 ppm. These are considered to be very good readings, indicating the health of the water environment. Temperature and pH readings were also collected and found to be within acceptable ranges. One aberrant temperature reading was recorded from a small creek passing through the former CSR particleboard timber mill.

The results of the investigation show the best water quality in the Gilmore Creek. It is recommended that the condition of this aquatic system is maintained, and considered in further development applications to Council.

The necessity to protect any other special features of the site.

There are no "special features" over and above those already addressed in the Study such as the National Park and Gilmore Creek.

A survey of existing vegetation (species and density).
Note this section of the brief was expanded to include a survey of fauna following the requests of planningNSW and NPWS.

A flora and fauna assessment was conducted of the study area by Ettamogah Research Consultants to assess the potential impacts of a proposed industrial land use rezoning on native flora and fauna. The proposed works and associated activities were assessed in order to determine if it is likely to have a significant effect on any *'threatened species, populations, ecological communities, or their habitats'* that may occur at the subject area. Assessment of the proposal is required under NSW legislation and recent environmental protection legislation of the Federal Government.

The specific aims of this flora and fauna assessment are:

- to identify and describe threatened flora species, other native flora species and vegetation communities present within the subject area and assess their conservation significance with regard to relevant Federal, State and Local Government environmental legislation;
- to identify and describe the threatened fauna species, other native fauna species and their habitats which are present, or which may occur within the subject area and surrounds, and assess their conservation significance with regard to relevant Federal, State and Local Government environmental legislation;
- to assess the significance of potential impacts arising from the proposed development on any threatened flora and fauna as well as other native flora and fauna which may occur at the subject area, with respect to Section 5A (8 part test) of the NSW *Environmental and Planning Assessment Act 1979 (EP&A Act 1979)*; as modified by the NSW *Threatened Species Conservation Act 1995 (TSC Act 1995)*;
- complete all requirements as stated by the NSW National Parks and Wildlife Service in regards to native flora and fauna and threatened species assessment; and
- provide recommendations based on these findings, which will mitigate the effects of the proposed work on any threatened flora and fauna, other native flora and fauna and the general environment.

The report is based upon flora and fauna surveys of the subject area and surrounding area conducted on the 1st and 2nd, and 21st to the 23rd of February 2002. Targeting methodologies were used to detect threatened species recorded in similar habitats to those present at the subject area and threatened species previously recorded in the area. Locally and regionally significant species and communities as well as the general flora and fauna found within the region were also taken into consideration during this assessment.

Information was collected on those threatened species and other species known to occur in the area. Information sources used in order to obtain an accurate inventory of threatened species and other species include:

- NSW NPWS Wildlife Database Atlas (14/02/02) – licensed version area search (Easting 594000-617000, Northing 6072000-6105000);
- NSW NPWS Wildlife Database Atlas (14/02/02) – public access web version (Tumut Local Government Area Search) http://wildlifeatlas.socialchange.net.au/;
- Environment Australia Online Database (14/02/02) –interactive map searcher http://www.environment.gov.au/epbc/db/interact.html;
- NSW Department of Agriculture – Tumut Local Government Area, Noxious Weeds; and
- Rare or Threatened Plant Species database (ROTAP).

The desktop review identified a range of species of flora and fauna from within the region, some of which are of particular conservation significance. The presence of these species indicated specific habitats and communities. Therefore, attention was

focused on the potential and actual occurrence of those species, their communities and habitats.

The findings of the review are summarised in Tables 3 and 4.

TABLE 3: FAUNA SPECIES OF CONSERVATION SIGNIFICANCE RECORDED FROM WITHIN THE REGION

FAUNA SPECIES	SOURCE	LEGAL STATUS	
		NSW	NATIONAL
Litoria raniformis Southern Bell Frog	EA	Endangered (Schedule 1-part 1)	Vulnerable
Litoria booroolongensis Booroolong Frog	NP1 NP2	Endangered (Schedule 1-part 1)	
Pseudophyrne corroboree Sth Corroboree Frog	NP2	Endangered (Schedule 1-part 1)	Vulnerable
Pseudophyrne pengilleyi Nth Corroboree Frog	NP2	Vulnerable (Schedule 2)	
Delmar impar Striped Legless Lizard	EA NP1 NP2	Vulnerable (Schedule 2)	
Ninox strenua Powerful Owl	NP2	Vulnerable (Schedule 2)	
Ninox connivens Barking Owl	OS	Vulnerable (Schedule 2)	
Climacteris picummnus victoriae Brown Treecreeper	NP2	Vulnerable (Schedule 2)	
Pachycephala olivacea Olive Whistler	NP2	Vulnerable (Schedule 2)	
Chthonicola sagittate Speckled Warbler	NP1 NP2	Vulnerable (Schedule 2)	
Stagonopleura guttata Diamond Firetail	NP2	Vulnerable (Schedule 2)	
Melanodryas cucullate Hooded Robin	NP2	Vulnerable (Schedule 2)	
Polytelis swainsonii Superb Parrot	OS	Vulnerable (Schedule 2)	Vulnerable
Lathamus discolor Swift Parrot	EA	Endangered (Schedule 1-part 1)	Endangered
Xanthomyza phrygia Regent Honeyeater	EA NP2	Endangered (Schedule 1-part 1)	Endangered TSMP
Grantiella picta Painted Honeyeater	NP2	Vulnerable (Schedule 2)	
Dasyurus maculatus subsp. maculatus Spotted-tailed Quoll	EA NP1 NP2	Vulnerable (Schedule 2)	Vulnerable
Mastacomys fuscus Broad-toothed Rat	NP2	Vulnerable (Schedule 2)	
Petaurus australis Yellow-bellied Glider	NP2	Vulnerable (Schedule 2)	
Phascolarctos cinereus Koala	NP2	Vulnerable (Schedule 2)	
Miniopterus schreibersii Common Bent-wing Bat	NP2	Vulnerable (Schedule 2)	
Nyctophilus timoriensis Greater Long-eared Bat	NP2	Vulnerable (Schedule 2)	
Macquaria australasica Macquarie Perch	EA	FMA	

TABLE 4: SUMMARY OF FLORA SPECIES WITH CONSERVATION SIGNIFICANCE RECORDED FROM WITHIN THE REGION

FAUNA SPECIES	SOURCE	LEGAL STATUS	
		NSW	National
Callotis glandulosa	NP2	Vulnerable (Schedule 2)	Vulnerable
Rutidosis leiolepis	NP2	Vulnerable (Schedule 2)	Vulnerable
Ammobium craspedioides Yass Daisy	EA	Vulnerable (Schedule 2)	Vulnerable
Diuris sheffiana Tricolour Diuris	EA	Vulnerable (Schedule 2)	Vulnerable
Discaria nitida	EA	Vulnerable (Schedule 2)	Vulnerable
Thesium australe Austral Toadflax	EA NP2	Vulnerable (Schedule 2)	Vulnerable
Euphrasia scabra	NP2	Endangered (Schedule 1-part 1)	Endangered

Source:
EA – Environment Australia Online Database interactive map searcher http://www.environment.gov.au/epbc/db/interact.html
NP1 – NPWS Wildlife Atlas Database 2002 (licensed version)
BA – Birds Australia 2002
NP2- NPWS Wildlife Atlas Database 2002 (public access web version)
OS – Other source including general distribution maps, field guides and local knowledge.

Legal Status:
NSW: identifies the legal status of species as listed under the NSW *Threatened Species Conservation Act 1995*.
National: identifies the legal status of species as listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*.
FMA: identifies the species as listed under the *NSW Fisheries Management Act*.

TSMP: Terrestrial species covered by migratory provisions of the EPBC Act 1999.

WSMP: Wetland species covered by migratory provisions of the EPBC Act 1999

Methodology

TABLE 5 SURVEY METHODS & EFFORT APPLIED DURING FIELD INVESTIGATIONS

SURVEY METHOD	STUDY SITE			
	1A	1B	2A	2B
Flora survey - traverses (100 x 20 m)	no	no	no	6 over various landform types
Flora survey – 'Random meander'	length of study area	length of study area	majority of study area	majority of study area
Isolated paddock tree survey	Yes	Yes	Yes	Yes
Nocturnal Bird Call Playback 1 session @ 30 min	No	1 session + opportunistic observations	1 session + opportunistic observations	3 sessions + opportunistic observations
Spotlighting (mammals, birds, amphibians)	opportunistic	opportunistic	opportunistic	4 x 30 minute 1 ha area search + opportunistic observations
Anabat Recording	no	no	no	1 session
Amphibian Call Playback 1 session @ 15 min	opportunistic observations	1 session + opportunistic observations	1 session + opportunistic observations	4 sessions + opportunistic observations
Diurnal Herpetofauna	opportunistic observations	opportunistic observations	opportunistic observations	opportunistic observations
Diurnal Bird	opportunistic observations	opportunistic observations	opportunistic observations	4 x 20 minute 1 ha area search + opportunistic observations

Time frame and potential limitations

The timing of the study (late summer – early autumn) and associated weather probably reduced the ability to detect the presence of some bird, mammal and reptile species. Climatic conditions and seasonal variability affect the movement and activity patterns of these groups of vertebrates. These factors also influenced the ability to assess abundance and species diversity of some native terrestrial plants, particularly native grasses and forbs. Some species, particularly threatened species may be seasonal or vagrant (ie. herpetofauna, some plants), cryptic and difficult to survey (ie. orchids), or occur in low abundance and utilise large areas of habitat. To overcome this potential limitation a search of all relevant databases (ie. NPWS wildlife atlas) and relevant literature was undertaken.

FLORA

Existing environment

Of the four study areas of the proposed study area about 70% is located on or adjacent to cleared, degraded land, pastureland or existing industrial land.

The majority of this type of land can be found at study areas 1A, 1B and 2A. This type of land holds little floristic or habitat value for native flora and fauna. Some native vegetation in the form of isolated remnant trees (Area 1B), remnant patch of woodland, and minor clumps of native vegetation (Area 2A) was recorded. This remaining native vegetation should be of conservation priority given the lack of native vegetation within these areas and general locality.

Study area 2B has the highest floristic and habitat value of all study areas. About 50% of this area is well vegetated consisting of Stringybark/box dry forest, and linked clumps of remnant vegetation and paddock trees. Most the natural drainage lines and minor creeks of the area have some native riparian vegetation, but are usually dominated by introduced species. The remaining half consists primarily of cleared pastureland dominated by introduced pasture grasses with some over-storey species in the form of isolated remnant paddock trees and clumps of remnant vegetation.

The majority of existing minor roadsides and access roads within each study area were dominated by introduced weeds. Native ground cover species were recorded, but were never dominate. Most roadside verges, especially dirt roads (study area 2B) were almost entirely dominated by noxious weeds. The access road leading to the abandoned paint ball area within area 2B is dominated by at least seven noxious weeds including Paterson's Curse, various thistles including Saffron, Blackberry and Sweet Briar and a score of listed environmental weeds. Many areas along the abandoned railway line which borders study areas 1B and 2A are dominated by introduced tree species and noxious and environmental ground cover species.

The aerial photograph shown at Figure 4 demonstrates the vegetation types of the four study areas. Main vegetation communities/types recorded include; cleared pastureland, isolated paddock trees and clumps of isolated remnant vegetation, dry forest, riparian vegetation, revegetation and introduced isolated trees or clumps of introduced vegetation.

Study area 1A

This area has little to no native vegetation value. Little native vegetation was recorded for this study area with the area currently being used as a grazing paddock. European pasture weeds dominated the area, including: Paspalum (*Paspalum dilatatum*), Barely Grass (*Critesion murinum)*, Phalaris (*Phalaris aquatica)*, Prickly Lettuce (*Lactuca serriola*) and Couch Grass. Some hardier native species: *Juncus sp*., *Cyperus sp*. and Windmill Grass (*Chloris truncata*) persisted under the heavy grazing. The over-storey was very sparse (< 10%) and almost entirely consisted of introduced tree species including *Salix sp.* (Willow) and *Populus sp.* (Poplar). Two stag trees, one inside the study area and just outside provide some of the very little habitat value offered by the study area.

Study area 1B

This area slopes gently towards Gilmore Creek to include the Gilmore Creek floodplain. The area contains little structural or floristic vegetation value, being dominated by cleared pastureland with some isolated remnant paddock trees, numerous stag trees and some revegetation. A minor creek tributary flows through the area and is feed by several natural drainage lines.

The vegetation of the area is co-dominated by a introduced pasture weeds, native sedges and rushes. Elevated areas were dominated by introduced weeds including Saffron Thistle (*Cardus lanatus*), Barely Grass, Wild Oats (*Avena fatua*), *Bromus spp.* and Flatweed (*Hypochoeris radicata*). Lower lying areas including drainage lines and soaks were dominated by native rushes and sedges including; *Carex appressa*, *Carex breviculmis* (Sedges), Common Rush (*Juncus usitatus*), Common Spike-rush (*Eleocharis acuta*), Umbrella Sedge (*Cyperus eragrostis*) and *Cyperus sp.* (Native Sedge). Other species that typically frequent wetter areas were also recorded including Knotweed (*Persicaria decipiens*), *Rumex spp.* (Swamp Docks), and Water Plantain (*Alisma plantago-aquatica*) (creek only).

Isolated remnant River Red Gum (*Eucalyptus camaldulensis*), were recorded throughout the study area (exact boundaries could not be determined therefore this number is considered an estimate). Up to 15 individuals were recorded, most were fully mature with an estimated height of between 30 – 40 m and estimated trunk (dbh) of three meters. The majority of these tress were of good health and with a few displaying signs of crown dieback and trunk decay.

Three patches of native revegatation were also recorded. Species included Blue Gum (*E. globulus*), Manna Gum (*E viminalis*), Red Box (*E.* polyanthemos), Blakely's Red Gum (*E. blakelyi*), She-oak (*Allocasuarina sp.*), *Acacia spp.* (Wattles) and *Hakea sp.*, and some introduced tree and shrub species.

Study area 2A

This area is characterized by a number of different land uses including cleared pastureland (majority of area), existing industry (timber mill) and rural residential dwellings. The area is longer (3 km) than it is wide (20 – 400 metre width). Native vegetation in the form of Box woodland, isolated remnants and native revegetation probably amounted to less than 20% coverage of the entire study area.

North of Whatman's Lane is dominated by cleared pastureland. The only vegetation of significance is the Box woodland immediately north of Whatman's Lane and the occasional isolated remnant paddock tree. A number of isolated introduced trees also occur in this area. The cleared pastureland has little to no floristic or structural value for native flora or fauna. No over-storey existed apart from the occasional isolated remnant and introduced tree species and was otherwise dominated by introduced pasture weeds. Lower lying areas, drainage lines and soaks contained some of the hardier native species including *Carex appressa*, *Carex breviculmis* (Sedges), Common Rush, Umbrella Sedge and Native Sedge and Docks species.

The remnant Box woodland consists of Eucalyptus species being dominated by Yellow Box (*Eucalyptus melliodora*), with some Red Box, Grey Box (*E. microcarpa*) and Blakely's Gum. Some of the Eucalypts were thought to be hybrids. The trees were mostly fully maturity and displayed good health, although some had severe to medium crown dieback. Nearly all trees contained *Ameyma pendulosa* (Mistletoe). Very little to no regeneration was recorded within the woodland. Few native groundcover species were recorded within the woodland area and included the occasional *Austrodanthonia sp.* (Wallaby Grass, probably short), Native Fireweed (*Senecio sp.*)

and Spear Grass *(Austrostipa sp.*). Otherwise the woodland was dominated by introduced pasture weeds.

A narrow strip of native revegetation has been planted alongside the highway inside the area and extends the greater length of this portion of the area.

South of Whatman's Lane the vegetation is fragmented and dominated by introduced tree species and pasture weeds. Some native vegetation in the form of isolated remnant paddock trees, clumps of Box trees, and native revegetation was recorded. A patch of Eucalypts with significant regeneration was recorded directly south of Whatman's Lane below the Box woodland within the existing mill boundary.

Two small patches of Apple Box (*Eucalyptus bridgesiana*) approximately 20 x 20 m with some regeneration were recorded in this section of the study area. Each patch consisted of several semi-mature trees and saplings. Up to seven isolated paddock trees (River Red Gum or Apple Box) were recorded. Most trees were of medium health with some dieback, minor regeneration, and most contained mistletoe.

A small portion of Gilmore Creek passes through the south-west corner of the study area. The riparian vegetation is dominated by introduced species including Poplar, Willows, Stonefruit (*Prunus sp.*), Elm (*Ulmus sp*), Crab Apple (*Malus sp.*) and other introduced tree species. A few semi-mature and the occasional mature River Red Gum were recorded with some regeneration. Riparian under-storey is dominated by juvenile trees of the above introduced species.

Narrow strips of native revegetation have been planted along fence lines and alongside the highway inside the area.

Study area 2B

Study area 2B has the highest floristic and habitat value of all study areas. About 50% of this area is well vegetated consisting of remnant Box woodland, clumps of remnant vegetation, isolated remnant paddock trees and some minor native revegetation along creek and drainage lines. The remaining half consists primarily of cleared pastureland dominated by introduced pasture grasses with some isolated remnant paddock trees as mentioned above.

The Stringybark/box dry forest is remnant of what would have been typically found on the lower-slopes and mid-slopes of this area. Red Box and Red Stringybark (*E. macrorhyncha*) co-dominated this dry forest community. Red Box dominated the box species in most areas along with Apple Box, Long-leaved Box (*E. goniocalyx*) and occasionally Grey Box. The occasional Kurrajong (*Brachychiton populneus*) tree was recorded but more commonly in juvenile form throughout the area. As slope increased Red Stringybark became the dominate over-storey species, especially on the southern facing slopes. Canopy cover ranged from dense (100% - 80%) to sparse (50-20%), but generally being mid-dense (80-50%) and tree height ranged from 10-30 metres. All age classes were represented (dead stag trees, old growth through to regeneration) but generally being mature trees. Tree species diversity was at its greatest around the mid-slope region as was understorey and groundcover diversity. Most trees along the edge and up to 50 m from the edge contained some type of mistletoe, with *Ameyma pendulosa* the more common form. Over-storey health was generally good with some occasional crown dieback. Trees were generally mature but few old growth, large

hollow bearing trees were recorded within the dry forest area. Larger old growth trees were more frequently recorded along gullies, drainage lines and in the southern portion of this community. The dominant age structure (mature) highlights the previous land clearance and timber harvesting practices were evident by the numerous tree stumps.

Understorey and groundcover diversity and abundance varied considerably with slope, aspect and land usage. Generally as slope increased native species diversity increased, especially across the mid-slope of the dry forest community. Areas fenced off from grazing also contained higher native species diversity than areas further down the slope towards cleared pastureland, which were prone to grazing and more so to invasion by introduced pasture species. The dry forest area has a very high native ground cover and over-storey species diversity giving it a high floristic and structural value. Table 6 lists native ground cover and understorey species and gives an indication of abundance for each species within the dry forest area of study area 2B. Important key species are highlighted.

Under-storey was generally sparse across the area and was almost absent from pastureland areas apart from some native revegetation works along drainage lines and minor regeneration. Under-storey/shrub layer was sparse in the dry forest but considered common. Three species dominated the shrub layer of the dry forest are including Late Black Wattle (*Acacia mearnsii*), Dagger Wattle (*A. siculiformis*) and Nodding Blue-lily (*Stypandra* glauca). Late Black Wattle was common in gullies and along drainage lines. Dagger Wattle and Nodding Blue-lily were frequently recorded in small patches through the dry forest. Both species were absent from pastureland areas. Isolated remnant paddock trees and clumps of remnant vegetation did not support any understorey/ shrub layer.

TABLE 6: NATIVE UNDERSTOREY/GROUND COVER SPECIES WITHIN DRY FOREST AREA OF STUDY AREA 2B.

SPECIES		OCCURANCE			
Common Name	**Scientific name**	Abundant	Common	Uncommon	Rare
Cheilanthes austrotenuifolia	Rock fern		C		
Bulbine bulosa	Native Leek				R
Dianella spp	Blue Flax Lilly				R
Austrodanthonia spp.	Wallaby-grass	A			
Austrostipa sp.	Spear-grass			U	
Bothriochloa macra	Red-leg Grass		C		
Dichanthium sericeum	Silky Blue-grass			U	
Dichelachne crinta	Long-hair Plume-grass			U	
Elymus scabra	Common Wheat Grass		C		
Poa sp.	Tussock Grass				R
Themeda triandra	Kangaroo Grass		C		
Xanthorrhoea australis	Grass-tree			U	
Lomondra spp.	Mat-rush		C		
Hydrocotyle laxiflora	Stinking Pennywort		C		
Cassinia aculeata	Common Cassinia		C		

TABLE 6 (CONT.): NATIVE UNDERSTOREY/GROUND COVER SPECIES WITHIN DRY FOREST AREA OF STUDY AREA 2B.

SPECIES		OCCURANCE			
Common Name	**Scientific name**	Abundant	Common	Uncommon	Rare
Cymbonotus preissianus	Austral Bear's-ears			U	
Desmodium brachypodum	Large Tick-trefoil			U	
Euchiton involucratus	Common Cudweed			U	
Senecio quadridentatus	Cotton Fireweed		C		
Brunonia australis	Blue Pincushion			U	
Whalenbergia spp.	Bluebell			U	
Convolvulus eurubescens	Pink Bindweed		C		
Dichondra repens	Kidney Weed	A			
Crassula decumbens	Austral Stonecrop			U	
Hibbertia obtusifolia	Grey Guinea-flower		C		
Hibbertia sp. (serphylliolia)?	Hibbertia			U	
Brachyloma daphnoides	Daphne Heath		C		
Glycine clandestina	Twining Glycine		C		
Glycine tabicina	Variable Glycine			U	
Glycine latifolia	Glycine				R
Hardenbergia violacea	Purple Coral-pea		C		
Indigofera australis	Austral Indigo		C		
Acacia implexa	Lightwood			U	
Acacia mearnsii	Late Black Wattle		C		
Acacia melanoxylon	Blackwood			U	
Acacia siculiformis	Dagger Wattle		C		
Goodenia geniculata	Bent Goodenia		C		
Goodenia sp. (pusilliflora)	Small-leaf Goodenia			U	
Gonocarpus tatragynus	Common Raspwort		C		
Hypoxis sp.	Yellow Star				R
Stypandra glauca	Nodding Blue-lily		C		
Tricoryne elatior	Yellow Rush-lily	A			
Oxalis perennans	Grassland Wood-sorrel		C		
Pultenaea cunninghamii	Grey Bush-pea			U	
Busaria spinosa	Sweet Bursaria				R
Grevillea ramosissima	Fan Grevillea			U	
Acaena agnipila	Sheeps Burr		C		
Acaena novae-zelandiae	Bidgee Widgee	A			
Correa reflexa	Common Correa				R
Exocarpus cupressiformis	Cherry Ballart			U	
Dodonaea angustissima	Narrow-leaf Hop-bush				R

Isolated remnant paddock trees and clumps of remnant vegetation were common throughout the pastureland area of this area. Two main patches of remnant vegetation were identified during the survey within this area. Although not completely isolated from surrounding vegetation (usually linked by isolated remnant paddock trees to the dry forest or adjacent roadside vegetation) both patches differ in species diversity and structure. Both patches represent the open dry forest/woodland type vegetation that

probably existed on the lower slopes leading into the floodplain area prior to clearing. Most trees within these patches were old growth and displayed good health, although some had severe to medium crown dieback. Most are subject to grazing and have very little to no regeneration. Ground cover is dominated by introduced pasture weeds. Remnant patches are generally dominated by Yellow Box, with Long-leaved Box, Apple Box, Red Box and Blakely's Gum also being common. Isolated remnant paddock trees were generally Yellow Box or Blakely's Gum. Most of the largest trees for this area were recorded as isolated remnants or within the isolated clumps with an estimated height of between 30 – 40 m and estimated trunk (dbh) of up to three meters

Habitat types

Habitat qualities of the various study areas were assessed in terms of specific fauna and flora resources (hollow-bearing trees, foraging opportunities, available ground substrate etc.) and structural diversity. Study area 2B has the highest habitat value of the study area.

Study area 1A lacked any specific habitat value in terms of sheltering and breeding opportunities. The area may offer very limited feeding opportunities, which area already well represented on adjoining land.

Study area 1B provided some foraging, sheltering and breeding opportunities in the from of isolated remnant River Red Gums and stag trees. This area also offered semi-aquatic habitat in the form of drainage lines, a creek tributary and two small dams. Foraging, sheltering and breeding opportunities for amphibian and semi-aquatic bird species are provided.

Study area 2A provided foraging, sheltering and breeding opportunities in the form of isolated remnant trees, stag trees and woodland area north of adjacent to Whatman's Lane. The woodland patch offers high foraging, roosting and breeding opportunities for may bird species. It is considered to have high habitat value given the lack of native vegetation within the study area. Four dams, drainage lines and lower lying wet areas also offered semi-aquatic and aquatic habitat.

Study area 2B provides a wide range of habitat values. The dry forest area provides for a wide range of foraging, sheltering and breeding opportunities for a number of species. Many of the mature trees and all old growth trees contained small to large hollows, crevices and bark slabs, which provide suitable nesting and roosting areas for some bird, reptile, arboreal mammal and microchiropteran bat species. During spotlighting a number of Brush Tail Possums were observed foraging in the canopy and leaving hollows of the larger mature and old growth trees. Several bird nests were recorded in mature and old growth trees.

Isolated remnant trees and stag trees (standing dead trees)

Isolated remnant trees and Stag trees (also called habitat trees) were although not numerous were more common within the dry forest area. The majority of stags provide many opportunities for suitable nesting and sheltering areas in the form of a range of hollow sizes, and deep fissures. Stags provide valuable habitat for a variety of native fauna including birds, microchiropteran bats, and arboreal mammals.

Ground debris – Non-vascular ground cover

The occurrence of ground debris or non-vascular ground cover (eg. rock, leaf litter, fallen timber, logs and also artificial substrate such as fence posts, sheets of iron etc) largely depended upon the property owner and their management practices. Study areas 1A and the majority of 1B and 2A and almost certainly half of 2B contained sub-optimal habitat in terms of ground debris. Ground debris in the form of fallen logs, branches and leaf litter was commonly recorded within the dry forest area of area 2B, providing suitable habitat for small ground dwelling mammals and reptile species. Pastureland areas and isolated remnant trees and clumps of remnant vegetation generally lacked ground debris.

However large amounts of ground debris in the form of artificial substrates ie. fallen fence posts and sheds, drums, concrete poles, sheets of tin and iron etc were commonly recorded throughout the study area and could potentially support suitable resources for some native ground dwelling mammals and reptiles in the absence of natural substrates.

Dams, drainage lines, lower-lying wet areas and creek tributaries.

The creek itself provides habitat for aquatic and semi-aquatic vertebrate and invertebrate fauna. Currently a number of native vertebrate species utilise the creek, creek tributary and drainage lines and lower-lying areas (study areas 1B, 2A and 2B) including three amphibian and a number of semi-aquatic bird species utilise the creek. In general, the creek provides opportunities for feeding and foraging in the form of invertebrates and organic matter, shelter, temporary refuge and breeding areas.

These resources were also offered by low-lying wet areas and dams, which occur along the drainage lines and at the bottom of slopes. Some of these dams provide sub-optimal wetland habitat. Similar natural wetland areas were probably frequent, especially in areas 1B and 2A along the floodplain area but have been lost to agricultural development. These areas were often characterised by *Juncus, Cyperus, Carex* and *Eleocharis* species. These areas are exposed to various intensities of stock grazing and trampling although, provide valuable breeding and foraging habitat for amphibians, water birds and areas of refuge.

Noxious weeds and pest plants

Fourteen species of noxious weeds as listed under the NSW *Noxious Weeds Act 1993* were recorded for the study area. The most commonly recorded species, *Echium spp*. (Paterson's Curse), *Rosa rubiginosa* (Sweet Briar) *Rosa fruiticosa* (Blackberry) and *Salix spp.* (Willows) and various thistles were found throughout the study area. Appropriate management should be undertaken as outlined below under the NSW *Noxious Weeds Act 1993*. It is also advised that advice be sought from the pest control/weeds officer from Council.

TABLE 7: NOXIOUS WEEDS RECORDED FOR THE STUDY AREA, TUMUT LOCAL GOVERNMENT AREA

SCIENTIFIC NAME	COMMON NAME	CATEGORY
Alternanthera pungens	Khaki weed	W3
Centaurea nigra	Black Knapweed	W1
Rubus fruticosus (agg. spp.)	Blackberry	W2
Orobranche sp.	Broomrape	W1
Sorghum sp.	Columbus/Johnson Grass	W2
Conium maculatum	Hemlock	W3
Marrubium vulgare	Horehound	W3
Carduus nutans	Nodding Thistle	W2
Echium sp.	Paterson's curse, Vipers/Italian bugloss	W3
Onopordum spp.	Scotch Thistle	W2
Solanum elaeagnifolium	Silverleaf nightshade	W3
Hypericum perforatum	St John's wort	W2
Rosa rubiginosa	Sweet Briar	W3
Salix spp. except S. babylonica, S. reichardtii and S. calodendron	Willows	W4g

Action for control categories under the NSW *Noxious Weeds Act 1993:*

W2 The weed must be fully and continuously suppressed and destroyed.

W3 The weed must be prevented from spreading and its numbers and distribution reduced.

W4 In accordance with sections 8(3) and 9 of the Act, the action as specified below must be taken in respect of the weed:

(g) Where the letter **"g"** appears beside the control category W4 in the third column of the Schedule: - The weed must not be sold, propagated or knowingly distributed.

Species considered within this group also include proclaimed environmental weeds. Species of environmental and other pest weeds that are common across the study area include:

- Thistle species (Nodding, Saffron, Californian and Spear)
- *Avena fatua* (Wild Oats)
- *Bromus spp.* (Brome)
- *Phalaris aquatica* (Phalaris)
- *Chondrilla juncea* (Skeleton Weed)
- *Hypochoeris radicata* (Flatweed)
- *Lactuca serriola* (Prickly Lettuce)
- *Verbena virgatum* (Purple Top)
- *Conicum maculatum* (Hemlock)
- *Prunus spp.* (Stonefruits) and

- *Populus spp.* (Poplar)

FAUNA

A total of 105 native and 9 introduced vertebrate fauna species were recorded in the study area during survey and incidental observations. All species recorded during this assessment have been recorded previously in the Tumut region by the NPWS *Wildlife Atlas Database*, *Birds Australia* or other source.

Additional species have been recorded in the Tumut region as a result of previous studies and database searches (NSW NPWS 2002). These records are from an extensive area and although it is possible that some of the more mobile species could use the subject area on occasions, it is very unlikely that any species would solely rely on the resources provided by the area for their continued existence.

Amphibians

Three amphibian species were recorded within the study area; Plains Froglet (*Crinia parsignifera),* Common Eastern Froglet (*Crinia signifera)* and Spotted Marsh Frog *Limnodynastes tasmaniensis*. Species were heard calling during the day and whilst conducting spotlighting and call playback census for the Southern Bell Frog (*Litoria raniformis*) at night.

The Common Eastern Froglet was the most frequently recorded species occurring in all study areas in a wide range of habitat types including dams, drainage lines and seemingly dry pastureland area. The other two species were also recorded in all study areas (except study area 1A) but were confined to dams and permanent wet areas.

Like the Plain's Froglet the Common Eastern Froglet occurs in a variety of habitats and can be found sheltering beneath rocks, logs and thick vegetation during dry periods. It to emerges to breed in slow-flowing creeks, claypans, lagoons, gutters and roadside pools after rain. It can be heard calling from shallow water, fringing grass or leaf litter (Cogger, 2000 and Robinson, 1998). The Spotted Marsh Frog is a very adaptable species and is often the first frog to take advantage of new dams, ditches, and water-covered areas on disturbed ground (Cogger, 2000 and Robinson, 1998). It can be found in woodland, shrubland and grassland and is usually found under cover near water by day. After rain, it breeds among the shallow grassy borders of both temperate and permanent watercourses (Cogger, 2000 and Robinson, 1998).

No threatened amphibian species as listed in Table 9 were recorded during this field investigation or as a result of previous studies of the area. The study area is considered to support some potentially suitable habitat in the form of natural drainage lines, some dams and wetter areas for the Southern Bell Frog However, given that intensive searches (ie. call playback and spotlighting), was conducted in and around potentially suitable habitat, no evidence was recorded of this species occurring within the study area. No recent records exist of this species being recorded within the study area, or general locality of the study area. It is therefore considered *unlikely* that the proposed development will impose a *"significant effect"* on the Southern Bell Frog.

Reptiles

Eight reptile species consisting of one snake, one lizard and six skinks were positively recorded during the field surveys. All species but one (Blue-tongue Lizard) were recorded within study area 2B. All species are considered common and secure within the Tumut region. The Eastern Brown Snakes was recorded with the dry forest, pastureland and Gilmore Creek area of area 2. Eastern Brown Snakes occupy a wide range of habitats and feed on a variety of prey, including small mammals and reptiles.

The South-eastern Morethia Skink *Morethia boulengeri*, were frequently observed in areas with ground debris, especially the dry forest area of area 2B. The South-eastern Morethia Skink travels through areas with fallen timber using it for shelter, nesting and thermoregulation. It was often found under the bark of fallen or standing dead trees. Ground debris is important for shelter, nesting and thermoregulation for reptiles. In areas devoid of ground debris these species were absent. A Lace Monitor (*Varanus varius*) was recorded passing through the dry forest area of area 2B.

Considering the low number of species recorded opportunistically during this assessment it is more than likely that a number of more common species to the region probably occur within the study area, e.g. the Tiger Snake, Red-bellied Black Snake and other skinks. No threatened reptile species as listed under the *TSC Act 1995* were recorded during this field investigation or previous studies of the study area. It is considered *'unlikely'* that the proposed development will have a *'significant effect'* upon any of the reptile species that may be found in the Study area.

Birds

Opportunistic and plot based bird surveys revealed the presence of 85 native and 4 introduced species. Only species recorded within the study area will be discussed for the purpose of this assessment. However most species recorded within areas adjacent to the study area were also recorded within the various study areas.

The cleared pastureland areas directly adjacent the study area yielded few species in comparison to the more structurally and floristically diverse dry forest. Bird species diversity within pastureland areas could only be attributed to the isolated remnant trees and clumps of remnant vegetation. A number of broad guilds of diurnal birds were identified during the survey including:

1. Larger and more aggressive wide-ranging birds which forage over the study area eg Little and Australian Ravens, Australian Magpie, Kookaburra etc.
2. Woodland birds eg. smaller birds which utilise shrubs (Brown and Striated Thornbill) and other woodland species (Brown Treecreeper, Golden Whistler, Grey Shrike-thrush).
3. Semi-aquatic species eg. Ducks, Cormorants, Herons.

Nocturnal surveys revealed the presence of three nocturnal bird species. An Australian Owlet-nightjar (*Aegotheles cristatus)* was heard on two occasions within the dry forest area of Area 2B. The Barn Owl (*Tyto alba)* was observed on five different occasions within Area 2B. The Tawny Frogmouth (*Podargus strigoides)* was also heard within the dry forest of Area 2B. No other nocturnal birds were recorded during this assessment.

It is likely that a number of common bird species from the region may frequent the study area, particularly during different seasons and when different plant species are in flower. Indirect evidence such as white-wash also revealed the presence of a number of roosting and basking positions for bird species within the dry forest area of Area 2B and the isolated remnants of Area 1B. A number of bird nests of varying sizes in mature and old growth trees, believed to be Australian Magpies and raptors were also recorded in Areas 1B, 2A and 2B.

The Brown Treecreeper (*Climacteris picumnus victoriae)* eastern subspecies was recorded on two occasions during vegetation surveys within the dry forest community of Area 2B. This species has been recently listed as threatened under Schedule 2 of the NSW *Threatened Species Conservation Act*. Other woodland species which have been recently listed could also occur within Area 2B including Diamond Firetail, Hooded Robin and Speckled Warbler.

Based on the results of this field investigation and preliminary research, the study area (especially Area 2B and the woodland area north of Whatman's Lane in Area 2A) does provide resources for some of the bird species as listed in Table 9. It is considered *unlikely* that the proposed works will have an adverse affect upon any bird species inhabiting the study area. Suitable habitat and resources are well represented within Area 2B and within general locality of this study area (ie. Tumut State Forest). It is unlikely that the proposed works will involve the removal of any part of the dry forest area or associated habitat. It is considered unlikely that a significant portion of any habitat or resources of any species of bird will be removed or modified, including roosting and breeding areas, foraging/feeding. Furthermore, recommendations have been implemented to ensure that abundant, suitable habitat remains within the study area (ie. conservation of dry forest area, isolated habitat trees and clumps of remnant vegetation).

Mammals

Ten native and five introduced mammal species were recorded within the study area during fauna surveys. Spotlighting surveys revealed the presence of a number of arboreal and terrestrial mammals. The Common Brushtail Possum (*Trichosurus vulpecula)* was the most frequently recorded during spotlighting surveys in the dry forest vegetation (Area 2B) and riparian vegetation along Gilmore Creek (Area 2A). Opportunistic searches for indirect evidence ie. scats and tracks revealed the presence of the Short-beaked Echidna (*Tachyglossus aculeatus*) and Common Wombat (*Vombatus ursinus)* within Area 2B. Eastern Grey Kangaroos were frequently recorded within the pastureland and dry forest area of Area 2B.

Four microchiropteran bat species including one threatened species were recorded within Area 2B as a result of the Anabat analysis. These species Freetail Bat (*Mormopterus sp)* Gould's Wattled Bat (*Chalinolobus gouldii),* Large Forest Bat (*Vespadelus darlingtonii)* are considered relatively common and widespread throughout the Tumut region. They can be found primarily roosting in tree hollows (especially those offered by old growth trees), and under bark slabs and deep fissures.

The Common Bent-wing Bat *(Miniopterus schreibersii)* was recorded as possible as a result of anabat analysis for Area 2B. This species is listed as threatened under

Schedule 2 of the NSW *Threatened Species Conservation Act.* Although only listed as possible it is very likely that this species does inhabit the study area on a permanent basis given the suitable resources presented by the area.

It is considered *unlikely* that the proposed works will have an adverse affect upon bat species inhabiting the study area. Suitable habitat and resources are well represented within Area 2B and within general locality of this study area (ie. Tumut State Forest). It is unlikely that the proposed works will involve the removal of any part of the dry forest area or associated habitat. It is considered unlikely that a significant portion of any habitat or resources of any species of microchiropteran bat will be removed or modified, including roosting and breeding areas, foraging/feeding areas or the modification of flight paths and corridors. Also, most microchiropteran bat species are mobile and can range from 5-10km each night to forage. Furthermore, recommendations have been implemented to ensure that abundant, suitable habitat remains within the study area (ie. preservation of existing remnant vegetation including isolated habitat trees).

The introduced Fox (*Vulpes vulpes)* was sighted on three occasions within Area 2B and once within Area 2A. Rabbits (*Oryctolagus cuniculus)* were also frequently recorded with Areas 2A and 2B. The Brown Hare (*Lepus capensis)* was recorded occasionally within Area 2B only.

The Study area does offer known habitat and resources, which support microchiropteran bats and other arboreal mammals, nocturnal and diurnal bird species not detected. No other threatened mammal species as listed under the *TSC Act 1995* were recorded during this field investigation or previous studies of the area. It is considered *'unlikely'* that the proposed development will have a *'significant effect'* upon any of the mammal species that may be found in the study area.

Flora and fauna potential impacts, considering the issues of biodiversity and habitat.

The suite of survey techniques used in this assessment are believed to have revealed the presence of the majority of species present within the study area during the time of the survey, except for the possible limitations as described earlier.

Overall the majority of vegetation within Areas 1A and 1B, is modified and of very limited floristic and habitat value for threatened species or native common species and limited in area compared to adjacent areas of similar vegetation (apart from the isolated River Red Gums of Area 1B). This type of vegetation is well represented within the general locality and immediate area, with the exception of the isolated remnant River Red Gum trees. These tree would have previously been numerous along the floodplain area of Gilmore Creek, however they are now largely confined to the riparian zone of the creek and are not considered common along the floodplain outside the riparian zone. In local terms, if the vegetation of Areas 1A and 1B (excluding the isolated River Red Gums) was to be removed and/or modified it would consequently be of no affect to native fauna and flora species. However if the isolated stag trees and remnant River Red Gums were to be removed or modified, it would in turn remove nearly all floristic and habitat value of the area and may consequently cause local extinctions of native fauna and flora.

The vegetation of Area 2A is also modified and of limited floristic and habitat value for native flora and fauna. The remaining native vegetation of this area is not well represented on the western side of the highway, although similar vegetation of greater quality is well represented east of the highway. Like the isolated remnant River Red Gums of Areas 1A and 1B the remnant woodland and isolated remnant trees and clumps of remnant vegetation within this area represent the majority of the native floristic and habitat value of the area. In local terms if the native vegetation of the study area was to be removed or modified, it would in turn remove most of the floristic and habitat value of the area and may consequently affect local common native fauna and flora.

Area 2B contains the highest floristic and habitat value of the four study areas. More than 80% of native plant and animal species were recorded within the area. The cleared pastureland area, which contains no over-storey vegetation has little to no floristic or habitat value, especially those areas dominated by noxious and environmental weeds. Areas of pastureland containing native over-storey in the form of isolated remnant paddock trees and remnant clumps of trees greater floristic and habitat value.

These isolated remnant trees and clumps of isolated remnant vegetation are all that remain of the woodland, which once covered most of the lower slopes leading into the floodplain areas. In local terms if the majority of this type of vegetation was to be removed or modified it would constitute the loss of locally important vegetation. In regional terms if this vegetation was to be removed or modified it would not constitute the loss of regionally important vegetation. The threatened Common Bent Wing Bat could also be potentially utilising the isolated paddock trees or clumps of remnant vegetation for roosting areas.

It is likely that as a result of the proposed rezoning and consequent development that the isolated remnant trees and clumps of isolated remnant vegetation would be impacted upon greater than any other vegetation/habitat type recorded during this study. Ultimately it is considered that the removal of this vegetation is undesirable given it provides the only relevant native flora and fauna values within the pastureland area of all study areas.

The dry forest and dry open forest/woodland area covers approximately 50% of the Area 2B and accounts for the majority of native vegetation within the study area. It contains the highest floristic and habitat value of the study area. Given that the majority of this vegetation (> 80%) is contained above 10 percent slope it is unlikely that the area will be deemed unsuitable for development. If any vegetation was to be removed or modified it would most likely be from the edge area of this vegetation type. Considering that this vegetation is well represented within the study area and surrounding areas (Tumut State Forest and adjoining private property) it is considered unlikely that removing or modifying some of this vegetation would constitute a significant local or regional loss of vegetation.

However, the dry forest of Area 2B is representative of the Western Tablelands Dry Forest type (*E. macrorhyncha/ E. polyanthemos/ Hibbertia obtusifolia/ Gonocarpus tertragynas*) as identified in the Southern Forests Comprehensive Regional Assessment. It is thought that at least 73.5% of this Western Tablelands Dry Forest

type has been cleared and it is inadequately represented in the reserve network. The NSW National Parks and Wildlife Service considers that development should be directed away from this forest type. Furthermore, the dry forest area and open dry forest/woodland of Area 2B is the only area to support native grassland remnants. The NSW NPWS considers these areas of conservation importance and should be protected.

Two threatened species were also recorded utilising the resources of the dry forest area (Common Bent Wing Bat and Brown Treecreeper). The Hooded Robin also listed under Schedule 2 of the *Threatened Species Conservation Act* was also recorded in dry forest vegetation adjacent to the study area and it is considered likely that it could be utilising resources within the study area.

Isolated remnant trees and clumps of isolated vegetation provide important values including; scenic and aesthetic value, shade for stock, nesting areas for wildlife, feeding areas for wildlife, connective value (act like stepping stones throughout the landscape), nutrient cycling and as a seed source. Such vegetation can also potentially provide nesting areas for threatened bird species including the Superb Parrot.

The proposal at any stage is not likely to significantly affect the habitat values of the different types of vegetation within the study area or the connectivity of the existing vegetation corridors from the area to other areas. The proposed rezoning is unlikely to create a boundary to the movement of fauna, modify, and/or remove any existing remnant vegetation or wildlife corridors. It is considered *'unlikely'* that a significant component of habitat for any of the native flora and fauna found within the region will be affected by the proposed rezoning. Consequently, it is *'unlikely'* that the proposed works will have a detrimental affect upon the survival of any of the native species mentioned in this report or those that may otherwise use the area as part of their overall habitat area.

There is also potential to loose the existing aquatic habitat of the study area. Although considered sub-optimal it does provide some habitat for three amphibian species and numerous water birds. These areas provide minor semi-natural wetland like habitat for amphibians, water birds, fish and aquatic invertebrates. The works resulting from the proposed rezoning could diminish or eliminate this type of habitat, which is already depleted within the locality. It is considered that optimal aquatic like habitats are not represented within the study areas or general locality.

There is also potential for indirect impacts upon native flora and fauna within the study area and surrounds through erosion, sediment discharge and deposition, reduction in water quality, chemical and noise pollution. Potential noise and water pollution are of particular concern. These potential effects can be readily minimised or avoided through the implementation of environmental management and impact amelioration measures.

Given the noise levels emitting from the mill, landfill operations and highway which intersects Areas 2A and 2B it is considered unlikely that the proposed rezoning or works resulting from the rezoning will have a detrimental affect upon the survival of any

of the native species mentioned in this report or those that may otherwise use the area as part of their overall habitat area.

No threatened or ROTAP listed plant species were recorded within the study area during the time of this assessment. It is *unlikely* that the proposed development will have a *'significant effect'* upon any flora of conservation significance. The potential lies to increase the local populations of threatened flora species as part of the revegetation works proposed by the developer.

No other threatened fauna species, apart from the Common Bent-wing Bat and Brown Treecreeper (eastern subspecies) were recorded within the study area during the time of this assessment. Despite suitable habitat being available, it is *unlikely* that the proposed works will have a *'significant effect'* upon any of the threatened fauna or their habitat as listed in Table 9.

The potential impacts for each study area on flora and fauna are summarised in Table 8.

TABLE 8: SUMMARY OF POTENTIAL FLORA & FAUNA IMPACTS & RECOMMENDATIONS FOR EACH PART OF STUDY AREA.

STUDY SITE	POTENTIAL IMPACTS
Area 1A	It is considered very unlikely that there will be a "SIGNIFICANT EFFECT UPON ANY THREATENED SPECIES OF FLORA OR FAUNA OR THEIR HABITATS". ▪ May require removal/modification of introduced tree species and pastureland. ▪ May require removal of 1 or 2 stag trees (Habitat trees).
Recommendations	▪ Retain and conserve stag trees (Habitat trees). ▪ See Recommendations and impact amelioration measures.
Area 1B	It is considered unlikely that there will be a "SIGNIFICANT EFFECT UPON ANY THREATENED SPECIES OF FLORA OR FAUNA OR THEIR HABITATS". ▪ May require removal/modification of introduced tree species and pastureland. ▪ May require modification to native vegetation (*Juncus spp., Carex spp. and Cyperus sp.*) of natural drainage line, creek and lower lying areas. ▪ May require removal of some isolated remnant River Red Gum Trees (Habitat trees), which should be avoided.
Recommendations	▪ Retain and conserve isolated remnant River Red Gum Trees (Habitat trees) (High Priority). ▪ Retain all existing native revegetation. ▪ See Recommendations and impact amelioration measures.
Area 2A	It is considered unlikely that there will be a "SIGNIFICANT EFFECT UPON ANY THREATENED SPECIES OF FLORA OR FAUNA OR THEIR HABITATS". ▪ May require removal/modification of introduced tree species and pastureland. ▪ May require modification to native vegetation (*Juncus spp., Carex spp. and Cyperus sp.*) of natural drainage line, creek and lower lying areas. ▪ May require removal/modification of some native vegetation (Apple Box (Habitat trees), which should be avoided. ▪ May require removal of some isolated remnant Eucalyptus Trees (Habitat trees), which should be avoided. ▪ May require removal/modification to the Box woodland immediately north of Whatman's Lane within lot 148.

TABLE 8 (CONT.): SUMMARY OF POTENTIAL FLORA & FAUNA IMPACTS & RECOMMENDATIONS FOR EACH PART OF STUDY AREA.

STUDY SITE	POTENTIAL IMPACTS
Recommendations	▪ Retain and conserve Box woodland immediately north of Whatman's Lane within lot 148 (High Priority) and adjoining woodland immediately south of Whatman's Lane. ▪ Retain all existing native revegetation works. ▪ Retain and conserve all mature Eucalypt trees and regeneration (High Priority). ▪ See Recommendations and impact amelioration measures.
Area 2B	It is considered unlikely that there will be a "SIGNIFICANT EFFECT UPON ANY THREATENED SPECIES OF FLORA OR FAUNA OR THEIR HABITATS" given that the following recommendations are complied to. ▪ May require removal of some isolated remnant paddock trees (Habitat trees) and clumps of remnant vegetation (Yellow Box woodland area), which should be avoided. ▪ May require the removal/modification of the Yellow Box woodland and revegetation works located near the existing landfill operations within lot 94 and 62 (see vegetation map), which should be avoided. ▪ May require removal/modification to the vegetation of the dry forest area (see vegetation map) within lot 150 and lot 163, which should be avoided. ▪ May require removal/modification of introduced tree species and pastureland area within lots 150, 62, 94, 140 and 163.
Recommendations	▪ Retain and conserve all native vegetation along drainage lines/creeks and regeneration. ▪ Retain and conserve dry forest area (see vegetation map) (High conservation priority) ▪ Retain and conserve isolated remnant paddock trees (Habitat trees) and clumps of remnant vegetation (Yellow Box woodland located near the existing landfill operations within lot 94 and 62). (High conservation priority). ▪ Retain and conserve all existing native revegetation works. ▪ See Recommendations and impact amelioration measures.

Any known observation of threatened species in the area or surrounds.

Tables 9 and 10 present the threatened species, populations and ecological communities, which occur in the Tumut region. The likelihood of each of the threatened species occurring within the study area was assessed given the habitat requirements of each species and known records of each species in the Tumut region. The threatened species identified as *'likely'* to occur within the study area have been done so given that suitable habitat requirements for these species were identified within the study area and these species have been previously recorded within the locality of the study area. The threatened species, populations and ecological communities identified as *'unlikely'* to occur within the study area have been identified as such because suitable habitat was found within the study area yet no records exist within the locality of the study area although, the species has been previously recorded within the Tumut region.

TABLE 9: ASSESSMENT OF THE LIKELIHOOD OF THREATENED FAUNA SPECIES OCCURRING WITHIN THE STUDY AREA

FAUNA SPECIES	LIKELIHOOD OF OCCURRING WITHIN THE STUDY AREA			
	Area 1A	Area 1B	Area 2A	Area 2B
Litoria raniformis Southern Bell Frog	NO	Unlikely	Unlikely	Unlikely
Litoria booroolongensis Booroolong Frog	NO	NO	Unlikely	NO
Pseudophyrne corroboree Southern Corroboree Frog	NO	NO	NO	NO
Pseudophyrne pengilleyi Northern Corroboree Frog	NO	NO	NO	NO
Delmar impar Striped Legless Lizard	NO	NO	NO	Unlikley
Ninox strenua Powerful Owl	NO	Unlikely	Unlikely	Likely
Ninox connivens Barking Owl	NO	Unlikely	Unlikely	Unlikely
Climacteris picumnus Brown Treecreeper (eastern subspecies)	NO	Unlikely	Unlikely	YES
Pachycephala olivacea Olive Whistler	NO	NO	Unlikely	Likely
Chthonicola sagittate Speckled Warbler	NO	NO	Unlikely	Likely
Stagonopleura guttata Diamond Firetail	NO	Unlikely	Unlikely	Likely
Melanodryas cucullate Hooded Robin	NO	NO	NO	Likely
Polytelis swainsonii Superb Parrot	NO	Unlikely	Unlikely	Unlikely
Lathamus discolor Swift Parrot	NO	Unlikely	Unlikely	Unlikely
Xanthomyza phrygia Regent Honeyeater	NO	Unlikely	Unlikely	Unlikely
Grantiella picta Painted Honeyeater	NO	Unlikely	Unlikely	Unlikely
Dasyurus maculatus subsp. maculatus Spotted-tailed Quoll	NO	NO	NO	Unlikely
Mastacomys fuscus Broad-toothed Rat	NO	NO	NO	Unlikely
Petaurus australis Yellow-bellied Glider	NO	NO	NO	Unlikely
Phascolarctos cinereus Koala	NO	NO	NO	Unlikely
Miniopterus schreibersii Common Bent-wing Bat	Unlikely	Unlikely	Unlikely	YES
Nyctophilus timoriensis Greater Long-eared Bat	Unlikely	Unlikely	Unlikely	Likely
Macquaria australasica Macquarie Perch	NO	NO	NO	NO

TABLE 10: ASSESSMENT OF THE LIKELIHOOD OF THREATENED FLORA SPECIES OCCURRING WITHIN THE STUDY AREA

FLORA SPECIES	LIKELIHOOD OF OCCURRING WITHIN THE STUDY AREA			
	Area 1A	Area 1B	Area 2A	Area 2B
Callotis glandulosa	NO	NO	NO	Unlikely
Rutidosis leiolepis	NO	NO	NO	Unlikely
Ammobium craspedioides Yass Daisy	NO	NO	NO	Unlikely
Diuris sheffiana Tricolour Diuris	NO	NO	NO	Unlikely
Discaria nitida	NO	NO	NO	Unlikely
Thesium australe Austral Toadflax	NO	NO	NO	Unlikely
Euphrasia scabra	NO	NO	NO	Unlikely

Legend to table 10

Likelihood of occurring at the area:

No (no suitable habitat on area, or surrounding area)

Unlikely (suitable habitat found on area yet no records exist within the locality of the subject area, yet records exist of the species within the Tumut region)

Likely (recorded in the locality, close to the area, suitable habitat on area)

Yes (recorded at area).

Flora of conservation significance

No threatened plant species were recorded within the study area. It is considered very unlikely that any threatened flora species as listed in Table 9 would occur within Areas 1A, 1B or 2A. Given the history of disturbance, modified and degraded nature, especially in relation to native ground cover species, it is *unlikely* that any threatened or other significant plant species would occur within these study areas. Furthermore, considering the lack of any evidence of threatened species occurring within these study areas and extensive coverage of introduced weed species and grazing, it is considered very unlikely that the proposed development would have a "*significant affect*", on any threatened flora listed in Table 10 within these Study areas.

It is however considered likely that one or more of the threatened flora species as listed in Table 10 could potentially occur within the dry forest vegetation type of Area 2B. Given the high diversity of native species, especially native ground cover species it is considered that the area could potential support suitable habitat for threatened or other significant plant species. Also considering the topography of the study area and that grazing of the area is has been restricted in certain areas it is considered likely that threatened or other significant plant species could occur within the dry forest vegetation type of the study area. It is considered unlikely that the proposed development would have a "*significant affect*", on any threatened flora listed in Table 10 within the dry forest vegetation type within Area 2B given the unsuitability of the land to build upon.

Fauna of Conservation Significance

Miniopterus schreibersii - *Common Bent-wing Bat*

Three forms of M. schreibersii have been recognised within Australia (Duncan et al. 1999) including two named subspecies, M. schreibersii orianae (north-western Australia) and M. schreibersii oceanensis (eastern Australian form), and the geographical variant based on the Naracoote population (southern form from Naracoote, S.A and Warrambool, Victoria). The exact range and overlap if any between the southern form and M. schreibersii oceanensis is currently being determined by genetic studies. In eastern Australia this species is distributed from Cape York Peninsula through to Victoria.

This species occupies a range of habitats from grasslands through to subtropical rainforests but are typically found in well-timbered valleys (Dwyer, 1995 and Churchill, 1998). Considered an obligate cave dweller but has also been recorded using man-made habitats such as mine adits and road culverts (Dwyer, 1995 and Churchill, 1998). Maternity caves are more specific in nature compared to roosting areas, being characterised by constantly high temperatures and humidity throughout the year or being shaped such that the air warmed by the bats activities is retained within the cave whilst the colony is present (Dwyer, 1981). In eastern Australia discrete populations area formed and centred on a maternity cave that is used annually for the birth and development of young. Each population disperses to other caves during the year but only within its specific territorial range usually within 300 km (Churchill, 1998). It is thought that the southern from is likely to be dependent upon the only three known maternity caves (Naracoorte Bat Cave, Lake Gillear Guano Cave and the recently collapsed Thunder Point Blowhole) (Duncan et al, 1999). These bats are string fliers and have been recorded travelling long distances between roost areas according to their seasonal requirements (Dwyer, 1995). One bat has been recorded as having moved 1,300 km (Churchill, 1998). They are also known to travel at leat 65 km in a single night (Dwyer, 1966).

Threats to this species include frequent disturbances to hibernation roosts, which seriously increase winter mortality within this species (Dwyer, 1995). Destruction and or damage to the relatively few nursery caves that do exist. Predation by owls, pythons, feral cats and especially foxes is known but the long-term effects are yet to be studied. It is thought that the future of this species is dependent upon the protection of the majority of known and potential maternity caves.

It is considered unlikely that the proposed works will have an adverse affect upon the Common Bent-wing Bat or other bat species inhabiting the study area. The Common Bent-wing Bat is dependent upon specific conditions within naturally occurring caves to provide for the right breeding opportunities. No such caves where found within the study area and certainly not within the area deemed most likely to be developed. Furthermore suitable foraging and roosting resources are well represented within study area 2B and within general locality of this study area (ie. Tumut State Forest). It is unlikely that the proposed works will involve the removal of any part of the dry forest area or associated habitat. It is considered unlikely that a significant portion of any habitat or resources of any species of microchiropteran bat will be removed or modified, including roosting and breeding areas, foraging/feeding areas or the

modification of flight paths and corridors. Most microchiropteran bat species are mobile and can range from 5-10 km each night to forage. To ensure that adequate resources are conserved within the study areas for microchiropteran bats recommendations have been implemented and include the preservation of existing remnant vegetation including isolated habitat trees.

Climacteris picumnus victoriae - *Brown Treecreeper (eastern subspecies)*

The past range of this species within south-eastern Australia includes; subcoastal environments and slopes of the Great Dividing Range between the Grampians in western Victoria, through central NSW (Wagga Wagga, Temora, Forbes, Dubbo and Inverell), to the Queensland border and northward to the Bunya Mountains (Schodde and Mason, 1999). The broad range of the Brown Treecreeper has not changed but it is now extinct in parts of its range. Declines in populations have been recorded from the across most of its range. Reid (1999) identified the Brown Treecreeper as a 'decliner' in a review of bird species' status in the NSW sheep-wheatbelt. A decline of 70% has been recorded in last decade over the central NSW area (Schrader in Traill, 2000).

The Brown Treecreeper is a medium-sized insectivorous bird that occupies eucalypt woodlands, particularly open woodland lacking a dense understorey (Simpson and Day, 2000 & Blakers et al., 1984). It is sedentary and nests in tree hollows within permanent territories, breeding in pairs or communally in small groups (Noske 1991). Birds forage on tree trunks and on the ground amongst leaf litter and on fallen logs for ants, beetles and larvae (Noske 1979 & Blakers et al, 1984).

Brown treecreepers are threatened by clearance and the fragmentation of the woodland habitat including removal of dead timber. Increased isolation decreases treecreeper vagility and increases the vulnerability of populations to extinction as a result of stochastic events. This species appears unable to maintain viable populations in remnants less then 200ha and its abundance decreases as remnant size decreases (Barrett et al. 1994). Fragmentation also leads to a skewed sex ratio in Brown Treecreeper populations because female birds are unable to disperse to isolated remnants, increasing the chance of local extinctions (Walters et al. 1999). Habitat degradation, including loss of hollow bearing trees, threatens Brown Treecreeper populations. Grazing by stock in woodland areas leads to a decrease the diversity of ground-dwelling invertebrates (Bromham et al. 1999) decreasing the availability of food for the birds. In addition, Brown Treecreepers are likely to be threatened by such factors as increased competition with aggressive honeyeater species and increased levels of nest predation that are a consequence of fragmentation of habitat (Major et al. 1998).

Other declining woodland birds (as identified in the Action Plan for Australian Birds, 2000) listed under Schedule 2 of the NSW *Threatened Species Conservation Act*, which could potentially occur within Area 2B include:

- Hooded Robin (south-eastern form) Melanodryas cucullata cucullate (two females including one adult and one immature recorded on private property adjacent to the southern boundary of the Study area).
- Grey-crowned Babbler (eastern subspecies) Pomatastomus temporalis temporalis

- Diamond Firetail Stagonopleura guttata
- Black-chinned Honeyeater (eastern subspecies) Melithreptus gularis gularis
- Speckled Warbler Pyrrholaemus sagittata

Area 2B does provide known habitat and resources for the Brown Treecreeper and some of the bird species as listed in Table 9. It is considered unlikely that the proposed works will have an adverse affect upon any bird species inhabiting the study area. Suitable habitat and resources are well represented within Area 2B and within general locality of this study area (ie. National Park). It is unlikely that the proposed works will involve the removal of any part of the dry forest area or associated habitat. It is considered unlikely that a significant portion of any habitat or resources of any species of bird will be removed or modified, including roosting and breeding areas, and foraging/feeding areas. Furthermore, recommendations have been implemented to ensure that abundant, suitable habitat and resources remains within the study area (ie. conservation of dry forest area, isolated habitat trees and clumps of remnant vegetation).

4.7 LAND CONTAMINATION & OTHER UNHEALTHY LAND ISSUES

Listing of previously known uses of the subject land.

Not much is known of the history of land uses within the Study area. However, because the land is on the fringe of the Tumut township (and in the case of Area 2, some distance away), it is assumed that most of the land has been used for agricultural purposes since European settlement of the area.

A number of landfills are known within Area 2B although their location is unlikely to conflict with areas suitable for future development. An area at the rear of Area 2B has also been used in recent years for 'paint ball' games but this has since ceased.

Whether the land may contain contamination from any other previous land uses.

Council's contaminated and potentially contaminated land mapping does no show any affected land within the study area. However, adjoining Area 1B on the opposite side of the disused railway line "sawmill" and "bulk fuel depot" show up as "possible contaminated" sites.

According to the egis study on the Tumut-Cootamundra railway line there are a number of potential contaminants in Areas 1 and 2A. These are:

- Petroleum hydrocarbons including total petroleum hydrocarbon (tph) fractions and benzene, ethyl benzene, xylene (BTEX);
- Polycyclic aromatic hydrocarbons (PAH's) including benzo(a)pyrene;
- Heavy metals including arsenic, cadmium, chromium, copper, nickel, lead, zinc and mercury;
- Phenolic;

- Organochlorine pesticides (OCPs); and
- Volatile chlorinated hydrocarbons.

Asbestos may also be a source of contamination on railway sites and would present as fragments or particles of building material in soils.

The wastes dumped in land fills within Area 2B may house a variety of contaminants including petroleum hydrocarbons, heavy metals, polycyclic aromatic hydrocarbons, pesticides and asbestos. The situation deemed to be most at risk is the surface soils, although the potential for leaching and subsequent contamination of the groundwater and water ways is possible.

The reports and data received in relation to Bellet's landfill business indicate that contamination is unlikely and their environmental auditing further reinforces this. It is suggested that further tests be carried out prior to development. In addition the periphery of sawmills may also require testing for the previously mentioned contaminants

Any areas of fill or potential site/soil instability.

As mentioned above, there are a number of land fill sites along the northern boundary of Area 2B but these are unlikely to be within an area suitable for future development (see Study recommendations).

There are no known areas of soil instability.

4.8 HERITAGE & ABORIGINAL ARCHAEOLOGICAL SITES

Identification of any significant heritage and aboriginal archaeological sites and management measures for their retention, preservation or removal as appropriate.

None of the heritage items listed in the LEP are within or in proximity to the Study area.

The Study area was walked by a local Aboriginal Sites Identifier who concluded that:

"There were no visible signs of any Aboriginal occupancy within these areas. There is no evidence of any artifacts, campsites or scared trees."

4.9 HAZARD ASSESSMENT

An assessment of potential hazards such as bushfires.

The assessment of bushfire hazard in the 1988 *Rural Local Environmental Study and Urban Strategy* rates Area 1 and Area 2A as a "medium" bushfire hazard. The 1988 study states that the rating of "medium" mostly relates to "*grassland which, although capable of a very high intensity fires over a short period of time, does not occasion the same hazard planning problem as native forest.*" This description of the fire hazard for this part of the subject land is considered still be appropriate today.

The fire hazard map in the 1988 study shows a strip of land within Area 2B bordering the National Park as being a "high" hazard. The "high" definition is applied to those areas "*that are within 50 metres of native bushland and/or have a steep slope gradient*." The allocation of this hazard rating to parts of Area 2B are still appropriate today and is one of the factors contributing to a finding that the steeper parts of this area are not suitable for industrial development.

4.10 OPEN SPACE

Assessment of the need for public open space areas, particularly visual screening from the Snowy Mountains Highway.

Although there is not considered to be a need for public open space as a result of the development of the subject land for industry, it is appropriate to ensure sufficient 'open space' is provided between the Snowy Mountains Highway and industrial buildings and/or land usage. Requirements for this should be expressed within the Industrial Development DCP and apply specifically to land with highway frontage.

4.11 ENERGY EFFICIENCY

The proposal is to have regard to energy efficiency principles. This includes having regard to energy efficient subdivision design.

"Energy efficient subdivision design" is more a requirement for residential subdivision than industry. Council should ensure however that any subdivision of the subject land maximises the efficiency of existing and future infrastructure such as roads, water and sewerage.

4.12 PUBLIC BENEFIT

Details of any substantial public benefit that would result from the proposal.

A public benefit will be gained from the rezoning through the establishment of new industries and the associated employment growth and boost to the local economy.

Attitude of relevant public authorities.

See Section 3.4 of the report above.

4.13 OTHER RELEVANT ISSUES

Any other relevant issue identified in analysing the above specific matters to be assessed accordingly.

There were no other issues identified as a result of conducting the Study.

5. SUMMARY & CONCLUSIONS

This Environmental Study aims to assess whether a number of areas of land in and near Tumut are suitable for rezoning to allow development for industrial purposes. The Environmental Study has been instigated by Council identifying the need for additional industrial zoned land and a series of strategic planning documents that have also indicated that in the main, the study area is targeted for industrial development.

The land is held in a number of titles of various sizes and in the ownership of individuals and large existing industries in Tumut and Gilmore. The majority of the Study area has, and is currently, being used for grazing purposes.

The proposed rezoning is not prohibited by the requirements of planning and related legislation as well as State planning policies, Minister's Directions, regional strategies and the local planning instruments including the Tumut Local Environmental Plan and Industrial Development Development Control Plan. A variety of government departments and agencies have been consulted as to the preparation of the Study and none of these have objected subject to various matters being addressed.

For the purposes of analysis, it is convenient to divide the subject land into two areas and then two further sub-areas. These are:

Area 1A 7.5 hectares of land in Yarra Road, Tumut on the edge of the Gilmore Creek floodplain.

Area 1B 15.5 hectares of land on the western side of the Snowy Mountains Highway between Jepson Avenue and the Pioneer Cemetery.

Area 2A A long linear piece of land between the Snowy Mountains Highway and old Tumut-Cootamundra railway line.

Area 2B A large parcel of land between the Snowy Mountains Highway and National Park to the east.

The core element of the Study is the assessment of environmental issues. For this study, the following matters are considered to be of prime importance and have been the focus of assessment:

- traffic network and transportation
- sewerage and water
- drainage and stormwater management
- natural environment issues (including fauna and flora)
- land contamination
- Aboriginal archaeology
- natural hazards

All areas have good road access although the standard of construction varies substantially. Area 1 has no sealed road access and construction and/or upgrading of existing roads would be necessary to accommodate any development of land. Area 2 is well served by the Snowy Mountains Highway that is constructed to a state highway

standard and is in excellent condition in the proximity of this particular area. However, direct access to this road is not preferred (and not permitted by local planning instruments) and service roads will need to be constructed to service industry along the highway. Some intersecting roads provide access from the highway to land behind but these will also ideally require re-construction. Access and intersection works are more likely to be responsive to the actual development of the land and should be considered at this time. In conclusion, the issues surrounding roads and traffic do not prejudice the rezoning of the land.

The existing Sewerage Treatment Plan is already at capacity and will need to be upgraded to accommodate industrial development in the Study area. Area 1A has access to the existing sewer and therefore is the most attractive for immediate development. The other three areas do not have access to the existing sewer although Area 1B is in proximity. The sewer main will need to be extended some distance to service Area 2 although depending on the type of industrial activity (ie. the amount of effluent and waste generated), on-site treatment and disposal might be an option in the short term, particularly for Area 2B which is more distant from Gilmore Creek.

Areas 1A and 1B can be easily serviced by the existing reticulated water supply. Like the sewer, the water main would need to be extended some distance to service Area 2 and also be provided with a high level storage to guarantee supply at pressure, particularly in terms of fire fighting capability. Council will need to consider how these works are to be funded and whether they shoul be undertaken ahead of development or as a result of it.

In conclusion, the issues surrounding sewer and water are not insurmountable and not considered on their own to prejudice the rezoning of the land.

The topography of the subject land and proximity to discharge opportunities (ie. Gilmore Creek floodplain) leads to the conclusion that drainage is not a major issue. More the point for stormwater, is its quality at the time of entering the catchment. These matters should be addressed at the development stage with Council encouraging on-site retention of stormwater for treatment via wetlands and the like prior to discharge.

The current information on flooding is limited but the evidence available suggests that the land on the eastern side of the railway line is above the flood level of the Gilmore Creek. Area 2B is not affected by flooding other than 'flash' flooding that cannot be predicted in any case.

An extensive flora and fauna survey was conducted across the Study area. This survey concludes that of the threatened species of flora and fauna that could be present in the Tumut region, all but two were either not to be found or unlikely to be found in the Study area. One threatened bat species and one bird species were identified within Area 2B which is consistent with it being identified as having the highest value for habitat of the four areas. Fortunately the steep topography of the perimeter of Area 2B is prohibitive for any form of development and this is also the area of conservation significance. In conclusion, flora and fauna issues do not

prejudice the rezoning of the subject land with the exception of the steeper heaviliy vegetated land around the perimeter of Area 2B.

Evidence suggests that land surrounding the former Cootamundra-Tumut railway has the potential to be contaminated and this affects parts of Areas 1A, 1B and 2A. However the level of contamination would not be though to be detrimental to industrial development (as against residential development). Parts of the northern edge of Area 2B has been used for landfill although these dumps are remote from that part of Area 2B considered suitable for development (ie. the more level areas closer to the Snowy Mountains Highway). Council should ensure these landfills are located and accurately plotted for future reference.

The Study area has been assessed by the local Aboriginal Land Council and no sites or items of significance were discovered.

Only Area 2B requires consideration in terms of bushfire risk because it is the only part of the Study area that features any density of vegetation. Like for flora and fauna, those parts of Area 2B that may constitute an unreasonable fire risk either from proximity to the National Park or the more elevated areas where remnant vegetation exists at any scale, is not suitable for development in any case because of the topography.

In conclusion, there are no substantive reasons why the Study area should not be zoned for industrial development. It is considered that the Study area can in the main be developed for industrial purpose without having any significant impacts on the environment. Although there are some issues to be resolved such as services and roads, these can be assessed in appropriate detail at the development stage of the land. These issues are more about how the land should be developed as against whether it should be generally zoned for that development in the first place.

6. RECOMMENDATIONS

Based on the findings of the Environmental Study, it is recommended that the Study area be rezoned to Industrial 4(a) subject to the following provisos:

1. The Industrial Zone not to extend into the 'industrial exclusion zone' depicted in Appendix D4.
2. An appropriate buffer to development is established from the former Cootamundra-Tumut railway line to take account of not only potential contamination but also future re-use of the line or use for recreational purposes.
3. Depending on the type of industry, monitoring protocols (eg. groundwater) to be established in Areas 1A, 1B and 2A to ensure protection of the Gilmore Creek.
4. The Industrial Development DCP to be amended to include a section addressing building setbacks from the Snowy Mountains Highway and landscaping within this area.
5. A strategy for providing Area 2 with reticulated water and sewer be prepared by Council (possibly incorporating a Developer Contributions Plan).

APPENDIX A
STUDY BRIEF

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Technical Services: (02) 6947 0517

Our Ref: e\18_03_01 planning instruments\ env. study specification.doc

Your Ref:

SPECIFICATION
FOR
ENVIRONMENTAL STUDY
PROPOSED INDUSTRIAL LAND – TUMUT & GILMORE

Quotations

Quotations are invited to conduct an Environmental Study of the land described in Schedule 1. Quotations for the consulting services will be received by Council up until 5.00 p.m. on Friday, 30 November, 2001. Submissions should address:

1. The project team.
2. What makes the team different.
3. References.
4. Understanding of the project.
5. General approach to the project.
6. Key stages.
7. Fees and timing estimate.

Purpose

The purpose of the study is to determine the suitability of the land for industrial use and justification for rezoning. It will also become an important resource document upon which future development can be environmentally assessed.

Background

The 1988 Tumut Rural Local Environmental Study and Urban Strategy identified the Gilmore Valley as the preferred site for future industrial development.

The Synectics Group of Consultants undertook an Industrial Land Study for Council in 1998. The principal purpose of the study was to develop a strategy to deal with an estimated shortfall of industrial land.

Community Development Initiatives Pty Ltd undertook a Planning Directions Study for Council in 2000. The purpose of this study was to conduct a planning assessment of various options before Council for future industrial land development, based on previous studies.

As a consequence of the above reports, Council adopted an Industrial Strategy in April, 2001. The strategy states:

a) Short-term provision of industrial land be made by rezoning Area 1 (refer to Schedule 1 of this brief) to General Industrial;

b) Long-term provision of industrial land be made by rezoning Area 2 (refer to Schedule 1 of this brief) to General Industrial;

Council resolved on 21 August, 2001 to implement the goals of the Industrial Strategy by rezoning Areas 1 and 2 to General Industrial.

General Principles

The following general principles apply in preparing the Environmental Study:

1. Focus on the key issues;
2. Be selective and not collect and analyse information that is not relevant to the issues;
3. The simplest approach is often the most useful; and
4. Wherever possible, utilise existing studies and information.

Key Components

1. Research and issue identification.
2. Consultation.
3. Conduct appropriate studies (desktop and field).
4. Prepare draft report.
5. Draft report discussed with relevant Council staff and Council's Industrial Land Working Party.
6. Final report presented to Council.

Specific Matters

Specific matters to be addressed (but not limited to) in the Environmental Study are:

Section 1 - Ownership

1.1 Details of properties involved (land title details).
1.2 Location and general site plan.
1.3 Names of all landowners and if possible signatures endorsing the Study.
1.4 Existing zoning.
1.5 Description of the locality.

Section 2 - Background to the Proposal

2.1 Landuse history.
2.2 Circumstances that have resulted in this matter coming before Council.

Section 3 - Planning Legislation

3.1 State Planning Controls.
3.2 Local Environmental Plan.
3.3 Development Control Plans.
3.4 Any draft environmental planning instruments affecting the land.
3.5 An analysis of how the proposal would interact with any relevant aims and objectives contained in the Local Environmental Plan and relevant Development Control Plans.

3.6 How the proposal relates to Council's Industrial Strategy.
3.7 Any other likely concerns of Council in terms of other relevant Local Planning Policies and Guidelines.

Section 4 - Section 117 directions

4.1 The Study is to address all relevant section 117 Directions under the EP&A Act 1979. The Department of Urban Affairs & Planning suggests the following:

- Demonstrate that the rezoning of rural land for industrial purposes is justified in this instance, as required by *Ministerial Direction G8-Rural Lands.*

Section 5 - Land Use Issues

5.1 Objectives of the proposed rezoning.
5.2 The quality of the land and the effect of the proposed rezoning on any existing uses of the land.
5.3 Whether the land contains recoverable minerals of extractive materials.
5.4 Indication of lot yields, based on land capability.
5.5 General suitability of the site for the proposed rezoning.
5.6 What impact, if any, the release of this land will have on other land releases in the Shire.
5.7 Whether the proposal will prejudice the orderly expansion of the existing zoned General Industrial area in Tumut.
5.8 The appropriate staging of development.

Section 6 - Surrounding Properties

6.1 Details of the use of surrounding properties.
6.2 How the proposal may affect these properties.
6.3 Any other capability issues with surrounding land uses.

Section 7 - Traffic Network & Transportation Issues

7.1 An analysis of the traffic implications of the proposal for the immediate area and surrounding road network.

Section 8 - Effluent Disposal

8.1 Details of how reticulated sewer and water will be provided to the land, location of mains and ability of the network to take on the proposed load.
8.2 Relative costs to provide these services and what proportion of the cost will be borne by the community.
8.3 Impact on the capacity of the existing sewer reticulation system.

Section 9 - Drainage and Stormwater Management

9.1 Overland drainage routes and approximate sizes of any retention areas (existing and proposed).
9.2 Indication of potential flooding.

9.3 Drainage corridors required for this development as well as Best Practice Techniques for the management of surface water from the site and surrounding land within the catchment area.

Section 10 - Waste Collection

10.1 Proposed method of waste collection (kerbside or private)

Section 11 - Other Infrastructure

11.1 Whether the proposal and any other subsequent development will create demands for the provision or extension of services provided by Council or other infrastructure providers including - Country Energy (electricity and gas); Telstra; Australia Post; Department of Transport; etc.
11.2 Attitude of relevant public infrastructure authorities.
11.3 Relative cost to provide other necessary infrastructure services and what proportion of the cost will be borne by the community.

Section 12 - Natural Environment Issues

12.1 The physical characteristics of the land indicating drainage patterns, erosion, geological hazards and landscape features.
12.2 A survey of existing vegetation (species and density).
12.3 Flora and fauna potential impacts, considering the issue of bio-diversity and habitat.
12.4 The assessment of land capability in accordance with Best Practice Principles established by the Department of Land and Water Conservation.
12.5 An assessment of salinity and how to manage any affected areas.
12.6 Soil and ground water testing.
12.7 Any known observation of threatened species in the area or surrounds.
12.8 Rating on ground water vulnerability and how this will be addressed.
12.9 An assessment of soil erosion problems and how these will be managed.
12.10 A measure of the water quality and quantity leaving the site now.
12.11 The necessity to protect any other special features of the site.

Section 13 - Land Contamination and other Unhealthy Land Issues

13.1 Listing of previously known uses of the subject land.
13.2 Whether the land may contain contamination from any other previous land uses.
13.3 Any areas of fill or potential/site instability.

Section 14 - Heritage & Aboriginal Archaeological Sites

14.1 Identification of any significant heritage and aboriginal archaeological sites and management measures for their retention, preservation or removal as appropriate.

Section 15 - Hazard Assessment

15.1 An assessment of potential hazards such as bushfires.

Section 16 - Open Space

16.1 An assessment of the need for public open space areas, particularly visual screening of the land from the Snowy Mountains Highway.

Section 17 - Energy Efficiency

17.1 The proposal is to have regard to energy efficiency principles. This includes having regard to energy efficient subdivision design.

Section 18 - Public Benefit

18.1 Details of any substantial public benefit that would result from the proposal.
18.2 Attitude of relevant public authorities.

Section 19 - Other Relevant Issues

19.1 Any other relevant issues identified in analysing the above specific matters, to be assessed accordingly.

Consultation

1. Project Officer.
2. Relevant Council staff.
3. Department of Urban Affairs and Planning.
4. National Parks & Wildlife Service.
5. Department of Land and Water Conservation.
6. Department of Agriculture.
7. Environment Protection Authority.
8. Roads & Traffic Authority.
9. Local Aboriginal Land Council.
10. Others as deemed necessary.

Timing

The consultant shall report on progress to the Project Officer on a regular basis.

The final report shall be presented to Council at its Ordinary Meeting on 26 March, 2002.

Documentation

The final report shall be presented in A4 format. 20 printed copies shall be supplied, accompanied with an electronic version in Microsoft Word format on disc or CD. One unbound printed copy shall be supplied for duplication purposes.

The report shall contain the following:

1. Executive summary.
2. Analysis of environmental constraints, opportunities and best management of specific matters identified above.

3. Conclude with a clear recommendation/s on the suitability of the land for industrial use, including the establishment of any development guidelines required to achieve specific outcomes and preferred timing of land release.
4. Accompanying plans, including a concept plan showing how the area is to be redeveloped including staging and incorporating opportunities and constraints identified in the environmental analysis of the proposal. The plan is also to demonstrate phasing and co-ordination of services in an orderly and economic manner.

Final Use of the Document

1. The document will form part of the exhibition of the draft Local Environmental Plan and any Development Control Plan for the area.
2. Ownership of the document will be vested in the Council.

Budget

A lump sum quotation, inclusive of the Goods and Services Tax, shall be submitted to Council for the work. The payment schedule will be negotiated with the Project Officer.

Project Officer

Paul Mullins
Manager Development & Environment.
Phone (02) 6947 0530
Fax: (02) 6947 2141
Email: pmullins.admin@tumut.nsw.gov.au

Schedule 1

Area 1

This land immediately adjoins the existing General Industrial 4(a) zone in Tumut, northwest of the disused railway line.

The land consists of open grassland used for grazing purposes. The land slopes gently to the northwest, towards the Gilmore Creek floodplain.

The area has existing road access off Jepsen Avenue and Pioneer Cemetery Lane, with an approx. area of 23 ha.

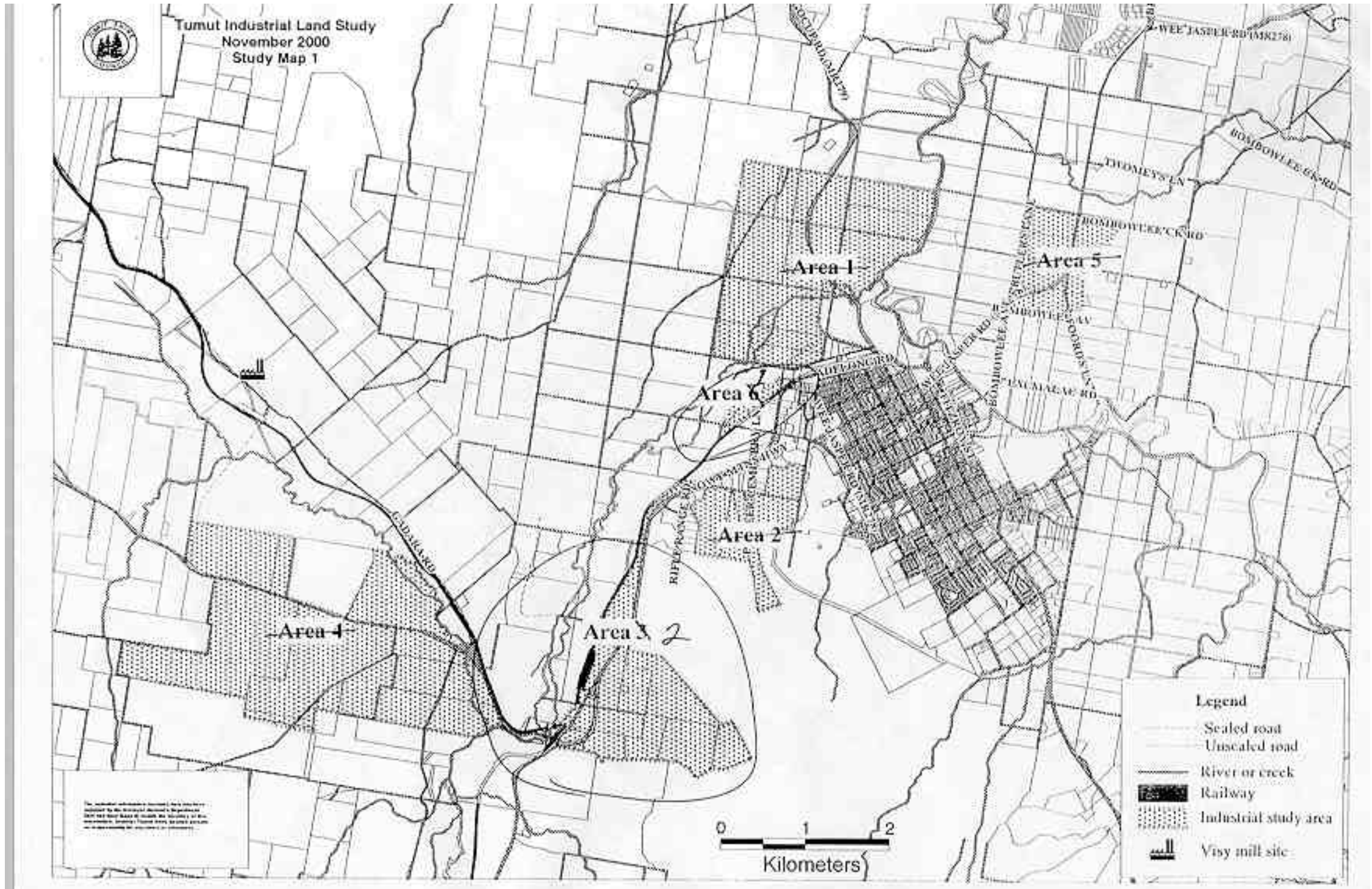
Area 2

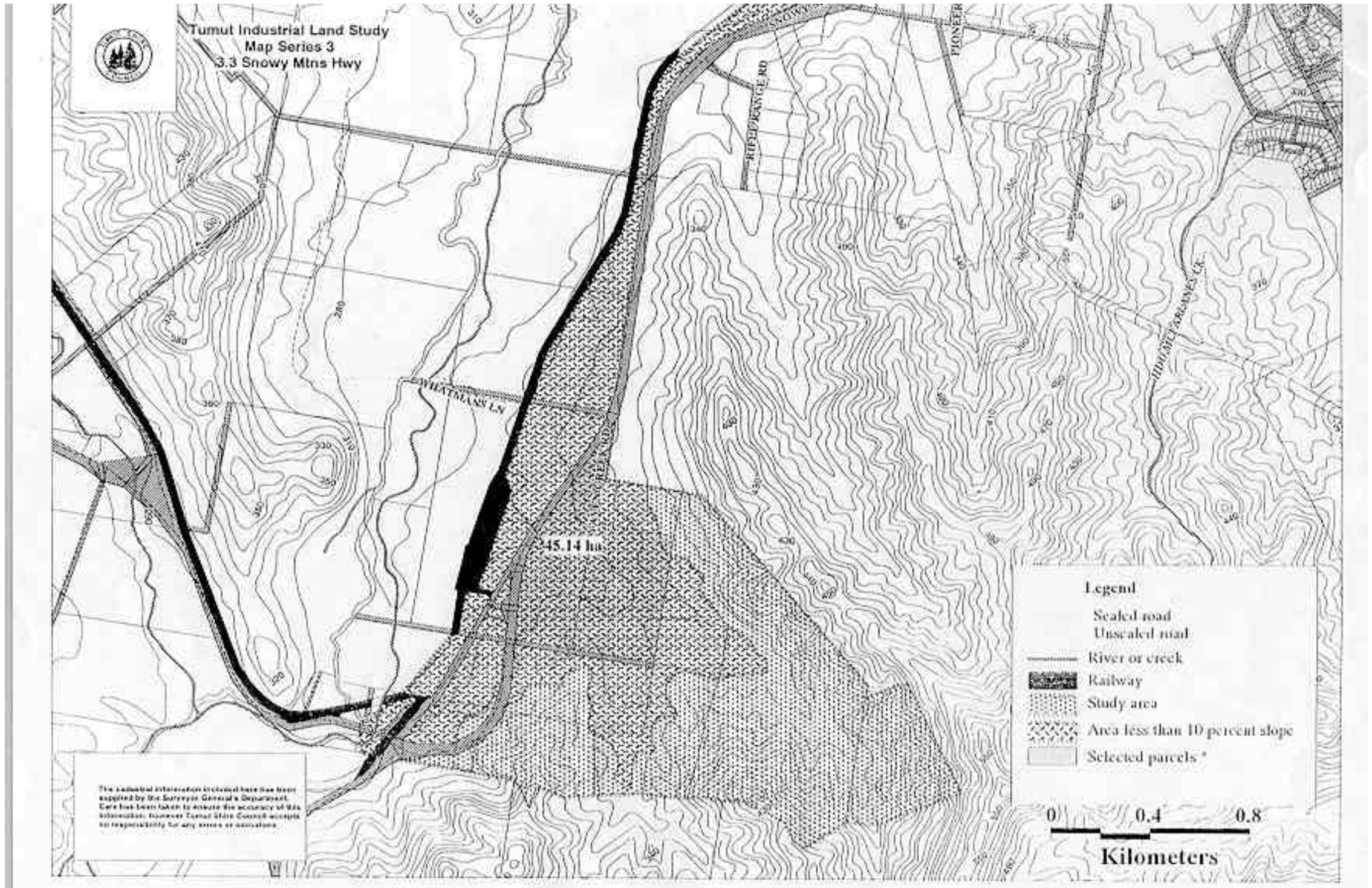
Land in the vicinity of what is commonly referred to as the Gilmore Mill. It includes land on both sides of Snowy Mountains Highway, but the majority of the land is in the valley on the eastern side of the highway opposite the Weyerhaeuser Timber Mill.

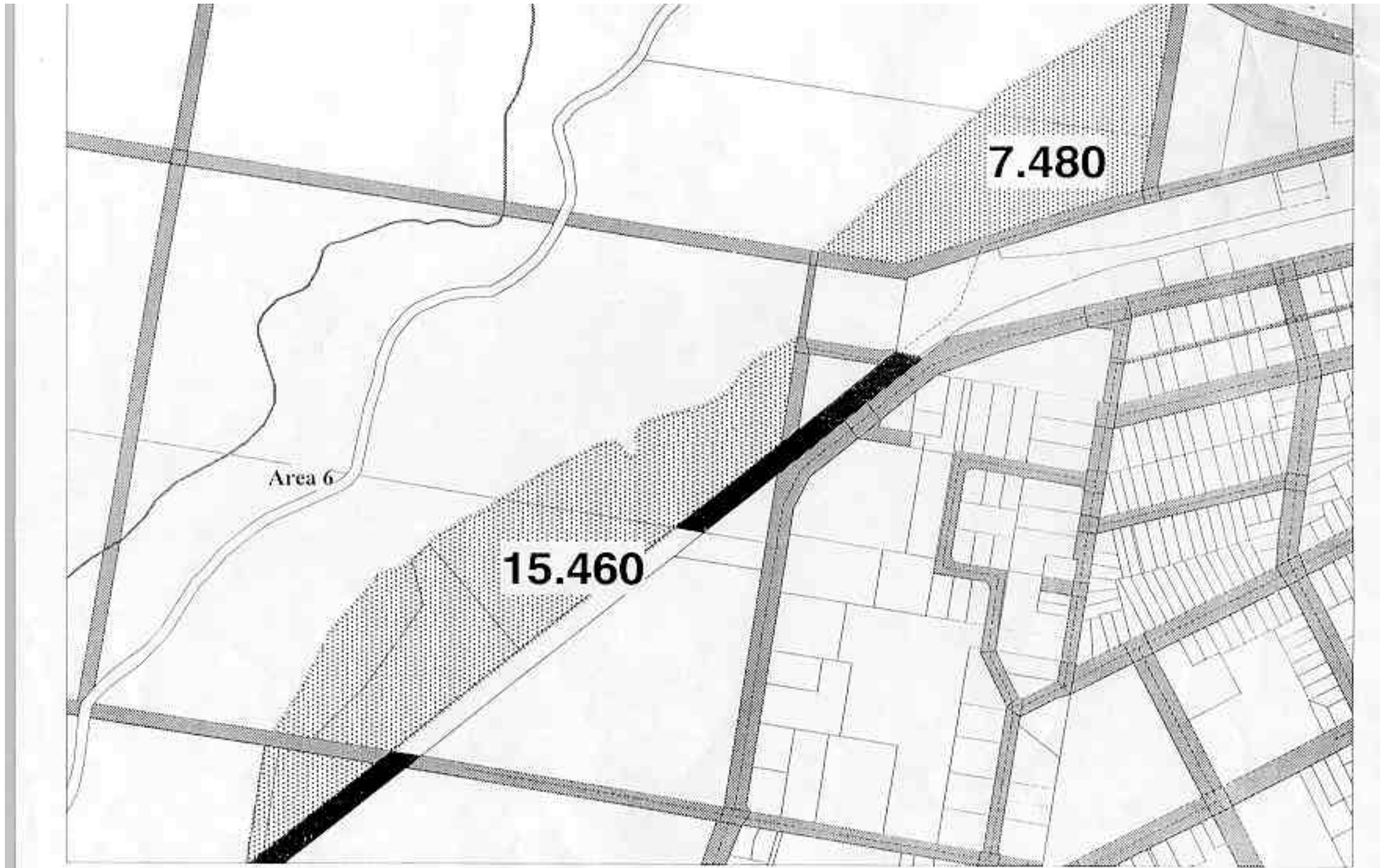
The land is mostly open grassland and is used for grazing purposes. A small area is used as an industrial landfill. The majority of the land is gently undulating and, for the most part, open grassland with some light to moderate vegetation cover at various points.

The highway effectively separates a large portion of land on the eastern side of the highway from a smaller and more elongated portion on the western side of the highway.

The total area is approx. 45 ha.


Tumut Industrial Land Study
November 2000
Study Map 1
Area 1
Area 2
Area 3
Area 4
Area 5
Area 6
Legend
Sealed road
Unsealed road
River or creek
Railway
Industrial study area
Visy mill site
0
1
2
Kilometers


Tumut Industrial Land Study
Map Series 3
3.3 Snowy Mtns Hwy
WHEATMANS LN
RIDGEVALE RD
PIONEER
45.14 ha
Legend
Sealed road
Unsealed road
River or creek
Railway
Study area
Area less than 10 percent slope
Selected parcels *
0
0.4
0.8
Kilometers


7.480
Area 6
15.460

APPENDIX B
REFERRAL AUTHORITIES

Shirley (Tammy) Tidmarsh.
Aboriginal Artist. Aboriginal Education Assistant. Sites Identifier.
15 Min-Eve Drive Brungle via Gundagai. NSW. 2722. (02)6944 9069

REPORT 1
Local Environmental Study.
Proposed Industrial Land at Tumut and Gilmore

Report on work carried out within the Tumut/Gilmore areas as follows;

There were no visible signs of any Aboriginal occupancy within these areas, There are no evidence of any "Artefacts, Campsites or scared Trees".

Myself and my monitors are relived to report we found all these areas clear. We have no recommendations in this matter

Yours truly,

Shirley Tidmarsh

Shirley Tidmarsh
Aboriginal Sites Identifier.

Mr Warwick Horsfall
Habitat Planning
609 Olive Street
Albury-Wodonga 2640

LAND & WATER CONSERVATION

Contact: Paul Hutchings
Phone: (02) 6923 0400
Fax: (02) 6921 7308
e mail:
phutchings@dwc.nsw.gov.au

Our Ref: R030
[Proposed industrial land tumut_gilmore]

31 January 2002

Dear Mr Horsfall,

Re: Local Environmental Study: Proposed Industrial Land - Tumut and Gilmore

Thank you for providing the Department of Land and Water Conservation (DLWC) with the opportunity to provide advice in the preparation of the Local Environmental Study (LES) for proposed industrial land in Tumut and Gilmore.

The Department respectfully requests that you consider the following issues in the preparation of the LES:

Crown Land

The LES should provide details of any Crown Land including Crown Roads that are impacted by the proposal. A cadastral map of the proposal that shows the relationship of lot boundaries to actual development areas must be provided.

The location of Crown lands can be determined by contacting Mr John Flarrety DLWC in Wagga Wagga on (02) 6921 2503.

Mr Flarrety can advise of any constraints that may occur in any proposed dealings with Crown Land.

Native Vegetation

The rezoning of land to "industrial" means that the land will be excluded from the operation of the Native Vegetation Conservation Act 1997. DLWC encourages the retention of remnant vegetation as part of the proposal.

The LES should detail the following in relation to native vegetation on-site:

- A description of the vegetation communities that are affected by the proposal;

- Details of the condition and conservation status of the vegetation communities. Mr Michael Hood of the National Parks and Wildlife Service (phone 6298 9700) may be able to provide additional information in this regard.
- The proposed extent of clearing, including native trees, shrubs and groundcover;
- The effect of the proposal upon threatened species listed in Schedule 1 or 2 of the Threatened Species Conservation Act 1995.
- Details of any vegetation/habitat management measures that may be applied to mitigate impacts of development.

Surface Drainage

A number of drainage lines traverse the subject land. The LES should provide details of how surface water drainage and stormwater runoff will be affected by the proposal. DLWC suggests that the drainage lines should not be altered or impeded by any development.

Provision of appropriate drainage works should precede any large-scale development.

Landscape Limitations

The LES should detail landform properties that may restrict development. The severity of any landscape limitations should be described. Limitations could be related to the following:

- Slope
- Mass movement potential
- Rock fall hazard
- Flood hazard
- Waterlogging
- High watertables
- Water run-on
- Erosion hazard
- Shallow soils
- Non-cohesive soils
- Rock outcrop
- Foundation hazard.

Where limitations are identified, details of the possible mitigation options could be detailed (where appropriate).

Soil qualities and constraints

The LES should identify constraints to development associated with the soils of the subject land. This could include a general assessment of the following soil characteristics:

- Acidity/alkalinity (pH)
- Plasticity and seasonal cracking characteristics
- Hardsetting characteristics
- Fertility

- Sodicity/dispersibility
- Wet bearing strength
- Salinity
- Waterholding capacity
- Depth of soil mantle.

Many of these soil characteristics may be inferred through identification and classification of the soils on-site, and will aid in the determination of the landscape limitations noted above.

Land Capability

Council should consider the recommendations of the "Urban Capability Study: South West Tumut" prepared for Tumut Shire Council by the former Soil Conservation Service of New South Wales, in March 1979. This report provides a guide to development potential in terms of erosion hazard and land stability. The principles of the study should be applied to the proposed site.

The LES should also provide details of the site's land capability according to the DLWC 8-class land capability system.

Land Use/Existing Degradation

The LES should document existing land use and existing land degradation on site (such as salinity, erosion etc).

Waste Disposal

The LES should provide an indication of the potential of the land for waste disposal. This should extend to suitability for septic disposal and for pond construction.

Groundwater

The LES should provide sufficient information to enable an assessment of the impact of any change of landuse upon groundwater aquifers. The following information should be provided:

- Baseline information on groundwater aquifers including its quality, movement patterns, and users of the resource;
- Potential sources of pollution from designed and accidental sources as well as potential pollution pathways including contamination from seepage from fuel or chemical storage facilities or from contaminated surface water;
- Any use of groundwater or drawing down of aquifers that may be associated with the proposal.

The proposed site should also be assessed in the context of other potential land within the area to show that site selection has followed a process of shire-wide strategic planning.

For further information relating to groundwater, please contact Mr Mark Mitchell on phone (02) 6923 0400.

Should you wish to discuss any of the issues raised in this letter, please don't hesitate to contact Mr Paul Hutchings on phone (02) 6923 0400 or 0429 328 010.

Yours sincerely,

Paul Hutchings
For
Warwick Ford
Regional Director
Murrumbidgee Region

Our Reference : AL141/02 - ALF2628
Contact :

NSW EPA

Murray Region

Mr Warwick Horsfall
Habitat Planning
609 Olive St
ALBURY NSW 2640

Dear Mr Horsfall

LOCAL ENVIRONMENTAL STUDY - PROPOSED INDUSTRIAL LAND AT TUMUT AND GILMORE

Reference is made to your letter dated 11th January 2002 advising of the above study.

Activities in the existing industrial areas of Tumut have at times generated a number of environmental impacts. The EPA would therefore like to highlight several major issues that should be addressed in the study:

- Air Quality:

On account of the topography and metrological effects, there is at times very poor air dispersion, and even low level of emission can accumulate to create impacts.

- Noise Impacts:

Periods of inversions can significantly increase the noise impacts. Consideration should also be given to where there is direct line of sight to noise sensitive areas. Further industrial development should comply with the EPA publication "Industrial Noise Policy".

Traffic noise impacts should also be addressed in accordance with the EPA publication "Road Traffic Noise".

- Cumulative Impacts with Existing Industries:

The cumulative impact of existing developments with any new development should be considered, particularly with regard to air and noise emissions. For example, in the areas near the Weyerhaeuser and Carter Holt Harvey factories, and also on the elevated residential over looking these sites, existing noise level are at or near to recommended maximum levels. To preserve the amenity by preventing noise level creep, new developments may need to meet a much lower noise level than the existing developments.

- Surface Runoff:

Unpaved yards and contaminated external work areas may cause significant contamination of stormwater.

Environment Protection Authority
PO Box 544 Albury NSW 2640 Australia Telephone 61 2 6041 4963 Facsimile 61 2 6041 4973 ABN 43 692 285 758 www.epa.nsw.gov.au
Level 4 Albury City Council 553 Kiewa Street Albury NSW 2640

If you have any further queries, please contact Mr Mark Enright on (02) 6041 4963.

Yours sincerely

19/2/02

David Cook
Head, Regional Operations Unit, South West (Murray) Region
for Director-General

21 January 2002

Warwick Horsfall
Principle Planner
Habitat Planning
609 Olive St
ALBURY WODONGA 2640

Our reference:
Your reference:

ZF 1002

Dear Mr Horsfall

Local Environment Study – Proposed Industrial Land – Tumut & Gilmore

I refer to your letter of 11 January 2002, seeking comment from the National Parks and Wildlife Service (NPWS) on what should be addressed within the Local Environmental Study being prepared for the above proposal. The comments provided are in accordance with the Service's statutory responsibilities concerning the care, control and management of all areas dedicated as national parks, Aboriginal areas, historic sites, nature reserves and game reserves. In addition, the NPWS is responsible for the protection of native fauna and native plants throughout NSW and with the protection and care of the State's Aboriginal sites and relics.

I have attached NPWS guidelines for the preparation of impact assessment. These guidelines should be followed in the preparation of the LES.

Particular matters recommended to be addressed in the LES include;

- Mapping of the location and description of all native fauna habitats, vegetation communities and plant species that are within the area to be impacted and which are likely to be of local, regional or state conservation significance.
- Mapping of the location and description of Aboriginal sites and relics within the area to be impacted and identification of any areas of high archaeological potential.
- Assessment of the significance of the above attributes.
- Prediction of the likely impact of the proposal on the above attributes; and
- Assessment of measures available to minimise the impact of the proposal on these attributes.

In this context the NPWS considers that there is a high probability of Aboriginal sites being present on the subject land, while two threatened species the legless lizard (*Delma impar)* and the Booroolong Frog (*Litoria boorolongénsis)* have been recorded in the close vicinity of the study area. An Aboriginal sites survey and targeted surveys for the threatened species should be part of the LES. I have enclosed a list of other threatened species recorded in Tumut Shire and the likely habitat that they may occur in. In addition recently listed woodland birds such as the

NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE

ABN 30 841 387 271

Conservation
Programs &
Planning Division
Southern Directorate
6 Rutledge Street
PO Box 2115
Queanbeyan
NSW 2620
Australia
Tel: (02) 6298 9700
Fax: (02) 6299 4281

Head Office
43 Bridge Street
PO Box 1967
Hurstville NSW
2220 Australia
Tel: (02) 9585 6444
Fax: (02) 9585 6555

Brown Tree-Creeper (*Climacteris picumnus)*, Hooded Robin (*Melanodryas cucullata)*, Speckled Warbler (*Pyrrholaemus sagittatus)* or Diamond Firetail *(Stagonopleura guttata)* may also be present.

Vegetation modelling done as part of the Southern Forests Comprehensive Regional Assessment models two types of forests as likely to occur in the subject area. These are Western Slopes Grass/Herb Dry Forest (*Eucalyptus macrorhyncha/ E. gonicalyx/ Gonocarpus tetragynus/Poa sieberiana)* and Western Tablelands Dry Shrub/Grass Forest (*E. macrorhyncha/ E. polyanthemos/ Hibbertia obtusifolia/ Gonocarpus tetragynus).* The Western Slopes Dry Forest is well represented in the existing reserve network. However, 73.5% of the Western Tableland Dry Forest type is thought to have been cleared and it is inadequately represented in the reserve network. The NPWS considers that development should be directed away from this forest type.

It is also likely that the valleys and lower slopes of the Tumut – Gilmore area supported native grasslands. Any remaining grassland remnants are of conservation importance and should be protected.

If you would like to discuss the matters raised above please contact Environmental Planning Officer, Dr Michael Mulvaney (02 6298 9702).

Yours sincerely,

Michael Hood
Manager, Conservation Planning Unit
Southern Zone

439.5351
083623
Rhod Stevens
4827 3798

Roads and Traffic Authority
www.rta.nsw.gov.au

South Western Regional Office

1 Simmons Street
Wagga Wagga NSW 2650
Telephone (02) 6938 1111
Facsimile (02) 6938 1183
PO Box 484
Wagga Wagga NSW 2650

Habitat Planning
609 Olive Street
Albury NSW 2640

4 MAR 2002

Tumut Shire – Local Environmental Study
Proposed Industrial Land – Tumut & Gilmore

Dear Sir,

I refer to your letter dated 11 January 2002, seeking the Authorities comments on the proposed environmental study of land in Tumut and Gilmore, to ascertain suitability for rezoning for industrial development.

The Authority will require the following points addressed: -

- Type and potential number of vehicles that would need to access the area.
- Traffic impact statement addressing the potential effects on the road network including key intersections.
- Proposed access locations to the Snowy Mountains Highway including type of intersection treatments.
- The possible use of service roads to limit the number of access points.
- Possible hours of operation.

Thank you for inviting the Authorities comment.

Yours faithfully

C E Blomfield
Regional Manager

planningnsw

Henry Deane Building
20 Lee Street Sydney NSW 2000
GPO Box 3927 Sydney NSW 2001
T 02 9762 8000
www.planning.nsw.gov.au

Riverina & South East
32 Lowe Street
PO Box 728
QUEANBEYAN NSW 2620

Phone: 02 6297 6911
Fax: 02 6297 9505

- 6 FEB 2002

Your ref:
Our ref: Q91/00295/002
Contact: M. Lodder

Mr Warwick Horsfall
Habitat Planning
609 Olive Street
ALBURY- WODONGA NSW 2640

Dear Mr Horsfall

TUMUT LOCAL ENVIRONMENTAL STUDY

Thank you for your letter of 11th January 2002 on this matter. You rightly list a number of issues for consideration in this local environmental study.

We suggest consideration of the following issues:

- Supply and demand for industrial land – small, medium or large businesses and perhaps staging/release of industrial land;
- Topography and its effect on land establishment costs, benching, effect on existing drainage patterns;
- Subdivision pattern and Lot size;
- Flora and fauna survey;
- Road circulation according to expected vehicles and required turning circles;
- Boundary and neighbour issues – boundary of a new National Park at Site 2;
- Approaches to Tumut – landscape considerations such as siting, screening and tree planting;
- 'Ribbon development' – avoidance: alternatives, road reserve screening, separation & open space;
- Comparative establishment costs of subject land and discounted Area 4 on Gadara Road.

Yours sincerely

Chris Murray
Regional Planning Coordinator
Riverina & South East

APPENDIX C1
FLORA & FAUNA
Methodology

FLORA

To determine all flora species, vegetation types, communities and associated habitat types two methods were employed:

- Aerial photograph interpretation, preliminary database search and literary review before undertaking detailed ground surveys.
- Field surveys of the vegetation of the subject site and surrounds.

A review of the relevant literature and databases (NSW NPWS) was conducted to develop a preliminary flora species list of the subject site and surrounding area. A literary review, in combination with aerial photograph interpretation, allowed for the mapping of basic vegetation community boundaries and the initial location of traverses to be identified. Vegetation surveys were then conducted to ground truth and verify the vegetation types and species list determined from preliminary studies.

A general flora survey was conducted between the 1-2 and 21-23 of February 2002. A quantitative description of the flora species, the diagnosed plant communities (assemblages of flora species) and an assessment of the habitat value of the area was recorded.

To also ensure that the study site was appropriately sampled three survey methods were employed:

1. 100 x 20 metre traverse - a field recording form was used to record:
   - sample site identification;
   - disturbances (eg. grazing, weeds, clearing etc);
   - description of the native vegetation (structure and floristic classification, identification and extent vegetation communities, age structure, canopy health, all species);
   - non-vascular groundcover;
   - flora of conservation significance; and
   - habitat features (standing/fallen dead trees, availability of foraging substrate, feed trees, suitable shelter, hollows etc).

   Sites chosen to conduct traverses represent a range of visually different habitats (eg. gully areas, lower-lying marshy areas, slopes, drainage lines etc). Other factors taken into consideration included the possible association with threatened fauna and flora species.

2. The survey also targeted the hollow characteristics and habitat value of isolated paddock trees and clumps of isolated paddock trees (designated proposed clearing native trees in attached map). A census of these trees will be carried targeting clumps and individuals with a diameter breast height over bark (DBHOB) of > 20 cm. The value of hollow bearing trees as critical habitat is well documented for hollow dependant fauna. Therefore information regarding the number of hollow bearing trees across the study site is important to determining the effect of any clearing operation on threatened and protected species.

3. The 'Random Meander' technique (Cropper 1993) was employed for the majority of the site. Information recorded included the identification and extent of vegetation communities; all flora species observed, habitat features (standing/fallen dead trees, availability of foraging substrate, feed trees, suitable shelter, hollows etc); and flora of conservation significance.

   Any rare, threatened, or significant species found on site or in the immediate area surrounding the site was marked on a map of the site in relation to the proposed works. A broad vegetation survey was conducted outside of the study site. This involved recording most flora species, identification and

extent of vegetation communities and some habitat features The vegetation types/communities for the study site and surrounds were classified according to Specht's classification system (1981).

FAUNA

A general fauna survey was conducted on the 1st and 2nd and between the 21st and 23rd of February 2002. Specific survey techniques were used to give maximum results considering the season and time limitations imposed upon the survey. Searches were conducted for habitat or resources of relevance for threatened fauna species known from the general locality, or which might be anticipated to occur at the subject site. Opportunistic records and indirect searches of fauna species were also maintained throughout the survey period. Where applicable, survey methodology followed guidelines as used by the NSW NPWS for the comprehensive regional assessment vertebrate fauna surveys.

Reptiles & amphibians

Opportunistic diurnal searches

Opportunistic diurnal searches for reptiles and amphibians were employed while undertaking other activities. Searches were made beneath ground litter, fallen timber, leaf litter, decorticated bark, stones, debris such as scraps of metal, sheets of iron, and tufts of vegetation. These searches were made where suitable reptile habitat occurred.

Amphibian - nocturnal surveys

Nocturnal searches for amphibians were employed involving spotlighting along the creek and nearby ponds, drainage lines, depressions, and quiet listening to identify calls and location. Call playbacks were also carried out in order to elicit a response from males in the area. Calls were played for the threatened species *Litoria raniformis* (Southern Bell Frog) and *Litoria booroolongiensis* (Booroolong Frog), for a period of 5 minutes, followed by quite listening afterwards.

Birds

Diurnal Bird - Opportunistic sampling

Standard sample plot counts involving a 20 minute search within a 1ha area were employed (NPWS 1997). The sample plot configuration varied according to the nature and configuration of the vegetation community and landform being sampled. Counts were conducted only during periods of relatively high bird activity (i.e early morning or late afternoon) and reasonable detectability. All birds seen or heard within the plot were recorded.

Opportunistic sampling of bird species was conducted while undertaking other activities on site, particularly during early morning hours when birds are more active. All bird species and individuals seen or heard were recorded. Opportunistic sampling also included indirect searches for birds, such as searches for whitewash and regurgitated pellets of owls, particularly in close proximity to mature trees with large hollows.

Nocturnal survey

Nocturnal bird census was conducted following the methodology of Kavanagh and Peake (1993) and NPWS (1997). Nocturnal bird investigations were conducted within the first two hours following sunset. No surveys were conducted on nights with rainfall and/or strong winds, as these conditions adversely affect the detectability of all nocturnal bird species. Following dusk a quite listening period for a duration of 15 minutes was undertaken to determine the presence of any nest or roost sites in, or in close proximity to, the study site. Spotlighting surveys were then conducted for nocturnal birds in association with arboreal mammal spotlighting.

Following the completion of spotlighting surveys pre-recorded calls of nocturnal birds, including *Ninox connivens* (Barking Owl), *Ninox strenua* (Powerful Owl) and *Tyto novaehollandiae* (Masked Owl) and other native nocturnal bird species were broadcast through a 16 watt portable amplifier over the subject site and

adjacent bushland. Calls of each species were broadcast for a period of 2 to 3 minutes, coupled with short periods of quiet listening for any vocal responses and stationary spotlighting. Following the final broadcast, spotlighting searches of the area were undertaken.

Mammals

Arboreal mammal - nocturnal surveys

Spotlight searches were undertaken by foot across the study site and involved 20 minutes of searching followed by quiet listening in darkness to detect any animal movements or vocalisations. Habitat providing trees with large hollows were targeted, especially immediately after dark because of the increased chance of animal activity around that time. Particular attention was paid to any tree in flower, as these provide a reliable source of blossom and nectar. Arboreal mammal investigations were conducted within the first two hours following sunset. No surveys were conducted on nights with rainfall and/or strong winds, as these conditions adversely affect the detectability of all arboreal mammal species.

Stag watching

Stag watching was also conducted over five separate nights to detect the presence of nocturnal mammals and/or birds emerging from tree hollows at dusk. The number and identity of emerging animals following dusk was recorded for a period of 30 minutes.

Bat detector

While undertaking other nocturnal activities, an Anabat II bat detector connected to a tape recorder was used to record the presence of microchiropteran (insectivorous) bat species, through the detection of echolocation calls. The Anabat II bat detector was placed at Area 2B for one night. Calls were analysed by a qualified expert of bat calls.

Opportunistic searches

Opportunistic spotlight searches were also conducted on foot and from a vehicle across the subject site, any animal movements or vocalisations were recorded. Habitat providing trees with large hollows were targeted after dark because of the increased chance of animal activity around that time. Particular attention was paid to any tree in flower, as these provide a reliable source of blossom and nectar.

Opportunistic searches were conducted during vegetation surveys and diurnal bird surveys of the subject site to detect the presence of mammal species, including scats, examination of burrows, tracks and diggings. Opportunistic diurnal searches for reptiles and amphibians were also undertaken across the subject site while undertaking other activities. Searches were made beneath ground litter, fallen timber, leaf litter, decorticated bark, stones, debris such as scraps of metal, sheets of iron, and tufts of vegetation.

APPENDIX C2
FLORA & FAUNA
Species lists

FLORA SPECIES LIST (Introduced species are indicated with asterisks)

Ferns & fern-like plants

ADIANTACEAE	
Cheilanthes austrotenuifolia	Rock fern
DENNSTAEDIACEAE	
Pteridium esculentum	Bracken Fern

Conifers

PINACAEA	
Pinus radiata	Radiata Pine*
Pinus spp.	Pine*

Monocotyledons

ALISMATACEAE	
Alisma plantago-aquatica	Water Plantain
CYPERACEA	
Carex appressa	Tussock Sedge
Carex breviculmis	Common Grass-sedge
Carex inversa	Common Sedge
Carex sp.	Sedge
Cyperus eragrostis	Ubrella Sedge*
Cyperus sp.	Sedge
Eleocharis acuta	Common Spike-rush
IRIDACEAE	
Romulea rosea	Onion Grass*
JUNCACEAE	
Juncus usitatus	Common Rush
Juncus sp.	Rush
ASPARAGACEAE	
Myrsiphyllum asparagoides	Bridal Creeper*
Asphodelus fistulosus	Wild Onion*
Bulbine bulosa	Native Leek
Dianella spp	Blue Flax Lilly
POACEA	
Agrostis avenacea.	Common Blown Grass
Agrostis sp.	Blown Grass*
Anthoxanthum odoratum	Sweet Vernal Grass*
Aristida sp.	Wiregrass

Austrodanthonia caespitosa	Common Wallaby-grass
Austrodanthonia eriantha	Hill Wallaby-grass
Austrodanthonia setaceae	Bristly Wallaby-grass
Austrostipa aristiglumis	Bristly Spear-grass
Austrostipa scabra	Rough Spear-grass
Austrostipa sp.	Spear-grass
Avena fatua	Wild Oats*
Bothriochloa macra	Red-leg Grass
Briza maxima	Quaking-grass*
Bromus catharticus	Prairies Grass*
Bromus diandrus	Great Brome*
Bromus sp.	Brome*
Chloris truncata	Windmill Grass
Critesion murinum	Barely-grass*
Cynodon dactylon	Couch*
Cynosurus echinatus	Rough Dogstail*
Dichanthium sericeum	Silky Blue-grass
Dichelachne crinta	Long-hair Plume-grass
Digitaria sanguinalis	Summer-grass*
Echinocloa crus-galli	Barnyard-grass*
Elymus scabra	Common Wheat Grass
Enteropogon acicularis	Spider Grass
Eragrostis brownii	Common Love-grass
Eragrostis sp.	Love-grass*
Holcus lanatus	Yorkshire Fog*
Lolium sp.	Rye-grass*
Microlaena stipoides	Weeping Grass
Panicum sp	Panic Grass
Paspalum distichum	Water Couch
Paspalum dilatatum	Paspalum*
Pennisetum clandestinum	Kikuyu*
Phalaris aquatica	Phalaris*
Phalaris minor	Lesser Canary Grass*
Poa annua	Winter Grass*
Poa labillardieri	Tussock Grass
Poa sp.	Tussock Grass
Polypogon monspeliensis	Annual Beardgrass*
Setaria sp.	Pigeon-grass*
Themeda triandra	Kangaroo Grass
Vulpia sp.	Fescue*
TYPHACEAE	
Typha spp.	Cumbungi

XANTHORRHOEACEAE

Lomondra spp.	Mat-rush

Dicotyledons

AMARANTHACEAE

Alternanthera denticulata	Lesser Joyweed
Alternanthera nodiflora	Common Joyweed
Alternanthera pungens	Khaki Weed*
Amaranthus sp.	

APIACEA

Conium maculatum	Hemlock*
Daucas glochidiatus	Australian Carrot
Foeniculum vulgare	Fennel*
Hydrocotyle bonariensis	Pennywort*
Hydrocotyle laxiflora	Stinking Pennywort

ASTERACEAE

Ambrosia artemisiifolia	Annual Ragweed*
Arctotheca calendula	Capeweed*
Aster subulatus	Bushy Starwort*
Calotis sp.	Daisy Burrs*
Cardus lanatus	Saffron Thistle*
Cardus nutans	Nodding Thistle*
Carthamus lanatus	Saffron Thistle*
Cassinia aculeata	Common Cassinia
Chondrilla jumcea	Skeleton Weed*
Cichorium intybus	Chicory*
Cirsium vulgare	Spear Thistle*
Conyza albida	Tall Fleabane*
Conyza bonariensis	Flaxleaf Fleabane*
Cotula australis	Common Cotula
Crepis sp.	Hawksbeard*
Cymbonotus preissianus	Austral Bear's-ears
Cynara cardunculus	Artichoke Thistle*
Euchiton involucratus	Common Cudweed
Hypochoeris radicata	Flatweed*
Lactuca serriola	Prickly Lettuce*
Onopordum acanthium	Scotch Thistle*
Senecio quadridentatus	Cotton Fireweed
Senecio sp.	Fireweed
Senecio sp.	Fireweed*
Silybum marianum	Variegated Thistle*
Sonchus oleraceus	Common Milk Thistle*
Taraxacum officinale	Dandelion*

Vittadinia sp.	Fuzzweed
Xanthium spinosum	Bathurst Burr*
BORAGINACEAE	
Amsinckia sp.	Burrweeds*
Echium plantagineum	Paterson's Curse*
BRASSICACEAE	
Lepidium africanum	Common Pepper-cress*
Lepidium sp.	
BRUNONIACEAE	
Brunonia australis	Blue Pincushion
CARYOPHYLLACEA	
Cerastium sp.	Common Chickweed*
Petrorhagia nanteulli	Proliferous Pink*
CUCURBITACEAE	
Citrullus sp.	Wild Melon*
CAMPANULACEAE	
Wahlenbergia communis	Tufted Blubell
Whalenbergia sp.	Bluebell
CASUARINACEAE	
Allocasuarina sp.	She-oak
CONVOLVULACEAE	
Convolvulus eurubescens	Pink Bindweed
Convolvulus arvensis	Common Bindweed*
Dichondra repens	Kidney Weed
CRASSULACEAE	
Crassula decumbens	Austral Stonecrop
DILLENIACEAE	
Hibbertia obtusifolia	Grey Guinea-flower
Hibbertia sp.	Guinea Flower
EPACRIDACEAE	
Brachyloma daphnoides	Daphne Heath
EUPHORBIACEAE	
Chamaesyce sp.	Caustic Weed

Euphorbia peplus	Petty Spurge*
FABACEAE (FABOIDEAE)	
Desmodium brachypodum	Large Tick-trefoil
Genista monspessulana	Montpellier Broom*
Glycine clandestina	Twining Glycine
Glycine tabicina (variable)	Variable Glycine
Glycine latifolia	Glycine
Hardenbergia violacea	Purple Coral-pea
Indigofera australis	Austral Indigo
Trifolium repens	Clover*
Trifolium sp.	Clover*
FABACEAE (MIMOSOIDEAE)	
Acacia baileyana.	Cootamundra Wattle
Acacia implexa	Lightwood
Acacia mearnsii	Late Black Wattle
Acacia melanoxylon	Blackwood
Acacia siculiformis	Dagger Wattle
Acacia sp.	Wattle
GENTIANACEAE	
Centaurium erythraeae	Common Centaury*
GERANIACEAE	
Erodium crinitum	Blue Herons-bill
*Erodium sp.**	
Geraniaum sp.	
Pelargonium australe	Austral Crane's-bill
GOODINACEAE	
Goodenia geniculata	Bent Goodenia
Goodenia sp. (pusilliflora)	Small-leaf Goodenia
HALORAGACEAE	
Gonocarpus tatragynus	Common Raspwort
Gonocarpus sp.	
LAMIACEAE	
Marrubium vulgare	Horehound*
Mentha pulegium	Pennyroyal*
Salvia verbenaca	Wild Sage*
LAURACEAE	
Cinnamonium camphora	Camphor Tree*

LILIACEAE	
Hypoxis sp.	Yellow Star
Stypandra glauca	Nodding Blue-lily
Tricoryne elatior	Yellow Rush-lily
LORANTHACEA	
Amyema pendula	Drooping Mistletoe
Amyema sp.	
MALVACEAE	
Malva parviflora	Mallow*
Sida sp.	Sida
MYRTACEAE	
Eucalyptus macrorhyncha	Red Stringybark
Eucalyptus camaldulensis	River Red Gum
Eucalyptus blakelyi	Blakely's Gum
Eucalyptus bridgesiana	Apple Box
Eucalyptus globulus	Mountain Blue Gum
Eucalyptus goniocalyx	Long-leaved Box
Eucalyptus melliodora	Yellow Box
Eucalyptus microcarpa	Grey Box
Eucalyptus polyanthemos	Red Box
Eucalyptus rubida	Candlebark
OLEACEAE	
Ligustrum vulgare	Common Privet*
OROBANCHE	
Orobanche minor	Broomrape*
OXALIDACEAE	
Oxalis perennans	Grassland Wood-sorrel
PAPILIONACEAE	
Pultenaea cunninghamii	Grey Bush-pea
PITTOSPORACEAE	
Busaria spinosa	Sweet Bursaria
PLANTAGINACEAE	
Plantago lanceolata	Common Plantain*

POLYGONACEAE	
Acetosella vulgaris	Sheep Sorrel*
Persicaria decipiens	Knotweed
Polygonum aviculare	Wireweed*
Rumex acetosella	Sheep Sorrel*
Rumex brownii	Swamp Dock
Rumex crispus	Dock Weed*
*Rumex sp.**	
PROTEACEAE	
Grevillea ramosissima	Fan (branching) Grevillea
RANUNCULACEAE	
Ranunculus sp.	
ROSACEAE	
Acaena agnipila	Sheeps Burr
Acaena novae-zelandiae	Bidgee Widgee
Acaena sp.	
Cotoneaster sp.	Cotoneaster*
Rosa rubigonosa	Sweet Briar*
Rubus fruiticosus	Blackberries*
Rubus sp.	Bramble*
RUTACEAE	
Correa reflexa	Common Correa
SALIACEAE	
Populus sp	Poplar*
Salix fragilis	Crack Willow*
Salix spp.	Willow*
SANTALACEAE	
Exocarpus cupressiformis	Cherry Ballart
SAPINDACEAE	
Dodonaea angustissima	Narriw-leaf Hop-bush
SCROPHULARIACEAE	
Verbascum virgatum	Twiggy Mullein*
SOLANACEAE	
Solanum nigrum	Blackberry Nightshade*

STERCULIACEAE	
Brachychiton populneus	Kurrajong
URTICACEAE	
Urtica sp.	Stinging Nettles
VERBENACEAE	
Verbenaceae bonariensis	Purple Top*

FAUNA SPECIES LIST (Introduced species are indicated with asterisks)

Amphibians

Limnodynastes tasmaniensis	Spotted Marsh Frog
Litoria peronii	Peron's Tree Frog
Crinia signifera	Common Froglet
Crinia parinsignifera	Plains Froglet

Reptiles

Ctenotus robustus	Large Striped Skink
Egernia striolata	Tree-crevice Skink
Leiolopisma delicata	Grass Skink
Lerista bougainvillii	Bougainville's Skink
Morethia boulengeri	
Pseudonaja texitilis	Brown Snake
Varinus varius	Lace Monitor
Teliqua scinioides	Blue-tongue Lizard

Birds

Tachybaptus novaehollandiae	Australasian Grebe
Anas superaliosa	Pacific Black Duck
Anas castanea	Grey Teal
Chenonetta jubata	Maned Duck
Ardea pacifica	Pacific Heron
Ardea novaehollandiae	White-faced Heron
Threskiornis aethiopica	Australian White Ibis
Threskiornis spinicollis	Straw-necked Ibis
Vanellus miles	Masked Lapwing
Elanus notatus	Black-shouldered Kite
Aquila audax	Wedge-tailed Eagle
Hieraaetus morphnoides	Little Eagle
Accipiter fasciatus	Brown Goshawk
Falco longipennis	Australian Hobby
Falco berigora	Brown Falcon

Falco cenchroides	Australian Kestrel
Geopelia placida	Peaceful Dove
Geopelia cuneata	Diamond Dove
Phaps chalcoptera	Common Bronzewing
Geophaps lophotes	Crested Pigeon
Cacatua roseicapilla	Galah
Cacatua galerita	Sulphur-crested Cockatoo
Glossopsitta pusilla	Little Lorikeet
Platycercus elegans	Crimson Rosella
Platytcercus eximus	Eastern Rosella
Psephotus haematonotus	Red-rumped Parrot
Cuculus pallidus	Pallid Cuckoo
Chrysococcyx basalis	Horsefield's Bronze-Cuckoo
Ninox novaeseelandiae	Southern Boobook
Tyto alba	Barn Owl
Podargus strigoides	Tawny Frogmouth
Aegotheles cristatus	Australian Owlet-nightjar
Dacelo novaguineae	Laughing Kookaburra
Merops ornatus	Rainbow Bee-eater
Daphoenositta chrysoptera	Varied Sittella
Cormobates leucophaea	White-throated Tree-creeper
Climacteris picummnus victoriae picumnus	Brown Treecreeper
Malurus cyaneus	Superb Fairy-wren
Pardalotus punctatus	Spotted Pardalote
Paerdalotus striatus	Striated Pardalote
Sericornis frontalis	White-browed Scrubwren
Smicrornis brevirostris	Weebil
Gerygone olivcacea	White-throated Gerygone
Acanthiza pusilla	Brown Thornbill
Acanthiza lineata	Striated Thornbill
Acanthiza chrysorrhoa	Yellow-rumped Thornbill
Anthochaera carunculata	Red Wattlebird
Philemon corniculatus	Noisy Friarbird
Philemon citreogularis	Little Friarbird
Lichenostomus chrysops	Yellow-faced Honeyeater
Lichenostomus leucotis	White-eared Honeyeater
Lichenostomus pencillatus	White-plumed Honeyeater
Manorina melanocephala	Noisy Minor
Melithreptus brevirostris	Brown-headed Honeyeater
Melithreptus lunatus	White-naped honeyeater
Psophodes olivaceus	Eastern Whipbird
Petroica phoenicea	Flame Robin
Eopsaltria australis	Eastern Yellow Robin
Microeca leucophaea	Jacky Winter
Falcunculus frontatus	Crested Shrike-tit

Collurincincla harmonica	Grey Shrike-thrush
Pachycephala pectoralis	Golden Whistler
Pachycephala rufiventris	Rufous Whistler
Rhipidura fuliginosa	Grey Fantail
Rhipidura rufifrons	Rufous Fantail
Rhipidura leucophrys	Willie Wagtail
Myiagra inquieta	Restless Flycatcher
Grallina cyanoleuca	Australian Magpie-lark
Oriolus sagittatus	Olive-backed Oriole
Corancina novaehollandiae	Black-faced Cuckoo-shrike
Artamus cuanopterus	Dusky Woodswallow
Cracticus nigrogularis	Pied Butcherbird
Gymnorhina tibicen	Australian Magpie
Strepera graculina	Pied Currawong
Corvus coronoides	Australian Raven
Corvus mellori	Little Raven
Hirundo neoxena	Welcome Swallow
Hirundo nigricans	Tree Martin
Anthus novaeseelandiae	Richard's Pipit
Mirafra javanica	Singing Bushlark
Alauda arvensis	Skylark*
Cinclorhamphus mathewsi	Rufous Songlark
Passer domesticus	House Sparrow*
Neochemia temporalis	Red-browed Firetail
Dicaeum hirundinaceum	Mistletoebird
Zosterops lateralis	Silvereye
Turdus merula	Blackbird*
Sturnus vulgaris	Common Starling*

Mammals

Chalinolobus gouldii	Gould's Wattled Bat
Vespardelus darlingtoni	Large Forest Bat
Vespardelus sp.	Forest Bat
Mormopterus sp.	Freetail Bat
Miniopterus schreibersii	Common Bent-wing Bat
Nyctinomus australis	White-striped Mastiff-Bat
Trichosurus vulpecu	Common Brushtail Possum.
Tachyglossus aculeatus	Short-beaked Echidna
Vombatus ursinus	Common Wombat
Macropus giganteus	Eastern Grey Kangaroo
Mus domesticus	House Mouse*
Felis catus	Feral Cat*
Oryctolagus cuniculus	Rabbit*
Lepus capensis	Brown Hare*
Vulpes vulpes	Red Fox*

APPENDIX C3
FLORA & FAUNA
References

Auld, B.A. & Medd, R.W. (1997). *Weeds, An illustrated botanical guide to the weeds of Australia*. Inkata Press, Australia.

Ayers, D., Nash, S. and Baggett, K. (1996). *Threatened Species of Western New South Wales. N. S. W.* National Parks and Wildlife Service, Sydney.

Baldwin, M. (1975). Birds of the Inverell District, NSW. *Emu* **75**, 113-120.

Barrett, G.W., Ford, H.A. and Recher, H.F. (1994). Conservation of woodland birds in a fragmented rural landscape. *Pacific Conservation Biology* **1**, 245-256.

Bromham, L., Cardillo, M., Bennett, A. and Elgar, M. (1999). Effects of stock grazing on the ground invertebrate fauna of woodland remnants. *Australian Journal of Ecology* **24**, 199-207

Blakers, M., Davies, S. J. J. F. and Reilly, P. N. (1984). *The Atlas of Australian Birds*. RAOU and Melbourne University Press, Melbourne.

Brooker, M.I.H. & Kleinig, D.A. (1999) *Field Guide to Eucalypts, Volume 1 South-eastern Australia (second edition).* Bloomings Books, Victoria.

Churchill, S. (1998) *Australian Bats*. Reed New Holland, Australia.

Cogger, H. (2000) *Reptiles & Amphibians of Australia*. Reed Books, Chatswood.

Collard, S., (2000). *'Re-birding' the Holbrook landscape – a revegetation strategy for the Upper Billabong Catchment*. Holbrook Landcare.

Cooper, R. P. and I. A. W. McAllan. (1995). *The Birds of Western New South Wales. A Preliminary Atlas.* N. S. W. Bird Atlassers, Albury.

Costermans, L. (1998) *Native Trees and Shrubs of South-Eastern Australia, Covering Areas of New South Wales, Victoria and South Australia.* Lansdowne Publishing Pty Ltd, Australia.

Cronin, L., (1998). *Key Guide to Australian Wildflowers*. Reed New Holland Press, Australia.

Duncan, A., Baker, B.B., and Montgomery, N. (ed.) (1999). *The Action Plan for Australian Bats.* Environment Australia.

Dwyer, P. D. (1981). Centrefold No. 9. Common Bent-wing Bat, *Miniopterus schreibrsii*. ANH. 20(6):187 – 90.

Dwyer, P. D. (1995). Common Bent-wing Bat. Pp. 494-95 **in** *The complete book of Australian mammals* (Ed. R. Strahan). Reed Books, Sydney.

Garnett, S.T., and Crowley, G.M., (2000). *The Action Plan for Australian Birds*. Environment Australia.

Garnett, S. T. (ed.) (1992). *Threatened and Extinct Birds of Australia. RAOU Report 82.* RAOU, Melbourne and ANPWS, Canberra.

Greig, D., (1999). *Field Guide to Australian Wildflowers*. New Holland Press, Australia.

Harden, G. (ed). 1990. *Flora of New South Wales Volume 1.* NSW University Press, Kensington.

1991. *Flora of New South Wales Volume 2*. NSW University Press, Kensington.

1992. *Flora of New South Wales Volume 3.* NSW University Press, Kensington.

1993. *Flora of New South Wales Volume 4*. NSW University Press, Kensington.

Higgins, P. J. (ed.) (1999). *Handbook of Australian, New Zealand and Antarctic Birds. Vol. 4. Parrots to Dollarbird.* Oxford University Press, Melbourne.

Jones, D. (1988) *Native Orchids of Australia*. Reed Books. Frenchs Forest, NSW, Australia.

Keller, J. (1996) *Field Guide to orchids of NSW and Victoria*. University of New South Wales Press, Sydney, Australia.

Klomp, N.I. and Cosgriff, K.M. (1996) *Environmental assessment of the proposed gas pipeline: Rutherglen – Koonoomoo, Victoria.* Charles Sturt University, The Johnstone Centre: Albury NSW.

Maher, P. (1988). Threatened avifauna of New South Wales. *National Parks J.* 32:11-16 **In:** Garnett, S. & Crowley, G. (2000). *Action Plan for Australian Birds.* Environment Australia.

Marchant, S. and Higgins, P. J. (eds) (1993). *Handbook of Australian, New Zealand and Antarctic Birds. Vol. 2. Raptors to Lapwings.* Oxford University Press, Melbourne.

Marchant, S. and Higgins, P.J. (1990) eds. *Handbook of Australian, New Zealand and Antarctic Birds. Volume 1: Ratites to Ducks Part B: Australian Pelican to Ducks*. Oxford University Press, Melbourne.

Marchant, S. and Higgins, P.J. (1990) eds. *Handbook of Australian, New Zealand and Antarctic Birds. Volume 2: Raptors to Lapwings*. Oxford University Press, Melbourne.

Marriott, N. & Marriott, J. (1998) *Grassland Plants of South-Eastern Australia.* Bloomings Books, Victoria.

Maxwell, S., Burbidge, A.A, and Morris, K. (ed.) (1996). *The 1996 Action Plan For Australian marsupials and Monotremes*. Environment Australia.

Menkhorst P.W. (1995). (ed.) *Mammals of Victoria*. Oxford University Press, Melbourne.

Noske, R. A. (1979) Co-existence of three species of Treecreepers in north-east NSW. *Emu* 79:120 – 128.

NPWS 2002. Atlas of NSW Wildlife. NPWS, Hurtsville.

NSW National Parks and Wildlife Service (1999). *Threatened Species Management – Species Information*. Folder. NSW N. S. W. National Parks and Wildlife Service, Hurstville.

NSW National Parks and Wildlife Service (1996). *NSW Comprehensive Regional Assessments: Vertebrate fauna surveys.*

NSW National Parks and Wildlife Service (1996). *Threatened Species of Western New South Wales.* N. S. W. National Parks and Wildlife Service, Hurstville.

Patton, D. C., Carpenter, G. and Sinclair, R. G 1994. A second bird atlas of the Adelaide region. Part 1: changes in the distribution of birds: 1974 – 75 vs 1984 – 85. *South Australian Ornithology.* 31:151 – 193.

Pizzey, G., Knight, F. (1997) *The field guide to the birds of Australia*. Angus & Robertson, Sydney.

Reid, J. W (1999). Threatened and declining birds in the NSW sheep-wheat belt: diagnosis, characteristics and management. Report to NSW NPWS, Sydney.

Robinson, D. 1993. Vale Toolern Vale: the loss of our woodland birds. *Wingspan* (March):1 – 4).

Robinson, D. and Traill, B. J. (1996). Conserving woodland birds in the wheat and sheep belts of southern Australia. *RAOU Conservation Statement* 10.

Robinson, M. (1998) *A Field Guide to frogs of Australia*. Australian Museum/Reed Books.

Schodde, R. and Mason, I.J. (1999) *Directory of Australian Birds: Passerines.* CSIRO, Collingwood, Victotia.

Schodde, R. and Tidemann, S.C. (1986). *Readers Digest Complete Book of Australian Birds*. Readers Digest Services Pty Ltd, Surrey Hills.

Simpson, K. & Day, N. (2000) *Field Guide To The Birds Of Australia.* Penguin Books, Australia.

Smith, P.J., Smith, J.E., Pressey, R.L., and Whish, G.L. (1995). Birds of Particular Conservation Concern in the Western Division of New South wales: Distribution, Habitats and threats. NPWS, Hurtsville.

Stelling, F. (ed) (1998). *Revegetation Guide for Holbrook, Hume and Urana Districts*. Murray Catchment Management Committee and Department of Land and Water Conservation, Albury.

Stelling, F. (1996) *Roadside Vegetation Assessment and Management Guidelines,* Olympic Highway Committee.

Strahan, R. (1995) *The Mammals of Australia*. Reed Books, Chatswood.

Taylor, M. and COG (1992). *Birds of the Australian Capital Territory: an atlas.* Canberra Ornithologists Club and Natioanl Capital Planning Authority, Canberra.

Trail, B. J and Duncan, S. 2000. Status of birds in the NSW temperate woodlands region. Report to the NSW National Parks and Wildlife Service, Dubbo.

Triggs, B. (1996) *Tracks, Scats and Other Traces: A Field Guide to Australian Mammals*. Oxford University Press. Melbourne.

Tyler, J.T, (1997). *The Action Plan for Australian Frogs.* Environment Australia.

Walters, J., Ford, H. A. and Cooper, C. (1999). The ecological basis of sensitivity to habitat fragmentation: a preliminary assessment. *Biological Conservation*. 90:13 – 20.

APPENDIX D1
GEOTECHNICAL ANALYSIS
Methodology

Stage 1

Field investigation between the 10th and the 13th of February by staff from tda consulting. This encompassed the following:

- Walk over inspection of the sites, topographic and geological interpretations and locating sample sites
- Field techniques and classifications conducted as per AS 1289.3.2.1-1995, AS 1726-1993 & McDonald *et al*, (1990).
- Excavation and soil logging of 14 locations
- Landscape analysis
- Temperatures and pH
- Soil percolation tests at 4 locations
- Water sampling at 8 locations

Stage 2

Investigation and interpretation of relevant data and information of the sample area.

- Research on the history of land use and environmental characteristics of the greater Tumut area. Including past studies implemented and relevant legislation.
- Discussions were carried out with all stakeholders in the proposed re-zoning:
    - Tumut Council
    - John Bellet (Industrial waste disposal site owner)
    - Environment Protection Authority
    - Department of Land and Water Conservation
    - State Forests
    - Landholders
    - Representatives from present timber industry activities

Stage 3

Laboratory Analysis of Samples

Water Analysis:

- Total dissolved solids (mg/L, P.P.M)
- Electrical conductivity ($\mu S/cm^2$)
- pH (0.00-14.00)
- Temperatures (0-100°C)

Soil Analysis:

- Emerson aggregate index
- Plasticity
- General chemical suite
- Particle size analysis

Standards & legislation

tda environmental consulting have explored all relevant legislative and standard based requirements in the generation of the following geo-technical report. A full list of standards, previous studies and relevant statutes is listed in Appendix D2.

APPENDIX D2
GEOTECHNICAL ANALYSIS
References

Legislation:

Environmental Planning and Assessment Act 1979

Contaminated Land Management Act 1997

A Proposal for updated and consolidated water management legislation for NSW, A White Paper, December 1999

Australian Water Quality Guidlines for Fresh Water and Marine Waters (1992). Australian and New Zealand Environmental and Conservation Council (ANZECC)

Australian and New Zealand Guidlines for the Assessment and Management of Contaminated Sites (1992) ANZECC.

Tumut Local Environment Plan 1990

Standards:

- AS 1726-1993 Geotechnical Site Investigations

- AS 1289.3.8.1-1997 Soil classification tests, Emerson Class

- AS 1289.3.2.1-1995 Determination of the plastic limit of a soil

Previous Studies:

- *Summary Site Audit Report, Tumut Site*. Egis Consulting, commisioned by State Rail Authority of NSW, January 2000.

- Bellet's auditing (Lane consulting)

Other:

- Mcdonald, R.C., Isbell, R.F., Speight, J.G., Walker, J and Hopkins, M.S. 1990. *Australian Soil and Land Survey Field Handbook*, Inkata Press, Melbourne.

- Central Mapping Authority, Tumut Sheet 1:25,000

APPENDIX D3
GEOTECHNICAL ANALYSIS
Soil survey results

Area	Site #	East/North (GR)	Temp °C	Landform Description	Erosion Hazard	Soil Horizons	Depths (cm)	Sample	Comments
1A	1	09709360 265m	16.8	Very Gentle NW Slope, pasture land, no trees	Low	A: Sandy clay loam B: Higher clay content, darker red colour with depth	0-6cm 7cm-down (55cm)		- Location of Percolation test
1B	2	09209310 268m	19.6	Pastureland, with few trees on the primary terrace of the Gilmore Creek channel, drops down (west) to small open channel	Moderate	A: Organic topsoil B: Clay loam with small poorly sorted gravel particles increasing in size and abundance with depth	0-5cm 6cm-down (57cm)	Yes Yes	- Photo taken of soil profile in immediate area
1B	6	08499248 268m	21.7	Pastureland, on the floodplain of the Gilmore Creek, small stream channel, with boggy marsh area and small dams, occasional large trees	Moderate	Topsoil A: Friable with high silt content, and low plasticity. 10% sub angular gravel clasts B: Light texture, with organic compounds, roots etc C: High clay content, deep red colour	0-6cm 7-50cm 51-70cm 71cm-down (84cm)	Yes Yes Yes	
2	7	07709175 285m	24.3	Gentle NW slope, pasture land grazed moderately, no trees	Low	Topsoil A: Very dry (rain previous night), homogenic unit, with low plasticity, fine clay loam	0-4cm 5cm-down (45cm)	Yes	- Comparatively hard auger work, very dense soil - Percolation test
2	8	07809177 282m		Drainage depression trending WNW, 100m form site 7	Low	A: Organic topsoil, fine grained silt, with minor clay component B: Light coloured heavy clay, with gravel clasts, up to	0-25cm 26cm-down (55cm)		- Not necessarily indicative of local soil profile, much of the silt is from upslope mass movement processes

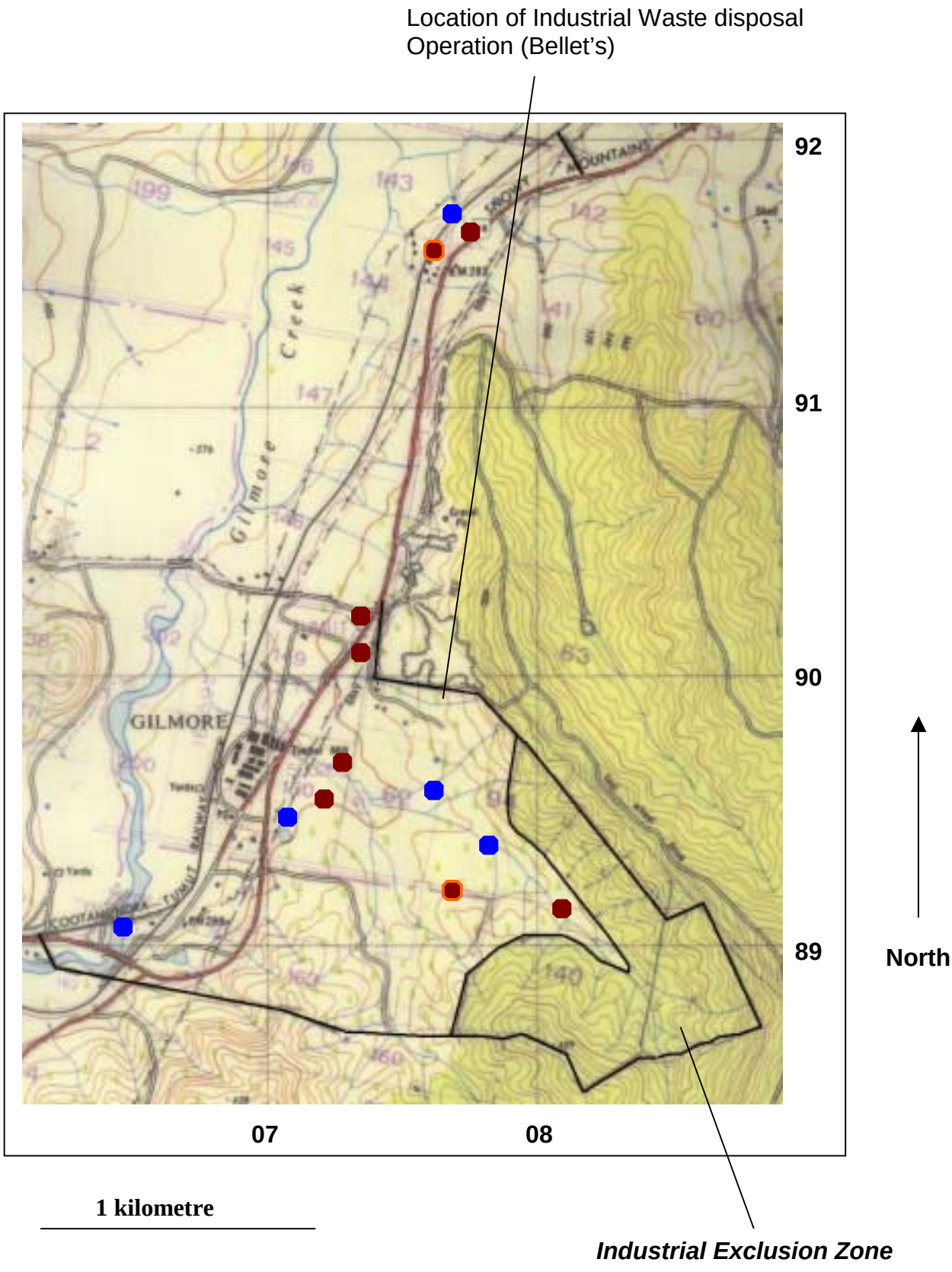
						10mm, texture contrast, with A horiz.			

Area	Site #	East/North (GR)	Soil Temp	Landform Description	Erosion Hazard	Soil Horizons	Depths (cm)	Sample	Comments
2	9	07359012 305m		Roadside excavation profile, outcrop of bedrock, and saprolite easily distinguished	N/A	Topsoil A: Clay layer with component of gravel towards the bottom, mild bioturbation B: Saprolitic representation of mudrock	0-5cm 6-79cm 80cm-down		- Outcrop of mudrock/fine grained siltstone at road level
2	10	07409012 308m	21.2	Base of steeply sloping medium timbered area, adjacent to Bellet's operation, very gentle W slope	Low	A: Rich Organic topsoil layer, with angular gravel component B: Light clay, with similar gravel, angular and poorly sorted C: Saprolite	0-12cm 13-40cm 41-down (55)	Yes Yes Yes	
2	11	07228961 293m		Severe gully erosion, through open paddock, with minimal vegetation along channel banks, trees have been cleared, in contrast to further up the channel course	High	A: Fine grained silt loam B: Clay loam with high plasticity C: Stone layer with varying clast size up to 10cm, angular	0-35cm 36-90cm 91cm-down (1.5metres)		-The stone layer provides a very clear fabric contrast to the clay loam above, possible glacial till, basal layer
2	16	07708935 325m	25.5	Upslope of re-vegetated channel, gently inclined to the NW, Undulating low hills, medium timber	Moderate	A: Fine grained silt loam, with fine gravel particles, increasing in size with	0-45cm	Yes	- Homogeneous composition, with no clear horizons, possible increase in clay content with depth - Percolation test

NB: Erosion hazard is a site determination value; on a scale from low, moderate, medium to high

APPENDIX D4
GEOTECHNICAL ANALYSIS
Map of test sites

Map of Area 2 *(Key as above)*



APPENDIX E
REFERENCES

- *Industrial Lands Study* (Issues and Options Paper) 1998 – Synetics, Canberra
- *Industrial Lands Study* (Recommendations Report) 1998 – Synetics, Canberra
- *Tumut Shire Rural Local Environmental Study and Urban Strategy*, 1988 – Tumut Shire Council
- *Industrial Development Development Control Plan No 6* – Tumut Shire Council
- *Tumut and Indusry – The Future for Industrial Land Development* – A Planning Directions Study for Tumut Shire Council, Dec 2000 (including appendices) by Community Development Initiatives Pty Ltd, Wagga Wagga
- *Tunut Local Environmental Plan*