EIS 1122

AB019873

Proposed forestry operation : Kempsey/Wauchope management area : environmental impact assessment

Proposed
Forestry
Operation

ENVIRONMENTAL IMPACT ASSESSMENT

DEPARTMENT OF PLANNING

Kempsey/ Wauchope

MANAGEMENT AREA

Printed February 1994
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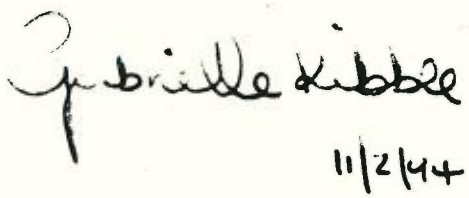
FOREWORD

State Forests of NSW propose to continue management of forestry operations in the Kempsey/Wauchope Management Area. The proposed forestry operations constitute an activity in terms of Section 110 of the Environmental Planning and Assessment Act, 1979 (EP&A Act). As the activity is likely to significantly affect the environment, an environmental impact statement (EIS) is required in accordance with Section 112 of the EP&A Act.

The Timber Industry (Interim Protection) Act, 1992 (TI(IP) Act) suspends Part 5 of the EP&A Act for areas listed in Schedule 4 of the TI(IP) Act, which includes significant portions of the Kempsey/Wauchope Management Area, to allow logging to continue while an EIS was obtained. For the balance of the forest areas within the Management Area a moratorium was placed on logging operations until a determination on those operations is made.

Section 9 of the TI(IP) Act provides for the Minister for Planning to be the determining authority in respect of logging operations within the Kempsey/Wauchope Management Area. The Act also provides that, notwithstanding the suspension of Part 5 of the EP&A Act, an EIS shall be obtained and displayed in accordance with Part 5 of the EP&A Act.

This report has been prepared in accordance with Section 9 of the TI(IP) Act which provides that the Minister, prior to making any determination in respect of logging operations, is to obtain a report from the Director of Planning. The Director's report must include an examination of the EIS, the public representations submitted in response to the EIS and any submissions from State Forests of NSW.



11/2/94

G. Kibble
Director of Planning

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1. INTRODUCTION

1.1 Nature of the Proposed Activity

State Forests of New South Wales propose to continue forestry operations in the Kempsey/Wauchope Management Areas (K/WMA) which are located mainly within the Local Government Areas of Hastings and Kempsey with the balance being in the Local Government Areas of Walcha, Nambucca and Dumaresq. The proposal applies to 207,887 ha of State Forests and 93,372 ha of other Crown-timber lands within the Management Area.

1.2 The Preparation and Display of the Environmental Impact Statement

In a letter dated 10 February, 1992 the Forestry Commission wrote to the Director of the Department of Planning and, pursuant to Clause 58(1) of the Environmental Planning and Assessment Regulation (1980), sought advice on the Director's requirements as to the form and content of an environmental impact statement for the proposed activity. Advice on the Director's requirements was forwarded to the Forestry Commission in a letter dated 2 April, 1992. This letter is reproduced in Appendix 1 of this report.

The EIS included a certificate signed by the Director of Truyard Pty Ltd (the consultants who prepared the EIS), Noel Anthony Corkery, stating that the EIS was prepared in accordance with Clauses 57 and 58 of the Environmental Planning and Assessment Regulation, 1980. Display of the EIS, in accordance with the provisions of the EP&A Act and Regulations, occurred initially for the period 14 July, 1993 to 8 September, 1993 at the following locations.

NSW Government Information Centre
Goodsell Building
Hunter Street
SYDNEY 2000

Department of Planning
Publications Desk, Remington Centre
175 Liverpool Street
SYDNEY 2000

NSW Environment Centre
39 George Street
SYDNEY 2000

Forestry Commission of NSW
Head Office, Building 2
473 Pennant Hills Road
PENNANT HILLS 2120

Central Regional Office
Forestry Commission of NSW
Oxley County Council Building
Stokes Avenue
TAREE 2430

Department of Planning
Hunter & Central Coast Regions (Newcastle)
20 Auckland Street
NEWCASTLE 2300

Department of Planning
Northern Region (Grafton)
49 Victoria Street
grafton 2460

National Parks & Wildlife Service
Level 1
43 Bridge Street
HURSTVILLE 2220

Northern Regional Office
National Parks & Wildlife Service
49 Victoria Street
GRAFTON 2460

Nambucca Council
Princess Street
MACKSVILLE 2447

Forestry Commission of NSW
Maher Street
WAUCHOPE 2446

Forestry Commission of NSW
31 Elbow Street
WEST KEMPSEY 2440

Port Macquarie District
National Parks and Wildlife Service
Roto House
Roto Place (off Lord Street)
PORT MACQUARIE 2444

National Parks and Wildlife Service
Cadman's Cottage
110 George Street
The Rocks, SYDNEY 2000

Hastings Council
Burrawan St (Corner Lord St)
PORT MACQUARIE 2444
and
5A High Street
WAUCHOPE 2446

Kempsey Council
Civic Centre
Cnr Tozer and Elbow Streets
WEST KEMPSEY 2440

Walcha Council
Hamilton Street
WALCHA 2354

Dumaresq Council
215 Beardy Street
ARMIDALE 2350

This public exhibition was extended to 13 October, 1993 to enable public consideration of amendments to Maps 6, 7 and 16 in the EIS. Additional information on the Yellow-eyed Cuckoo-Shrike and Stephens Banded Snake was also exhibited.

Advertisements indicating the public display were published in the Sydney Morning Herald on 14 and 31 July and on 3 September, in the Port Macquarie News on 16 and 30 July and 8 September, in the Macleay Argus 16 and 30 July and 10 September and in the Hastings Gazette on 15 and 29 July (extension not publicised in this paper).

The advertisement invited written submissions with respect to the activity proposed in the EIS from any person. Submissions received after close of public exhibition were accepted. The Forestry Commission forwarded copies of all submissions received to the Department of Planning.

During the period that the EIS was on public exhibition the Forestry Commission began trading as State Forests of NSW.

2.0 SUMMARY OF SUBMISSIONS

2.1 Introduction

166 submissions were received in response to the public display of the EIS, including one petition. Twelve submissions were received from government authorities or instrumentalities (including two from councils), fifteen from environmental groups, including the one petition, nine from the Timber Industry, six from other businesses, one from a four wheel drive club, one from a regional development board, one from a Chamber of Commerce and a total of 121 submissions from individuals.

The one petition received (12 signatures), supports the inclusion of Threadneedle Gorge into the Oxley - Wild Rivers National Park. Of the 121 submissions received from individuals, 95 are in the format of pro forma letters, these divide into two separate pro forma submissions, one stating that any reduction in sawlog quotas should be evenly distributed across the current mill quotas for the management areas (70 signed submissions). The second proforma offers support for alternative 1 (continuation of the 1988 plan of management) and the Kempsey Timbers submission to the public exhibition (25 signed submissions from Kempsey Timbers employees).

The majority of submissions (excluding the pro forma letter regarding sawlog quotas) are opposed to the EIS proposal for either environmental or economic reasons. Excluding the submissions received from government authorities and instrumentalities and the petition, 8 submissions support the EIS proposal and 68 oppose the proposal, 42 on economic grounds (including the 25 pro forma submissions from Kempsey Timbers employees) and 26 for environmental reasons. 74 submissions are impartial (including the 70 pro forma submissions regarding sawlog quotas).

2.2 Government Authorities and Instrumentalities

A total of 12 submissions were received from government agencies and instrumentalities commenting on the EIS. This sub-section gives a summary of the major issues raised in each submission.

2.2.1 Australian Museum

The Australian Museum identifies a number of concerns with the EIS, these are detailed below under separate sections.

EIS

The Museum criticises a number of aspects of the EIS. It considers that the EIS made poor use of available information concerning the biology of wildlife species and the impacts on these species from forestry operations. Specifically, the Museum considers that the information used for rarer species is insufficient. The EIS focuses overly on the potential impacts of logging and does not adequately address grazing, beekeeping or fire management.

The EIS fails to adequately identify and assess the potential and likely environmental impacts of the proposed Forestry activities. The submission suggests that while the

species richness of plots between logged and unlogged is the same, the actual community composition of Schedule 12 species is significantly different.

Fauna Survey

The Museum's major criticisms of the fauna survey are listed below:

. Survey design is inappropriate, attempting to assess too many faunal species over too large an area. This design makes it difficult to isolate forestry activities as a source of impact.

. More attention should be given to intensive survey for rare species and the impacts of grazing, fire management and beekeeping.

. Field methods are inadequate to survey all species likely to be present, e.g., the lack of detected presence of important reptile and amphibian habitat.

. The limitations of the avifauna study are not allowed for in the conclusions drawn.

. Literature reviews on rare species are inadequate.

Statistical Analysis

The Museum considers that the statistical procedures are inappropriate as it is only possible to detect significant effects on a very broad scale. It is therefore invalid to draw the conclusion that no significant effects on fauna populations occur from logging since this may only be a reflection of the unsuitable analysis used.

Archaeological AssessmentStatistical Analysis

The survey work is considered extensive and thorough. The Museum submission states support for the EIS proposals that the recorded sites require management and that forestry activities will have an impact on archaeological sites.

The museum considers management recommendations to be inadequate in that they do not explicitly protect sites from destruction but rather state "that forestry activities should be avoided where possible in the vicinity of these sites".

Further work needs to be undertaken to determine if currently reserved sites, in fauna and flora reservations, are sufficient to be representative of archaeological resources or if further areas need to be set aside.

2.2.2 Environment Protection Authority

The EPA considers that the EIS provides limited information for assessment of a number of areas, these are discussed seperately below.

Water Quality

The EIS provides insufficient detail on existing water quality to allow full assessment of potential impacts. The description needs to be expanded to include parameters such as sediment loading, particle size distribution and nutrient distribution. It is suggested that a monitoring program of a minimum 1 to 2 year duration is required to provide meaningful baseline data covering a reasonable range of event conditions with a complete range of seasons.

The EIS use of "research catchments" needs to be carefully evaluated to ensure that catchments used in comparisons are sufficiently similar to those in question to justify their use. If research catchments are different then it should be demonstrated why these differences are not important.

Hydrology

Hydrological monitoring is not included in the monitoring and research program proposed by the EIS.

Discussion of potential impacts of road construction suggests that in the research forests impacts are low due to low soil erodibility. In the discussion of the K/WMA the EIS does not address the potential for increased runoff from roads impacting on stability of drainage lines or the potential impact of new roads in steep terrain where the erosion hazard may, in fact, be high.

Sedimentation

The statement in the EIS that the return of turbidity levels to pre-logged state within 2 - 3 years is not sufficient, as is suggested, to disregard this potential impact. Two years can be regarded as a significant period ecologically and this claim over-simplifies the potential ecological damage that may occur in this time.

Application of SEMGL as a minimum requirement is supported.

Soils

The soil survey as it stands, based on geological boundaries, is not sufficient to determine where additional information may be required or to inform managers in assessing whether more stringent SEMGL are desirable for specific areas.

The disagreement between the consultants and CaLM regarding the SEMGL and the application of the universal soil loss equation to determine erosion hazards, needs to be resolved. The EPA submission states that there should also be resolution of this problem between State Forests of NSW and CaLM so that an agreed position for future EISs can be reached.

Nutrient Loads

The EIS discussion of impacts from logging operations on nutrient loads is qualitative and general, it does not offer clear indications of any potential impacts.

There is no mention in the EIS of the potential need for substantial run-off controls such as detention or sediment basins to manage soil losses and potential increases in discharge around active logging areas. These controls may be suitable in some circumstances.

Aquatic Ecosystem

It appears that no attempt is made to assess the impacts of operations on aquatic communities. There is no data or discussion provided on aquatic organisms such as amphibians or macroinvertebrates.

Licensing

A significant feature of the licensing approach currently being formulated by the EPA, is a requirement for water quality monitoring be carried out. EPA considers it disappointing that the EIS makes no reference to water quality monitoring and includes little meaningful assessment of existing water quality.

Economic Assessment

Although the economic significance of the forestry and timber industry to the Management Areas is discussed, no attempt is made to provide any environmental economic justification for the proposed activity. It is suggested that an environmental Cost Benefit Analysis be included to allow a decision to be made on the economic desirability of using forest resources for timber production as opposed to alternative uses.

The possible benefits of not proceeding or using alternatives involving less logging are not adequately evaluated.

Conclusion

In summation, the EPA considers that given the lack of meaningful data on existing water quality and the virtual total lack of data or impact assessment on aquatic ecosystems, it is not possible to conclude from the EIS that the impact of the proposed activities on either water quality or the aquatic ecosystems, is either known or can be adequately predicted.

2.2.3 Public Works Department

The Public Works submission details concerns in two main areas that involve its direct management.

Estuary Management

Concern is expressed over the impact of logging operations in close proximity to estuaries in regard to sedimentation, erosion and water quality. The submission states that safeguards should be enforced to minimise adverse affects.

Flood Plain Management

Public Works recognises that the EIS indicates that there is potential for logging to result in local increases to run-off. In view of this it may be necessary for the Commission to determine the impact of any run-off changes to flood behaviour.

2.2.4 Hastings Council

The Hastings Council submission deals with proposed fire regimes and management implications for the area. These are summarised below.

. It is considered that the EIS does not adequately address fire control and management in forest areas.

. Hazard reduction burning is not addressed adequately, the document makes no attempt to address the resources required or the Commission's ability to meet these requirements.

. The intensity of roading available for fire fighting should be addressed.

. Fire management for proposed conservation areas is not addressed.

. The relationship between grazing activity and the frequency of wildfires should be addressed in more detail.

. The ability of the Commission to resource fire fighting areas needs to be addressed in view of the reliance in the 1991/92 season on outside assistance.

2.2.5 Kempsey Council

The submission by Kempsey Council fundamentally opposes the loss of any jobs in the Kempsey Shire as a result of decreasing sawlog quotas. There is also a doubt expressed over the need to replace the SEMCLs with the SEMGLs. The submission states that should SEMGL be introduced the Forest Products Association estimate a 15 - 20% resource reduction and local foresters estimate a 28 - 33% reduction. A request is made for a full Cost Benefit Analysis of SEMGLs before their introduction.

The submission states that the EIS does not fully address the economic importance of "value adding" operations that are currently occurring and so undermines confidence for further investment.

The information provided in the EIS regarding the distribution and abundance of flora and fauna in National Parks, Nature Reserves and Wilderness areas is not assessed and so it is considered by Kempsey Council to be unfair to remove resources from forest industries on the basis that flora and fauna conservation is required in State Forests.

The Kempsey Council submission concludes that the EIS process should be reviewed and modified to give proper emphasis to resource utilisation and effective job creation and protection.

2.2.6 Department of Bushfire Services

This submission directs its attention primarily to the fact that fuel reduction burning will be excluded from conservation reserves unless assessment confirms the desirability from a conservation perspective. It considers that in light of this statement that conservation concerns will override the need for fuel reduction burning to ensure the protection of life and property in areas surrounding reserves.

Concern is also expressed that this may lead to a precedent for other Forest Management Areas.

It is the opinion of the Department of Bushfire Services that the EIS needs to take into account the Co-ordinating Committee fuel management policy. If management strategies such as fuel reduction burning are not to be undertaken within reserves on conservation grounds, the EIS needs to ensure protection of the surrounding community from the effects of wildfire.

2.2.7 Department of Water Resources

The Department of Water Resources addresses a number of matters which are detailed in the sections below.

Water Quality

The Department considers that further information is required to adequately predict impacts on water quality for downstream users from State forests. Some of the aspects that require addressing are: pH, temperature, BoD, salinity, suspended solids, conductivity, changes to canopy cover, surface run-off and wind erosion.

Yield

The current hydrology report is adequate but the modelling of yield and other hydrological parameters is a possibility that should be seriously considered.

Harvesting

The Department is very concerned with the proposal to log in wet weather as this is considered high risk in terms of potential soil loss.

Since harvesting is now occurring in high velocity upper mountain catchments, high stream flows quickly move any and all sediment loads downstream, this problem should be addressed.

Post Logging Burning

Water Resources is very concerned over the proposal to burn compartments after logging, this will substantially reduce the ability of remaining cover to filter water to retain nutrients, sediments or potentially harmful elements.

Road Construction

The Department would prefer minimal disturbance of riparian vegetation and further state that a management plan should be provided for all sediment control structures.

Grazing

Consideration should be given to the control of grazing in order to reduce this activity's impact on the catchment.

2.2.8 Department of Mineral Resources

The submission states that it is generally satisfied with the EIS as proposed.

The Department does however express concern over the possible proscription of mineral exploration and mining from the proposed flora and conservation reserves. The Department states that if these activities are proscribed then it would need to assess the proposed flora and conservation reserves on an individual basis.

This submission also states that such proscription would be unnecessary since the Mining Act already provides that mining leases can only be granted over Forestry Commission land with the consent of the commission.

2.2.9 Chamber of Mines, Metals and Extractive Industries

This submission states that the EIS is well prepared and provides a detailed picture of the forest resources and proposed future management. Criticism is focused on the reports failure to examine the detailed geology, mineral potential or mining history of the area.

The submission outlines mining history and considers that there is a high probability that the area will be subject to future mineral exploration for economic ore deposits. The point is also raised that the exploration may, in fact, be successful and there may be a need to allow for the development of mines in the area. A further matter raised is that as a result of previous mining and farming activities, Lantana has spread through previously logged areas and up associated streams and drainages and it may now be uncontrollable in some localities.

2.2.10 State Development

This submission outlines the discussion of a recent meeting of the Mid North Coast Regional Development Board and their objection to any possible reduction in timber resource as a result of the EIS determination. The board also strongly supports continuation and expansion of the local timber industry, highlighting that any reductions in sawlog quotas will severely impact on the local economy.

2.2.11 Department of Conservation and Land Management

The CaLM submission is an extremely detailed document that encompasses a broad range of issues regarding the Kempsey/Wauchope Management Area EIS and its

assessment of the 'Soil Environment'. The following summary, divided into various biophysical and forest management aspects, is not intended to fully cover all issues raised. Rather, it attempts to recognise and outline the major concerns expressed by CaLM. The submission also contains detailed appendices which comment on various technical aspects of the EIS and its supporting appendices (i.e. the Soils Survey, New Roads and Hydrology Reports).

Biophysical Environment

CaLM considers that the EIS does not comprehensively address many biophysical aspects. It is CaLM's view that the EIS requires greater definition in the understanding of long term landscape dynamics on the interaction of critical natural elements when subjected to a range of forest land management operations.

Soil

CaLM considers that the application of the methodology and the interpretation of data could be more fully developed. According to CaLM, the most significant impacts of harvesting operations on the soil environment are soil erosion and sedimentation and therefore these should be given a higher priority in the EIS. The sensitivity of current and alternative logging practices in causing physical disturbance on different terrain and soils should be considered.

The Soils Survey is criticized by CaLM on the basis of: the low intensity of sampling, the reliance on geology and superseded geological maps, the lack of consideration of soil formation processes (geology, climate, geomorphology and vegetation), the lack of sampling steep terrain, the incomplete soil profile descriptions, and minimal interpretation of the data collected. The Soil Survey Report (Appendix I of the EIS) is also of concern to CaLM as the report criticises the CaLM Soil Landscape Unit Mapping which has been conducted over a third of the Study Area. The CaLM submission refutes the EIS's criticism of the soil landscape mapping giving detailed reasons to support the CaLM mapping.

CaLM notes that the EIS views the Standard Erosion Mitigation Guidelines for Logging (SEMGL) as an impediment to economic production rather than as a practical conservation based measure to minimise environmental impacts. The claims regarding the resource reduction as a result of the SEMGL being implemented, must be substantiated. In relation to the Soil Survey Report's criticism of the use of the Universal Soil Loss Equation (USLE) in the SEMGL, the submission from CaLM provides extensive reasons to support the use of this tool for forestry purposes in NSW.

Hydrology

CaLM considers that the Hydrology Report consists of many superficial descriptions and does not adequately address the hydrological environment of the K/WMA, nor the impact of the proposed operations on that environment. CaLM notes that resource information is presented with little or no analysis, interpretation or assessment of the implications for the hydrologic environment. The submission explains that little attempt is made to interpret water quality and address water utilization issues. The effects of the proposed roading program must be effectively evaluated and discussed in

terms of its impact on sub-catchment hydrology as the increased run-off resulting from harvesting may have a significant impact on stream bank and bed erosion downstream. The Wilson River is particularly mentioned in this regard.

Geology

The geology section, in CaLM's view, provides a brief description of the existing environment and therefore gives limited recognition of the significance of this fundamental resource. CaLM also states that there is no attempt made to identify areas of potential geological hazard such as areas prone to landslip.

Landform

According to CaLM, the EIS would be much improved if it had included genuine landform maps of a usable scale whereby slope and terrain units could be delineated.

Climate

CaLM considers that the 'sub-tropical' features of climate (i.e. the episodic nature of the rainfall) need to be specifically discussed in relation to the effect of logging on the soil environment. In this regard soil erosion hazard and physical hydrology are of particular interest.

Conservation Area

In relation to the EIS's conservation strategy, CaLM comments that the reserves are small, often surrounded by logged forest or poor quality connections, are not representative of the regional forest types and contain significant areas of disturbed forest.

Bio-Diversity

The CaLM submission notes that the EIS fails to make any reference to soil conservation as an integral element of achieving or maintaining biological diversity.

Forest Management Aspects

Harvesting Plans

CaLM considers that the EIS could have provided a more full and descriptive explanation of how harvesting plans will be prepared. In this regard, the process and methodology used to prepare the plan and derive the limitations and constraints to logging operations, should be explained.

Road Construction and Maintenance

CaLM recognises that roading creates the greatest potential for soil erosion and sedimentation in forest operations. There is also concern that the terms 'Major Roads' and 'Minor Roads' are not defined in the EIS. It is CaLM's view that unless these terms can be equated with the scale of disturbance, their use in the EIS is unclear.

CaLM states that without adequate environmental survey and effective design and a standard adoption of maintenance and revegetation techniques, then road construction for logging poses an extremely high risk for soil erosion and sedimentation.

CaLM considers that Appendix C (Proposed Roading) of the EIS is limited by the following:

. the effect of geology, the potential for mass movement, and the impact on road construction;

. mapping at an inappropriate scale to identify slope and terrain to determine potential erosion hazard and the method of road construction, and road location;

. inadequate soil information to help determine the effect of construction or soil stability;

. lack of information regarding revegetation techniques or structural earthworks required to ensure road stability;

. no identification of known mass movement areas nor engineering designs or stabilisation techniques proposed;

. lack of site specific conditions;

. lack of erosion hazard mapping;

. lack of detail regarding location and design of snig tracks and other temporary logging roads.

Fire Management

CaLM notes that nutrients in ash can be lost through soil erosion, but considers that this should be minimised by restricting post-logging burns to periods of lowest erosivity. CaLM regards filter strips and protection strips as an integral part of erosion and sediment control strategy and emphasises the importance of not burning these areas during post-logging or hazard reduction burns. The post harvest burning section of the EIS would benefit from further explanation.

Forest Operations

In the opinion of CaLM the EIS would be improved by more specific information on the following:

. the revision of plans of management;

. supervision to comply with harvesting plans;

. guidelines for assessing environmental impacts at a local level;

. how SEMGL will be applied to all harvesting and road construction;

. how the Commission will monitor the implementation and compliance with the sediment and erosion control strategy and its effectiveness in controlling erosion:

Application of the SEMGL

CaLM acknowledges that so long as there is a rigorous, systematic and very strong commitment to the application of the SEMGL and to the preparation of holistic and detailed harvest plans, followed by a strong monitoring program commensurate with detailed staff training and technology transfer program, the major areas of its concern can be alleviated.

2.2.12 National Parks and Wildlife Service

The comprehensive submission of the Service outlines a broad range of concerns relating primarily to the Fauna and Flora Surveys and the proposed Conservation Strategy. The submission also deals with Aboriginal Cultural Heritage, wilderness areas, old growth and world heritage. The Service also makes a series of recommendations regarding various ecological attributes.

The submission highlights the need for a comprehensive regional overview for both conservation of biodiversity and forestry operations so that decisions can be based on rational and scientific information. The submission also provides improved natural and cultural heritage management guidelines for implementation in logging areas. It also states that the conservation strategy should be responsive to changes in knowledge and circumstances.

The following sub-sections deal with the major concerns raised in the Service's submission.

Flora Survey

Sampling Strategy

Based on the sampling intensity it would appear that the EIS may not provide an adequate description of variation in the vegetation. As a result of the limited number of survey sites, the Flora Survey fails to survey many forest types, the Service submission lists a number of vegetation associations not recorded in the Flora Survey but expected to occur. It also states that provision of a species list would be useful.

Forest Typing

The proposed conservation strategy does not include representative samples of each Forest Type in a logged or unlogged condition, as it claims to do. The Service considers that a number of floristic communities occur within some of the mapped Forest Types.

Significant Plants

The EIS definition of significant plant species is considered to be narrow and the Service lists 17 additional significant species found in the K/WMA and nearby areas. The NPWS considers that all populations of endangered, vulnerable and unknown status (K) plant species should be the subject of specific surveys and known populations mapped and reserved. This submission lists a number of species requiring attention.

Assessment of Impacts

The EIS and the Flora Survey report acknowledge that there is a fundamental problem with the analysis of the impacts of logging, that is, there is no information on the floristic composition of logged plots prior to logging. Consequently, substantial differences in site factors other than logging history may exist between previously logged and unlogged areas. The Service also considers that the intensity of sampling was too low to determine whether logging had any significant impact for the majority of species.

The EIS's claim that lantana appears to have little effect on floristic richness, is disputed by the Service.

Mitigation of Impacts

The conservation strategy does not include all Forest Types in the Management Areas nor does the strategy appear to be based on unlogged forest. The Service lists an extensive series of Forest Types that are mentioned in either the EIS or the Flora Survey Report and that are considered by Hager and Benson (1992) to be inadequately reserved and that have less than 10% of their area in the K/WMA reserved under the proposed Conservation Strategy.

Rainforests

The Service's submission disputes claims in the EIS that rainforests do not generally support wildfires and highlights possible impacts of fragmentation of rainforest due to roading. It considers that the EIS inadequately addresses the protection of rainforests. Specifically, statements made in the EIS are misleading and the special provisions to be included in Harvesting Plans for hardwood areas to protect adjoining rainforests during harvesting are not detailed enough to provide guidance to foresters.

It is suggested that a Management Plan should be prepared to outline the need for and how to determine adequate buffers around rainforest, protection of rainforest from damage by fire, particularly fuel-reduction burning and a program of rainforest condition assessment. A series of recommendations relating to rainforest protection and reservation are included.

Fauna Survey

NPWS considers that the coverage of the fauna surveys in the K/WMA is inadequate. The area is much less intensively sampled than other areas for which fauna surveys

have been recently undertaken. The range of survey techniques used for different faunal groups is insufficient to establish the presence of many frogs, reptiles and Schedule 12 species. Further information should be provided including the species targeted, the number of sites sampled, the number of trap nights, the location of sites (Australian Map Grid References) and description of habitats sampled.

The NPWS considers that many of the conclusions drawn regarding the impact of the proposed activity are invalid. The survey design is incapable of determining the potential effects of logging on fauna for several reasons. These include that for logged and unlogged plots, differences in site factors other than logging history such as geology, topographic position, elevation and rainfall may effect results. Other factors limiting validity of results are: small sample size; presence of mobile fauna moving from unlogged to logged plots while in transit; incorrect procedures being used for comparison of arboreal mammal abundance in logged and unlogged habitats. Conclusions presented in the EIS on the effects of logging on fauna are inconsistent and not supported by the survey results, e.g. impacts on herpetofauna.

Species Coverage

The NPWS comments that the EIS does not include all fauna species known or likely to occur in the K/WMA. The submission lists 25 species of birds, including six Schedule 12 species, that are not listed but are expected to occur.

Two Schedule 12 species of bats are not listed that are expected to occur and the Service also expresses concern that reported sightings of the Eastern Quoll, from the Carrai Plateau, have not been referenced. The EIS does not list all the species of frog that are likely to occur or are known to occur in the area. Ten species are listed that are omitted from the EIS, two of which are listed on Schedule 12. The species list for reptiles is completely from the literature, however, NPWS Wildlife Atlas and Australian Museum records identify an additional ten species of reptiles listed as likely to occur. The Service's submission also lists five species of reptiles and seven species of frog that while not listed on Schedule 12, do not receive adequate consideration in the EIS.

Areas of High Habitat Value/Refugia for Fauna

The Service considers that the identification of areas of high fauna value and habitat diversity is inadequately addressed in the EIS. Specifically the EIS fails to identify the high conservation significance, at State and Regional level, of the Willi Willi caves as maternity colonies for both species of Bent-wing Bat. The EIS also fails to identify areas of high habitat value for herpetofauna. For five of the Schedule 12 frogs there are no specific surveys to identify preferred habitat or breeding sites.

Thinning Operations

The NPWS notes that the EIS does not consider the impact of thinning on fauna and fauna habitat in any way, either by literature review, survey of structurally altered forest or by ecological interpretation. This is a significant omission given the extensive area of forest to be affected.

Non-flying Mammals

The EIS's conclusion that there is no significant difference in mammal species' richness or abundance between logged and unlogged forests is not supported by Fauna Survey results. The following impacts are not determined or given consideration in the EIS: the potential population or density changes resulting from the proposal; the potential impact of the proposal on hollow-dependent mammals; and the effects of fire on many terrestrial mammal faunas. Habitat tree protection prescriptions are inadequate for maintaining current populations of hollow-dependent fauna, including nine Schedule 12 species. It is recommended that habitat tree retention levels be increased to those specified in the Wingham determination. Detailed impact mitigation should be included for each of the Schedule 12 species.

Bats

The EIS does not provide an adequate evaluation of the potential impacts of forestry on bat species. The statements of impacts on the bat fauna in general and upon particular species is misleading and invalid. The limitations of the survey are not stated in the EIS, these include failure to: take account of species' mobility; identify roost site location in relation to study sites; and establish whether bats are foraging in logged areas or simply in transit to other areas.

The Conservation Strategy and impact mitigation measures proposed in the EIS to conserve viable populations of bat species are based on guess work and are inadequate. This is because the impacts of forestry operations upon bats remain largely unknown, as does the ecological requirements of any bat species. The proposed management prescriptions are grossly inadequate for ensuring the long term survival of the bat fauna, most are either not relevant to bats, cannot be evaluated for bats, or are inadequate for the application of the precautionary principle. A series of considerations are offered as to why the proposed three habitat trees per hectare are inadequate for conservation of viable populations of any bat species. It is stated that it is likely that the average retention rate of hollow bearing trees should be at least two to three times greater than that proposed in the EIS. It is also recommended that a long term monitoring program be undertaken for the bat fauna.

Birds

Although almost all species detected during surveys are recorded in logged and unlogged plots, it is not stated whether logging favours certain open country or edge species or causes a decline in some forest dependent species.

Given the small number of records, the EIS draws unwarranted conclusions on the occurrence of large owls in the various Forest Types according to logging history. The mitigation measures proposed are adequate for maintaining the species' richness and probably the density of the general avifauna community, however, some individual species of the forest interior are likely to be disadvantaged. There is a lack of detail in harvesting prescriptions for either fire management or Schedule 12 species. The Conservation Strategy is unlikely to maintain the conservation status of six Schedule 12 species. Suggested management practices for twelve Schedule 12 species are included to assist short and long term survival.

Herpetofauna

The NPWS consider that the EIS's treatment of the endangered frog fauna and general frog and reptile fauna is superficial. The examination of species at their distributional limits in the area is inadequate and erroneous statements are made in relation to the general ecological requirements and preferred habitats of species. The assessment of impacts on species is unreliable while the specific habitat requirements and refugia for endangered species are not identified. The Fauna Survey for herpetofauna makes no attempt to target rare and cryptic species, its reliance on similarity indices to adjacent areas is disputed, the number of specimens recorded is so low that no statistical comparisons would be valid and the effects of the proposed fire management scheme are not adequately addressed.

No special conservation strategy is proposed for any of the six endangered frog species known in the area, either singularly or grouped. A number of general and site specific management prescriptions are provided for the conservation of frogs. The shortcomings of the present conservation strategy discussed include: that the conservation reserves proposed do not effectively cover the endangered herpetological species; and the proposals are isolated and do not cover prime habitats.

Conservation Strategy

The Service takes issue with the selection of areas to be protected under the conservation strategy. Inadequate field surveys and inadequate utilisation of existing information sources results in a lack of protection for many areas which the strategy claims to protect. The conservation significance of steep and inaccessible areas unsuitable for logging, which will form the basis of the conservation strategy under the proposal, is not adequately assessed. No significant fauna surveys have been conducted in these areas and other attributes such as size, continuity, condition, fire and grazing impacts, are not considered.

The Service considers that representative fauna habitat protection is based primarily on existing flora reserves and inaccessible areas unsuitable for forestry. The Service lists a wide range of criteria commonly used by land managers for assessing the biological significance of potential reserves that are not considered. It is recommended that more information be collected on all these criteria before any old growth logging proceeds. Insufficient information is provided to assess the adequacy of proposed reserves for fauna conservation or to determine whether or not it includes sites of high biodiversity within the K/WMA.

Concern is also expressed that of the 17 existing conservation areas, five are forest preserves not having secure reservation status. Furthermore, of the 18 proposed conservation areas, 11 do not have secure reservation status.

While the Service acknowledges the EIS claim that broadly accepted conservation area criteria are not available, it lists a series of criteria which it considers must be assessed to adequately conserve forest bio-diversity. It also considers that the issue of wilderness and old growth forests should be addressed first in the reserve selection process to achieve the aims of the NFPS.

The regional reservation status, local conservation priorities and adequacy of the proposed conservation areas in K/WMA are analysed in terms of broad "environmental units". The Service's submission provides a detailed assessment of 20 separate 'environmental units' and makes a series of recommendations in view of the results.

Roading

No significant mitigation measures are proposed for reducing roading impacts, other than closing snig tracks and minor roads. Potential impacts may be reduced by allowing more roads to regenerate after logging. Appendix 4 of the submission provides a review of roading and recommends pre-construction surveys.

Feral Animal Control

Details of proposed feral animal management programs are vague and details of control methods are not specified. Specific cat control measures should be outlined as well as monitoring plans for sensitive species.

Monitoring

Details of monitoring procedures and target species should be given. Monitoring is essential to evaluate the reliability of impact predictions and to detect any adverse impacts which cannot be predicted on present limited knowledge. Recommendations to supplement the insufficient treatment in the FIS of specific monitoring programs for endangered species are included in the submission.

Aboriginal Cultural Heritage

The Service's submission considers that the EIS does not clearly present or discuss the recommendations from the Archaeological Survey Report. The failure of the EIS to append the archaeological survey report, or clearly quote its recommendations, reduces the ability to check between the documents. There should be justification for each variation between the archaeological survey report and the EIS, especially in relation to roading proposals.

The EIS places greatest emphasis on the major and minor roading and almost completely fails to address the potential impacts on, and implications for, sites away from roads and log dumps.

The Service includes a number of recommendations relating to further works, including requirements for explaining the divergence between the EIS and the archaeological survey report and a request for details on the training of Forestry Commission staff in identifying archaeological sites.

The Service also states that consideration must be given to creating further reserves where appropriate, if the results of further work indicate that existing reserves or preserves do not contain a representative sample of sites. The Service also objects to the absence of any consideration of cultural heritage conservation in the Conservation Strategy section of the EIS.

Wilderness

The issue of wilderness conservation is poorly addressed by the EIS. The proposed logging and roading will result in a significant degree of modification of the biophysical communities within the identified wilderness areas and could, therefore, have the effect of disqualifying affected forest lands from identification as wilderness and pre-empt a cabinet decision.

The EIS is stated to be misleading and incorrect in that it identifies areas as being substantially roaded and logged, therefore diminishing wilderness value, when they are not in a modified condition. It is also incorrectly stated in the EIS that wilderness declaration will result in potential loss of property and life resulting from severe wildfires. The submission states that active management for bushfire suppression and prescription burning will continue in wilderness areas. The EIS does not consider opportunities for solitude and minimum impact self-reliant recreation.

The impacts on the wilderness proposals, from the modifications proposed in the EIS are sufficiently severe to have the effect of disqualifying affected forest lands from identification as wilderness under the criteria set down in the Wilderness Act. The issue of mitigation of impacts of the proposal on wilderness is not addressed in the EIS in any detail. The EIS fails to consider the requirements of the National Forest Policy Statement (NFPS) in relation to wilderness.

The Service recommends that the order of working be arranged so that the identified wilderness areas are not logged and do not have roads constructed in them until further assessment of conservation values in the north east region consistent with NFPS and the National Wilderness Inventory, is completed.

Old Growth

The EIS does not provide an adequate description of old growth forests in the K/WMA. The area appears to support some of the most extensive tracks of unlogged forest remaining in the public estate in north east NSW. Given the national significance of remnant old growth forests, a more thorough assessment is warranted of potential forestry impacts on old growth values than that presented in the EIS.

The Service's submission disputes the broad estimate of old growth forest remaining in NSW, given by the EIS. A list of old growth areas is provided and it is stated that a lack of fauna and flora surveys in these areas makes it difficult to assess their conservation significance and, in turn, predict the potential impacts of logging and associated activities.

The EIS fails to assess the full range of values of old growth forests and their conservation significance, therefore it fails to adequately assess the impacts of the proposed operations on old growth forests.

The EIS proposes a conservation strategy and management prescriptions to mitigate the impacts on old growth forests. The conservation strategy fails, however, to adequately protect old growth forest of likely high conservation significance and the

prescriptions have not as yet been demonstrated to adequately protect fauna dependent on old growth forests. Flora and fauna surveys are required in areas of unlogged forest prior to logging and roading.

It is recommended that, in the Wauchope Management Area, logging and roading should be deferred in any moratorium areas listed in Schedule 1 of the Timber Industry (Interim Protection) Act 1992, until a comprehensive regional assessment is completed and a conservation reserve system implemented. In the Kempsey Management Area logging and roading should be deferred in the identified New England Wilderness area.

Areas Previously Identified For Reservation

The Service objects to the proposed logging in Carrai State Forest and vacant Crown land within the Willi Willi National Park proposal and an area recommended for evaluation for nomination to the World Heritage listing. The Service requests that any logging be deferred within this proposal until the completion of a comprehensive regional assessment.

The Service requests that any vacant Crown land, Crown leases or parts thereof, identified as having important heritage values, be retained in Crown ownership and no logging and roading be permitted until the resolution by State government of the most appropriate landuse.

World Heritage

The EIS does not address the important issue of World Heritage in any detail. It is recommended that consideration be given to the addition of State forests in the Carrai area, adjoining Banda Banda Flora Reserve and adjoining Mount Seaview Nature Reserve to the World Heritage List. It is also recommended that adequate buffer zones should be provided where State forests adjoin World Heritage Areas.

2.3 Public and Non-Government Organisations

The consideration of public and non-government submissions is subdivided into issues. An index to all submissions is provided in Appendix 2 of this report. A summary of the major issues raised is presented below.

2.3.1 Meeting Legal Requirements

Five submissions (136, 140, 147(a), 147(b), 147(c)) express the opinion that the EIS fails to meet the legal requirements of the EPA Act, 1979, and the National Parks and Wildlife Act 1974.

A number of submissions (136, 144, 146, 150, 153, 161) express a general concern that the EIS process is not the appropriate method for assessing long term management issues such as Forestry operations, since it does not produce the baseline data required to predict the impact of broad scale, time dependent activities.

2.3.2 Socio-economic Considerations

Employment

Numerous submissions raise employment issues including: discussion of the importance of the timber industry to employment (7, 11, 131, 147b, 150, 157, 161); the effect of quota reductions on employment (7, 11, 13, 23, 100-111, 115-117, 121-130, 133, 134, 136, 154, 156, 158, 161) and the methodology for determining this (134, 156, 157, 158); the potential for employment through value adding (22, 131, 133, 137, 150, 158, 159) and plantations (11, 137, 151); the unsustainability of employment levels (135, 137, 151); the impact of wood supply agreements (24-94, 133,138, 161) and mill closure (97, 100-111, 115-117, 121-130, 133, 134, 144); the high unemployment levels in the region (22, 96, 113, 131, 150, 156); the loss of local work opportunities through processing outside the region (100-111, 115-117, 121-130, 151) and the relocation of job seekers (151).

Concern is expressed that the social and economic assessment in the EIS is inadequate (149, 154, 156, 157, 159, 163). Several submissions (119, 150, 154, 156, 157, 158, 159, 164) state that the impact of the 10% sawlog quota reduction on the local timber and milling industry will be severe. Three submissions (157, 158, 159) also predict that implementation of the EIS proposal will result in a much greater quota reduction that 10%. One submission (13) states that there should be no undermining of the 10% sawlog quota reduction during determination.

Output

Some submissions identify the opportunities to increase output through value adding (150). Others consider the output impacts of adopting the preferred option to be understated (131). Submission (156) raises the loss of turnover as a result of the 1982 rainforest decision. While submission (163) identified that the linear relationship used to estimate loss of turnover under various alternatives ignores threshold levels of mills.

Wood Supply Agreements

Numerous submissions raise the existence of Long Term Wood Supply Agreements (LTWSA) as an issue. Aspects include: that the EIS ignores the impacts of the existence of these on individual mills (161) and that quota reductions will impact disproportionately (22, 137, 145, 146, 147c, 150, 158) on the very mills able and willing to value add, leading to closure of these mills (97, 113, 145, 150) and exacerbating socio-economic effects identified in the EIS (144). Some submissions question the legal right of State Forests to enter into LTWSA with Boral (133, 136, 145), and consider LTWSA's to compromise the EIS process (133, 134).

Multipliers

A number of submissions raise concern over the employment multipliers used. Submissions (134, 150, 157, 161) state that the multipliers are incorrect and substantially underestimates unemployment that will result from the projected 10% quota reduction. Conversely, (147c) states that the multipliers overestimate

employment in the timber industry. Submission (161) states that the derivation of multipliers used to assess the total impact of the industry is not clear.

Industry

Some submissions raise the importance of the timber industry to local economic activity (131, 161) with a number identifying that all aspects of the timber industry are not identified in the EIS (10, 131). Other issues raised are the impact of the proposal on the timber industry and the viability of operations (7, 97, 131, 134, 145, 147a, 150, 158, 161, 163) including salvage operations (10, 13,131). The decline in the timber industry is also raised (156, 159), as are the opportunities for further restructuring and future industry development (133, 150, 157, 159). It is stated that the EIS does not identify the negative effects logging may have on other regional industries (147a).

Six submissions address the issue of the potential of 'value-adding' operations, noting that the potential of these operations is not adequately assessed (157, 158, 159, 144, 137, 138) and that employment impacts could be decreased by channeling remaining sawlog quotas into smaller mills employing 'value-adding' techniques (137, 138). One submission also states that future rights to mill resources should be decided on the employment potential per volume of timber the mill can generate (137). Other concerns are that there should be a discussion of minimum operating levels for mill viability (157, 161), that an economic assessment of the new Standard Erosion Mitigation Guidelines (SEMGL) should be undertaken (98, 113, 150, 159, 161, 163) and that old growth forest must be logged on economic grounds (13, 158). It is also stated in one submission that the Kempsey/Wauchope EIS should be the final review of forestry activities in the area and should lead to resource security (119).

Finance

Submission 161 identifies the royalties to the State Government from the timber industry in the region and believes that the relative proportion of forest costs would increase if quotas decreased, threatening the viability of the native forest timber industry. Submission (11) considers financial returns to be pitiful compared to environmental damage. Others question the viability of accessing old growth areas (151), while submission (147a) identifies the lack of assessment of the return on capital of the proposal and that obtained in other projects.

Trade

A number of submissions raise the issue of Australia's trade deficit in timber (22, 98, 147b, 155, 157, 161) with some considering that by making most of the forests available for logging the situation can be improved (22), while others consider the trade imbalance to be misrepresented in the EIS (147b).

Alternatives

A number of submissions support the preparation and expansion of plantations (3, 11, 137, 162,163), while others see this as being in addition to current resources (13). Others consider the choice of any of the alternatives to substantially reduce timber supply (161). Submission (136) considers that alternatives are evaluated without access

to the necessary information, while (147b) states that effects of alternatives are misrepresented.

Evaluation Methodology

Submission (135) raises the issue of the opportunity cost of logging old growth. Submissions (147a, 147b) identify that there is no Cost Benefit Analysis and that the proposed activities are justified in erroneous economic terms. There is no attempt to assess non-timber values (145, 147b). The EIS fails to undertake a sensitivity analysis of the assumptions made (147b). The EIS should show flows over time of profit, wood, jobs etc (147b).

Social Impacts

Social impacts raised include the threat to the town of Wauchope (7), concern at the effect of quota reduction on business (12, 154), the social fabric of the North Coast (13), loss of self esteem (154), loss of homes if repayments can not be met (154) and impacts on local communities (147b). Others are concerned that benefits available to the regional community would be lost (161), that social implications are more difficult to determine from the inaccurate forecasts of long term timber yield (137, 162) and that socioeconomic impacts of the preferred option are underestimated (156).

2.3.3 Tourism

Three submissions directly address the issue of tourism. It is stated that the tourism potential of the area will be greatly reduced by forestry activities (137) and conversely that no potential exists for eco-tourism in the region (150, 159).

2.3.4 Harvesting

A number of submissions question the accuracy of predicted harvesting levels and the lack of substantiation of predicted yields (134, 136, 139, 147b, 147c). Two submissions also address the lack of estimation of wood supply from regrowth forests, making it difficult to determine sustainability after 2008 when old growth harvesting is complete in KMA (135, 137). One submission (133) also states that little attempt is made to confirm the predicted yields or the implications if the predicted yields are lower than forecast in either the first or second cutting cycles.

Four submissions also raise general concerns over the unsustainability of wood supply quotas (138, 147, 151). One submission (137) states that the Commission had contracted itself at unsustainable cutting levels to mills in the area, leading to employment levels which are unsustainable, without an increase in 'value-adding' operations.

One submission (119) states that the Forestry Commission's current silvicultural practice of thinning is performed 'late' and is driven by demand for small logs and pulpwood rather than to maximise growth and yield in younger stands.

2.3.5 Information Base

A number of submissions (136, 140, 142, 143, 144, 147a, 147b, 150) state that the information available in the EIS is not sufficient to determine the impacts of logging or to make a decision regarding suitability of forestry operations in the management area. Two submissions (147a, 147b) state that the EIS/FIS is so limited it must be withdrawn. Another submission (146) states that the combination of the Kempsey and Wauchope Management Areas is invalid.

2.3.6 Fauna

The public submissions raise a number of general issues regarding fauna, particularly general concerns about endangered species (8, 98, 112, 113, 132, 133, 135, 136, 138, 143, 144, 147a, 147b, 147c, 159, 162). Specific issues are discussed below:

There is general concern expressed over the adequacy of fauna surveys (19, 132, 133, 138, 144, 147a, 147b, 147c, 162) and the difficulties in determining the effects of forestry operations on endangered fauna (135, 143, 147a, 147b, 160). Three submissions state directly that the logging operations will result in a loss of endangered fauna habitat (8, 133, 138). The claim that endangered fauna will successfully recolonise regrowth is disputed (160). One submission (140) states that the EIS does not address the requirements of migratory species.

Four submissions highlight the absence of an invertebrate study and stress the ecological importance of this group (136, 147a, 147b, 160). One submission (99) identifies the inadequacy of the avifauna survey, stating that it was inappropriately timed and only cursory in nature. 100 bird species are said to be known from the Kempsey/ Wauchope Management Area in addition to those listed in the EIS. One submission (112) states that bat surveys are not extensive enough to assess impacts, especially in relation to Willi Willi bat cave. It is also stated (140) that there is no consistent and adequate criteria for differentiating species of high priority for evaluation.

Three submissions (132, 147a, 147b) express concern that no mention is made in the FIS of the possible presence of the Eastern Quoll in the plateau forests of Carrai and Petroi.

Ongoing monitoring plans are said to be vague (147b) and a lack of specific management plans for endangered fauna are noted (135, 160). Two submissions consider that no attempt has been made to assess the impacts of 1080 baiting programs on native fauna (147a, 147b).

Five submissions (132, 145, 147a, 147c, 160) state that the proposed amelioration prescription for habitat tree retention at 3 per hectare is inadequate. One submission (147c) also specifies that the proposal for 'clumping' of habitat trees is unclear in the EIS. Submission (147b) makes a general criticism in that the proposed ameliorative measures are vague and unspecific.

Three submissions state that no fauna species have become extinct as a result of logging activities (98, 113, 159) and submission (159) further states that there are no

species of fauna which would be adversley affected by logging if appropriate ameliorative conditions were in place.

2.3.7 Flora

General flora issues are raised in five submissions (112, 115, 144, 147a, 147c), these mainly concern the inadequacy of flora survey methodology and the lack of information regarding predicted regrowth levels. Two submissions (147a, 147b) believe that rainforest associations have not been fully delineated and therefore have not been adequately assessed. One submission (11) states a concern that there will be a significant loss of the gene pool for seed trees through selective loss, as a result of logging of the healthiest, strongest specimens.

2.3.8 Reserve System

Several submissions outline faults with the proposed reservation systems, these include the observation that the proposed reserve selection is based on the least usable areas being kept (146, 147a) and that many of the areas on offer are of no value to either the Commission or the public (137, 144). It is also claimed that the suggested reserve system is not based on scientific data or adequate information (133, 135, 147b), that a large amount of the proposed reserves have been previously logged (138) and that a number of the reserves are long, narrow and potentially vulnerable to degradation (138, 140, 147b).

The proposed Petroi Wildlife corridor is said to be so steep that its use as a wildlife corridor is questionable (137). It is also stated in one submission (151) that no old growth areas have been proposed as flora reserves.

A number of submissions make firm statements against any additional reservations within the management areas. They state that until an assessment has been made of resources in existing National Parks and Nature Reserves that no new reserves should be dedicated (150; 153, 157, 158, 159, 163).

2.3.9 Old Growth

A total of 19 submissions refer to the issue of old growth forests, eleven of which (3, 8, 11, 21, 132, 133, 139, 146, 151, 155, 160) state that no logging of old growth should occur and that only the EIS alternatives that proposed this should be considered. Three submissions (138, 147a, 147b) state that the EIS is inadequate in terms of its old growth assessment and should not be used for this purpose. Any attempts to further survey remaining old growth are considered likely to be very difficult due to the steepness of sites (135, 145) and one submission (138) expresses concern that any logging occurring on remaining old growth in steep areas will lead to weed infestation and catchment siltation problems.

Ten submissions (6, 19, 133, 136, 137, 146, 147a, 147b, 151, 160) regard the EIS as being contrary to the National Forest Policy.

2.3.10 Wilderness Proposals

Three submissions (6, 132, 147a) identify concerns regarding Wilderness. One states that the EIS does not adequately address wilderness proposal assessment (147a). Two submissions (6, 132) express concern that logging has been proposed in areas identified in wilderness proposals. Submission (132) also specifically states that the New England and Werrikimbi Wilderness Areas will be compromised by forestry activities and no activity should occur within them until wilderness assessment is complete.

Three submissions (119, 159, 161) are strongly opposed to any additional wilderness proposals, stating that present National Parks and Nature Reserves are more than adequate.

One submission (163) states that there should be no additional reserves until after assessment in accordance with the National Forest Policy and that the current wilderness proposals are not sufficiently substantiated.

2.3.11 Conservation Strategy

Five submissions (133, 136, 137, 144, 149) are concerned with the failure of the EIS to adequately address the overall conservation status of the region, within the conservation strategy. Submission (137) also specifies that the EIS conservation strategy needs to address the lack of conserved forest areas in the Kempsey Management Area.

One submission (159) states that the EIS conservation strategy should not be implemented until the economic implications of the SEMGL's are assessed.

2.3.12 Soil Conservation

Four submissions (136, 138, 147a, 147b) state that the overall soil assessment in the EIS is very poor. One submission (159) states that the soil loss estimates in the EIS are not adequately explained.

Submission (112) makes a general statement that examples of soil erosion are found throughout all forestry areas post logging.

Six submissions (22, 97, 98, 113, 150, 159) question the need to introduce SEMGL's when the present SEMC are more than adequate. These submissions also request that SEMGL's be subjected to comprehensive cost benefit analysis before possible implementation.

2.3.13 Burning and Grazing

Several submissions express concern that while the long term effects of burning and grazing are stated to be unknown they are allowed to continue (112, 132, 136, 147a, 147b, 147c).

One submission (159) recommends the continuation of control burning in State Forests. Two submissions (156, 159) state that grazing within State Forests is an important activity and must be allowed to continue.

2.3.14 Beekeeping

Six submissions (13, 96, 120, 147b, 148, 156) address beekeeping concerns. Two submissions (13, 147b) state that the EIS does not adequately address beekeeping issues. Submission (148) stresses that the Maria River State Forest is important for beekeeping and that retention of beekeeping sites in this area is required. Submission (156) makes a general statement that beekeeping should be encouraged in the area.

Two submissions (96, 148) refute claims in the FIS that beekeeping impacts on native species and spreads 'dieback' and state that it should not be stopped. One beekeeping submission (120) states that Wilderness legislation should be rejected.

2.3.15 4WD Access

One submission (5) mentions 4WD issues. It supports the EIS but strongly favours continued access to State Forests by 4WD vehicles.

2.3.16 Roading

Four submissions address the issue of proposed roading in the EIS. Submission (132) makes a general statement that the proposed roading through sensitive areas is unacceptable. One submission (151) states that the proposals to undertake road works on slopes of 35% in areas of old growth will severely disturb catchments.

Submission (114) objects to the EIS on the grounds that a major haulage road, servicing over 5,000 ha, is proposed to run through the author's property. The objection is based on the fact that "right of way" does not exist and will not be granted.

One submission (155) commends the Forestry Commission on its current road management within the Kempsey/ Wauchope Management Areas.

Submission (147a) raises the issue that the EIS does not include unrecovered road damage data.

2.3.17 Water Quality

Five submissions (14, 144, 146, 147a, 147b) express concern that the hydrological attributes of the study area, including existing water quality and possible logging impacts, are not adequately assessed in the EIS.

2.3.18 Sawlog Quotas

One individual submission (131), in addition to 70 pro forma submissions (24 - 94), addresses the issue of sawlog quotas. Specific concerns are to ensure that quota reductions are reduced equally from all current sawlog quotas and that smaller mills are guaranteed access to the remaining sawlog resource.

2.3.19 Mineral Exploration

Two submissions (15, 165) address mineral exploration. One submission (15) suggests that the EIS would be more comprehensive if the mineral potential of the area and its likely economic significance or impact on management proposals was included.

Submission (165) objects to the inclusion of the Carrai Plateau in the Oxley-Wild Rivers National Park, on the grounds that an exploration licence has been granted for this area and it should not be "locked-up" until the extent of mineral resources are determined.

2.3.20 Archaeological Assessment

Two submissions (144, 147a) consider the archaeological assessment of the EIS to be inadequate for decision making.

2.3.21 Community Participation

Three submissions (133, 144, 147a) consider that the community participation/ consultation procedures followed prior to completion of the EIS were inadequate.

Submission (161) states that more industry based consultation should have occurred.

2.3.22 Alternative One

A total of 36 submissions, including 25 pro forma letters, indicated with a 'p' prefix (18, 22, 98, p100-111, 113, p115 - 117, 119, p121 - 130, 150, 156, 157, 158, 161, 164), support alternative 1. This is the continued implementation of the 1988 plan of management.

3.0 THE DIRECTOR'S CONSIDERATION OF THE PROPOSED ACTIVITY

This chapter outlines the consideration of the proposal by the Department of Planning having regard to the information presented in the EIS, the submissions received in response to its public exhibition, the State Forests of NSW submissions and field inspection by Departmental officers. In considering the proposal, the Department has also given regard to clause 56 of the Environmental Planning and Assessment Act 1979 (EP&A Act). However, this consideration of clause 56 has not been undertaken for the purposes of Part V of the EP&A Act.

For presentation purposes the considerations are divided into the issues of adequacy, flora, fauna, old growth forests, salvage logging, wilderness, world heritage, soils, hydrology and water quality, new roads, socioeconomic considerations, length of approval and resource security, harvesting, forest resources, use of fire, roads and traffic, cultural areas, tourism and recreation, scenic resources, grazing, bee keeping, Crown-timber lands, air quality and noise pollution, greenhouse, energy, cumulative impacts, monitoring-general.

3.1 Adequacy of the EIS

Many submissions criticise the FIS/EIS as being inadequate, claiming that it does not satisfactorily deal with many issues and that there are a number of inaccuracies and inconsistencies in the documents.

What these submissions fail to realise is that an EIS is not a final decision in its own right and there are numerous other sources of information available to the Department of Planning that can be (and have been) used in deciding on the appropriate recommendations to make to the Minister for Planning.

The assessment of the EIS by the Department of Planning takes into account the EIS documentation, many other reports, information supplied in submissions to the EIS by the public and Government agencies, a submission by the SFNSW in response to other submissions, and information supplied by SFNSW in response to questions put to it by the Department of Planning. The other sources in the following discussion are listed in the References section of this report.

The Department is of the opinion that the extensive surveys carried out have alerted the Department to the possible or potential environmental consequences of the activity and, while the Department does not necessarily agree with all the analyses carried out, the data presented have been sufficient to allow the Department to utilise the other sources of information to develop appropriate prescriptions and ensure that the Minister can make an informed determination.

3.2 Flora

The assessment of flora considers the following topics:

- Forest Typing
- Flora Survey
- Assessment of Environmental Impacts

- Rare and Significant Species
- Regional Significance of the Vegetation
- Conservation Strategy
- Rainforest
- Weeds

3.2.1 Forest Typing

For forestry management purposes, the SFNSW classifies forest types according to Forest Research Note 17 (Forestry Commission of NSW 1989) and has mapped these in the K/WMA at a scale of 1:25,000. This forest typing classification concentrates on dominant overstorey species of commercial value rather than ecological associations and understorey species. The static nature of this mapping does not allow for the dynamics of forest ecosystems and the development of seral stages. However, despite these limitations, Forest Type maps provide a consistent classification of forests over all the State, recognising over 192 different Forest Types (Forestry Commission of NSW 1989). To date, forest type maps are considered to be the most practical management tool available for identifying the location and extent of forest vegetation communities in NSW.

For the purposes of the following discussion, the K/WMA is defined as all State Forests (207,887ha) and other Crown-timber lands (93;732ha) covered by the proposal. Prior to considering the merits of the Flora Survey and the resulting conservation strategy from a flora perspective, it is necessary to comment on the range of forest types occurring in the K/WMA. The EIS does not provide an inventory of all of the Forest Types occurring in the K/WMA and the NPWS, in its submission, notes that there is some confusion as to which Forest Types occur in the K/WMA. The DOP recognises that there are discrepancies between various information tools including; the Forest Types listed in Tables 3.4 (Forest Associations) and 9.1 (Existing and Proposed Conservation Reserves in Study Area) of the EIS, the 'Map Units' of Table 1 of the Flora Survey Report, the Types listed in the Kempsey and Wauchope Management Plans (1988), and the Types actually mapped on the 1:25,000 Forest Type Maps. It should be noted that the Flora Survey recognised that there were minor discrepancies between Forest Types as mapped and those listed in the Management Plans, and tried to take this into account in the survey design.

The most apparent anomaly is the EIS's (Tables 3.4 and 9.1) oversight of certain mapped Forest Types. Examination of the 1:25,000 Forest Type Maps of the K/WMA shows that the following potentially commercial Types are present on the 1:25,000 Maps but have not been considered in Table 9.1 of the EIS: 41, 45, 49, 73 (including 62/73), 74 (including 62/74), 85, 101, 117, 138 and 168 (see Table 1). The DOP has also noticed two resource discrepancies associated with Types 48 and 140 presented in Table 9.1. These anomalies have been pointed out to the SFNSW and have been addressed in the following table (Table 1) and supporting comments (supplied to the DOP 19/1/94). These Forest Types are also given greater consideration in Section 3.2.5 (Regional Significance of the Vegetation). Table 9.1 is further discussed in Section 3.2.6 (Conservation Strategy).

Table 1 - Resource Estimates for Specific WMA Forest Types

Type	Area (ha) Kempsey MA		Wauchope MA		Area within Reserves (ha)	Total (ha)
	SF	OCTL	SF	OCTL		
41	5	88	9	-	-	102
45	3	-	-	-	-	3
48	76	-	166	-	6	242
49	-	-	113	-	-	113
62						*
62/74						*
73	-	-	-	-	-	-
74	104	-	-	-	-	104*
85	-	-	24	-	-	24
101	-	-	8	-	1.5	8
117	16	-	-	-	14	16
138	7	-	-	-	5	7
140	63	-	-	-	4	63
168	48	-	-	-		48

SF refers to State Forests.
OCTL refers to Crown-timber land other than State Forest.

* Note: Types 62/74 and 74 were broadly grouped under Type 62 for the EIS (J. Murray, pers.comm. 21/1/94). Types 62/74 and 74 were amalgamated under Type 62 in Table 9.1 of the EIS because of the variation in species composition within these Types and the past intensive disturbance which has been carried out within them (e.g. the selective removal of certain species altering the Type classification).

From examination of the 1:25,000 Forest Type Map sheets for the K/WMA, it is apparent that two rainforest types (Types B/L and 22) may also have been overlooked by the EIS (see Table 2). The implications of this are given greater consideration in Section 3.2.7.

Table 2 Rainforest Types present in K/WMA but not recognised in Table 3.4 of the EIS

Forest Type	Map Sheet	K/WMA State Forests	Other Comments
B/L	Comara West	Cochrane	Typed as B/L (Includes Types 2,3,11,17)
	Willi Willi West	Carrai	Typed as B/L (Includes Types 2,3,11,17)
22	Willi Willi West	Carrai	

The other main discrepancy between the various management tools is the exclusion of certain forest types from the stratification of the Flora Survey. The Mapped Types which are sampled by the Flora Survey are listed under the 'Map Units' column of Table 1 of the Flora Survey Report. The exclusion of certain Forest Types from the stratification of the Flora Survey is discussed in Section 3.2.2 of this report.

It is also relevant to note that not all areas of State Forests in the Management Area are typed. Areas of State forest which are not typed include: Old Station State Forest (478ha), Skillion Flat State Forest (272ha), Mount Skillion State Forest (188ha), No. 12 Ext. Collombatti State Forest (44ha), Cpt 146 Nulla Five Day State Forest (235ha), Cpt 148-150 Nulla-Five Day State Forest (340ha), Cpt 27 Lower Creek State Forest (366ha). State Forests of NSW have also indicated that the south-west section of Carrai State Forest has only been typed by broad forest groups (1,175ha approximately). The majority of areas of Crown-timber land other than State Forest have also not been typed. Areas of Crown-timber land other than State Forest, which have been Typed include: Parts Por. 14 Parish Kangaroo Flat; Parts 3 and 5 Parish Mooraback; Various leases Upper Hastings River; Boonanghi Crown Land; Willi Willi Vacant Crown Land; Crown Land adjoining Maria River State Forest; Accessible Vacant Crown-Land adjoining Cochrane/Carrai State Forests; Crown Land adjoining Pee Dee State Forest. Ideally, all areas accessible for forestry purposes should be Typed to ensure that resource and conservation estimates are as accurate as possible. In light of this, **the DOP considers that prior to logging, untyped State Forest areas and Crown-timber lands should be typed according to Research Note 17 (1989) standards and examined for critical Forest Types and plant communities (Section 3.2.5). In calculating the total area of resource upon which to base the appropriate percentage of reservation referred to in the allocation of Forest Types in Section 3.2.5, consideration should be given to all Typed State Forest and Crown-timber land areas within the K/WMA.**

The results of the Flora Survey reflects upon the accuracy of Forest Type Mapping in the K/WMA. Many of the mapped Forest Types are comprised of plant communities that either best relate to other Forest Types (e.g. Type 163 comprising communities that best relate to Type 167), or comprise of multiple communities (e.g. Types 62 and 163 are heterogeneous and contain many Hager and Benson (1992) associations which best relate to numerous other forest types). The discrepancies between the mapped forest types and their plant community composition may be due to errors in typing or possibly the scale of these occurrences as forest type mapping is generally limited to delineating plant communities of 2 hectares or greater (FCNSW 1989). Doubts regarding the accuracy of Forest Type mapping have been raised by the NPWS, NEFA, some of the Timber Industry submissions and in the Kempsey Management Area Annual Report 1990/91 which states: *"There is a real need in Kempsey Management Area of new aerial photography and API assessment of the resource".*

Mistyping of the following Types and areas is of note:

* As raised by the NPWS, Type 73, which represents the moister type of forest dominated by *Eucalyptus maculata (Spotted Gum)* has not been recognised in any of the assessments of the K/WMA but there are areas, particularly in Ballengarra State Forest, that fit the description of this Forest Type in Research Note 17 (FCNSW 1989).

  There is an incidence of Type 62a/73 on Cpt. 68 in Tamban State Forest. This has been checked by SFNSW back to the original typing. It was originally typed as Semi-Moist

Hardwood and this should have been recorded on the more recent Forest Type Maps as 62a/74a consistent with the conversion of the rest of the area at the time of mapping to Research Note 17 nomenclature.

* Appendix 1 of the NPWS submission identifies that areas of Type 62 in Ballengarra State Forest would be more appropriately mapped as Type 62/74 and 74.

* The NPWS notes that results from brief field work carried out as part of its assessment indicates that many areas mapped as Type 62 would be more appropriately typed as Type 70 or 73.

* Type 62/74 occurs on thousands of hectares of forest in Collombatti, Ingalba and Tamban State Forests. This area was typed as part of Tamban/Ingalba Management Area in 1957, pre-dating the Research No. 17 (RN 17) Forest Type classification. Type 62/74 was previously classified, according to the 1957 Typing, as Semi-Moist Hardwood, defined as follows:

  "*Stands with Spotted Gum, Tallowwood, White Mahogany, Ironbark, Bloodwood and Stringybark in very varying proportions but includes some log producing species (Spotted Gum, Tallowwood, White Mahogany) but not including stands where Spotted Gum is mostly capable only of reaching pole sizes.*"

  In conversion to RN 17 standard, the Semi-Moist Hardwood Type was classified as Type 62/74 because of the varying proportion of the species. Retyping of these State Forest areas according to RN Note 17 standards would more accurately distinguish between those areas of Type 62 (Grey Gum-Grey Ironbark-White Mahogany) and those of Type 74 (Spotted Gum).

* The EIS (p.279) indicates that large areas of Type 64, north of the Oxley Highway in Doyles River State Forest, are mapped as Type 62.

* Doyles River SF appears to contain areas of Type 163 which actually consists of plant communities which comprise Types 111, 167 and 168, all of which are considered to be inadequately conserved. The EIS (p.43) acknowledges this to some degree, stating that areas shown as Type 163 include occurrences of Types 167 and 168. This is discussed in greater detail in Section 3.2.5.

* Type 101 is relatively extensive in Banda Banda Flora Reserve where it is entirely mapped as Forest Type 163.

In relation to the specific Forest Typing concerns detailed above, **the DOP considers that the Forest Type maps for Ballengarra State Forest should be revised to identify areas of Types 62, 62/74, 73 and 74. Typing in Tamban, Ingalba, and Collombatti State Forests should be revised to distinguish between areas of Type 62 and 74. Retyping of Doyles River State Forest and the occurrence of Type 101 in the K/WMA, are given greater consideration in Section 3.2.5.**

The NPWS in its submission, considers that due to the apparent mistyping, the conservation strategy should be based on the consideration of environmental units rather than forest types.

The DOP disagrees and notes that as outlined in a letter from the NPWS (1994), the assessment of environmental units has the following limitations:

* the environmental units are used as an approximate surrogate for direct biological information; the assessment of environmental units does not incorporate any biological data for the unlogged forest units. It should be noted that in their study of the vegetation of Yengo National Park, Bedward et al (1992) found that environmental types were considerably less homogenous in terms of plant species than vegetation types. Hence the Yengo National Park study found that vegetation types better reflected plant species composition than environmental attributes;

* the environmental units are mapped at a relatively coarse scale. The units are derived from terrain and climate data at approximately 1:100,000 scale and geological data at 1:250,000 scale. (Forest Type Maps are presented at a scale of 1:25,000);

* some of the units contain a heterogeneity of environments with different conservation values. The environmental unit approach, if adopted, could well result in the conservation of many plant communities and Forest Types which are already adequately conserved;

* the assessment of regional reservation status of environmental units does not adequately consider disturbance history. There is the assumption that all uncleared areas of an environmental unit have had equal disturbance and are therefore equally suitable for conserving the natural attributes of that unit.

In light of these reasons and despite the limitations of forest typing in the K/WMA, as outlined, the DOP has opted to examine the K/WMA conservation strategy in terms of Forest Types rather than environmental attributes, giving special consideration to those areas which may be mistyped (see section 3.2.5).

Conclusion

The EIS's conservation strategy and resource estimates are based on the consideration of Forest Types. This is considered to be appropriate, however, there has been an oversight of certain K/WMA Forest Types in the EIS. These Types are predominantly those that have a limited occurrence in the K/WMA. Some areas of the K/WMA appear to be mistyped partly as a result of the previous typing not matching Research Note 17 standards. There are also some State Forest and Crown-timber land areas which are not Typed. Due to such anomalies, the NPWS considers that a conservation strategy based on the consideration of environmental units is more appropriate than one based on Forest Types. There are several limitations of the environmental unit approach and the DOP has consequently opted to examine the K/WMA conservation strategy in light of the Forest Type approach, giving particular consideration to those Types of limited occurrence not recognised by the EIS and those State Forest and Crown-timber land areas which are either not Typed or mistyped.

3.2.2 Flora Survey

Some public criticism has been raised over the methods used in the Flora Survey and the resulting report. This has predominantly focussed on the level of sampling intensity and the basis of stratification.

The Flora Survey for this EIS sampled 200 plots (one of which was in Thumbs Creek SF, Urunga MA). Excluding the Thumbs Creek Plot, this represents a sampling intensity of 1 plot/1516ha (199 plots in 301,619ha) which is far less intensive than compared with previous forestry EISs such as Wingham (64,253ha; 1 plot/506ha), Glen Innes (70,300ha; 1 plot/857ha) and Mount Royal (6,694ha; 1 plot/88ha). York et al (1991) recommend a minimum desirable intensity of 1 plot/1,000ha to 1 plot/100ha as a rough guideline for the minimum sampling intensity to be used for general flora surveys. However, York et al (1991) also identify that in most cases resources will be inadequate to survey to such a desired intensity. The NPWS, in its submission, considers that based on the sampling intensity conducted for the K/WMA, the EIS may not provide an adequate description of variation in the vegetation. The DOP has similar concerns but notes that such a low sampling intensity may be justified provided stratification and replication are adequately considered. This is discussed below.

The Flora Survey Report notes that stratification was based on mapped Forest Types implying that one of the objectives of the survey was to examine how flora communities varied within the forest types of the K/WMA. The Flora Survey Report (p.1) noted that *"a few Forest Types which were of very limited extent and occurred only in one or a few small aggregated patches were allocated a single plot"*. The DOP considers in such instances the lack of replication is justified but notes that such a statement also implies that all Forest Types within the K/WMA were surveyed. It is apparent, however, that numerous Forest Types within the K/WMA have not been sampled.

After examination of Tables 3.4 and 9.1 of the EIS plus the Forest Type inventories of the respective Kempsey and Wauchope Management Plans (1988), plus the examination of the 1:25,000 Forest Type Maps for the K/WMA, it is clear that the following Forest Types were omitted from sampling: Type B/L (rainforest), 26 (rainforest), 32, 39, 45, 48, 49, 64, 70, 73, 74, 85, 87, 92, 97, 101, 117, 122, 126, 168, 216, 218, 219, 220 and 230. It should be noted that Types 216 (Improved Pasture and Cropland), 218 (Forestry Plantations), 219 (Settlements, Roads, Gravel Pits etc), 220 (Cleared/Partially Cleared) and 230 (Natural Grassland) are justified omissions as they do not contain natural forest. Binns (pers.comm., 1993) has indicated that in Table 1 of the Flora Survey Report, Forest Type 40 (instead of 37) should be entered in the 'Map Unit' column against KWov 13.2. Hence Type 40 has actually been sampled. The Flora Survey Report (p.14) also justifies the omission of Type 48 although the DOP considers that this Type should have been surveyed. The DOP considers that a full inventory of Forest Types occurring in the K/WMA should have been compiled prior to conducting the Flora Survey, based on the examination of all Forest Type maps for the Kempsey and Wauchope Management Areas. The omission of two rainforest types and eighteen naturally occurring hardwood types from sampling has resulted in certain habitats not being sampled. Such habitats may well contain rare or significant plant species and/or inadequately reserved communities. D. Binns (pers.comm., 2/11/93) has proposed arguments justifying the exclusion of many of the unsampled Forest Types, however these explanations have not satisfied the DOP's concerns. **To compensate for the omission of certain potentially commercial Forest Types from sampling, the DOP considers that**

pre-logging surveys should be conducted in Types 32, 39, 45, 48, 49, 64, 70, 73, 74 (including 62/74), 85, 87, 92, 97, 101, 117, 122, 126 and 168 to identify rare, vulnerable or endangered plant species. Details of what to do when such species are found are detailed later in this section. These Types are also given further consideration in Section 3.2.5. Pre-logging surveys for rare, vulnerable or endangered plant species are not required for rainforest Types B/L and 26 as this report provides for the exclusion of logging in rainforest (see Section 3.2.7).

The NPWS, in its submission, notes that from an assessment of Table 1 in the Flora Survey Report, the consideration of the inconsistencies mentioned above and preliminary field inspections within the K/WMA, there are problems with using Forest Type Maps as a basis for conservation planning. The NPWS emphasises the need for a sampling design stratified on environmental attributes rather than forest types. The limitations of the environmental unit approach have been previously discussed. Like previous forestry EISs, the K/WMA was stratified according to mapped forest types. For the K/WMA, geology was also considered in the stratification process. In support of the forest type stratification approach, York et al (1991) note that where Forest Type or vegetation maps are available, these offer the most convenient and appropriate means for stratification. The DOP is of the opinion that the Forest Type basis of stratification is satisfactory for the purposes of sampling the flora resources of the area covered by the EIS. However, the DOP also notes that the inclusion of other variables such as altitude and topography may give an even more accurate explanation for vegetation variation.

Of the 200 sites used in the Flora Survey analysis, there were 23 rainforest sites, seven shrubland and four *Melaleuca* swamp forest sites and 166 sites were located in hardwood forest vegetation. The NPWS, in its submission, considers that the number of sites is probably not adequate to describe the vegetation of the K/WMA, particularly as logged replicates were considered in the survey design. The DOP considers that the sampling intensity should have been greater but only because certain Types were overlooked in the sampling. This limitation is overcome by the DOP's proposed requirement for pre-logging surveys in the unsampled Forest Types. The DOP considers that the intensity of sampling for the sampled Forest Types is adequate.

The flora sampling intensity allocated to each State Forest covered by the K/WMA EIS is shown in Table 3. This table shows that a number of the State Forests were not sampled. These forests include: Boonanghi, Brassey, Bril Bril, Collombatti, Cowarra, Dyke, Enfield, Mount Seaview, Mount Skillion, Old Station, Pee Dee and Skillion Flat. State Forests which had a particularly low sampling intensity (1 plot) include: Bulga, Ingalba, Kalateenee, Queens Lake, Tamban and Way Way. It should be noted that those State Forests which were not sampled or had a particularly low number of survey plots allocated to them tend to contain those forest types which were not sampled during the Flora Survey. D. Binns (pers.comm. 5/11/93) indicates that in general, he would regard boundaries between individual State Forests as irrelevant to sampling for flora survey purposes, and the absence of sample plots from a particular forest should not, by itself, be seen as a deficiency in the comprehensiveness of the sample. The DOP agrees. Binns (pers.comm.) further notes that if a State Forest is geographically isolated or contains unsampled habitats, the absence of the sample does indicate potentially inadequate sampling. The DOP is also of a similar opinion. The consideration of unsampled habitat (in this case forest types), has already been provided above. Consideration of the unsampled state forests and their degree of isolation is provided below.

Table 3 - Flora sampling intensity in relation to TI(IP) Act Moratorium areas

State Forest	No. of Flora Survey Plots	Moratorium under Schedule 1 TI(IP) Act
Andersons	2	No
Ballengarra	4	Yes
Bellangry	8	No
Boonanghi	0	No
Brassey	0	No
Bril Bril	0	No
Broken Bago	4	No
Bulga	1	No
Cairncross	4	No
Carrai	46	No
Cochrane	3	No
Collombatti	0	No
Cowarra	0	No
Doyles River	28	Yes
Dyke	0	No
Enfield	0	No
Ingalba	1	No
Kalateenee	1	No
Kippara	12	No
Lower Creek	4	Yes
Maria River	5	No
Mount Boss	27	Yes
Mount Seaview	0	Yes
Mount Skillion	0	No
Nulla Five Day	21	Yes
Old Station	0	No
Pappinbarra	4	No
Pee Dee	0	Yes
Queens Lake	1	No
Skillion Flat	0	No
Styx River	9	Yes
Tamban	1	No
Thumb Creek (Urunga MA?)	1	No
VCL	6	Yes
Way Way	1	No
Yessabah	6	Yes
Total (excluding Thumb Creek)	199	

Comments from D. Binns regarding the individual State Forests are as follows:

"*Dyke - Isolated and likely to contain unsampled habitat, but a very small remnant.*
Pee Dee - Similar habitats to those sampled in Nulla-Five Day SF.
Collombatti - Similar habitats to Ingalba SF.
Old Station, Mount Skillion, Skillion Flat - An isolated group of forests likely to contain different habitats to those of nearby forests. At least one sample in this group would have been desirable.
Boonanghi - Similar habitats in Yessabah and adjacent VCL.
Bril Bril - Similar habitat sampled in adjacent Bellangry SF.
Cowarra - Within Wauchope MA, a bit isolated and slightly different to nearby Broken Bago SF.
Brassey, Enfield, Mount Seaview - Similar habitats in adjacent Doyles River SF."

The DOP considers that due to their isolation Dyke, Cowarra and the Skillion Group (Mount Skillion, Old Station and Skillion Flat) of forests should have been sampled by the Flora Survey. This concern is also raised in the NPWS submission which notes that there is a deficiency in the location of survey sites in areas of drier open forests and woodlands on gentle topography and poorly draining clay soils such as occur on parts of Skillion Flat, Mt. Skillion and Old Station State Forests. This further emphasises the need to sample these areas for flora. (The community composition of these three State Forests is given greater consideration in Section 3.2.5). **The DOP is of the opinion that because of their lack of sampling and their degree of isolation, pre-logging surveys are warranted in Dyke, Cowarra, Mount Skillion, Old Station and Skillion Flat State Forests. These surveys should be designed to identify rare, vulnerable and endangered flora species. Details of what to do when such species are found, are detailed later in this section.**

The areas of Mount Seaview and Pee Dee State Forests are of concern to the DOP. These State Forests are not isolated and all the forest types that occur in these State Forests are sampled elsewhere in the K/WMA. These forests, however, are listed in the moratorium areas under Schedule 1 of the TI(IP) Act (i.e. contain significant old growth areas) and were not allocated any flora survey plots. The DOP considers that these areas should have been given special emphasis when designing the Flora Survey. **In light of this, the DOP considers that pre-logging surveys for rare, vulnerable and endangered plant species should occur in Mount Seaview and Pee Dee State Forests.**

For all pre-logging surveys for rare, vulnerable or endangered plant species, the following shall apply:

(i) **if a rare (Briggs & Leigh 1988) species is located and it has not been reserved from logging by the EIS, as modified by the determination, then it shall be protected from logging;**

(ii) **if a vulnerable or endangered (Briggs & Leigh 1988) species is located, then it shall be protected from logging.**

It is envisaged that this recommendation could be applied in the a similar way to which CaLM in Western Australia maintains its records of endangered flora. Each Management

Area could keep up-to-date records of the location of all rare or significant plant species under its jurisdiction (including State forests and other Crown-timber lands accessible for logging). This could then be known as the *"Declared Rare or Significant Flora Register"*. For each rare or significant species, the Register would contain a mounted specimen, a map (of a suitable scale) of its location(s), a coloured photograph of the species, a description of the species, and a description of its habitat. Prior to any activity involving the destruction of native flora, the SFNSW could then consult the *"Declared Rare or Significant Flora Register"* and identify any species known to occur within a certain radius, say 5km, of the proposed activity. These species could then be targeted in pre-disturbance inspections.

From a flora sampling perspective, the DOP is also concerned with the isolated remnant of Mount Boss State Forest (compartments 264-272, 304). This remnant shares a common boundary with Werrikimbe National Park and contains significant old growth areas which were identified in Schedule 1 of the TI(IP) Act. Despite this area being isolated and containing old growth, it was not afforded any flora survey plots. Although all forest types occurring in this area were sampled elsewhere in the K/WMA by the Flora Survey, this remnant contains a variety of geological substrates some of which have not been sampled elsewhere in the K/WMA (e.g. serpentinite). The DOP considers that this area is likely to contain different habitats compared with other State Forests within the K/WMA. **The DOP considers that to permit further investigation, this area should not be subject to forestry operations within the term of the approval.**

The Flora Survey Report and its results do not rely heavily on flora comparisons between logged and unlogged areas as the Survey was predominantly conducted to obtain an improved inventory of the flora resources of the K/WMA. This intent is considered appropriate but could have been better explained through the provision of an opening section of the Report describing the aims of the Survey. Had this been provided then the purpose and intent of the Survey would have been clear. Clearly identified aims would have also aided in the assessment of whether the Flora Survey objectives had been satisfactorily met.

The limitations of the Flora Survey are identified on page 4 of the Flora Survey Report and the EIS (p.47, 48 and 203). The multivariate statistical analysis techniques (UPGMA and ordination) used are considered appropriate for the data analysis. The Flora Survey Report, however, could have also been improved by the inclusion of a full species list for the K/WMA. It is also worth noting that logging impacts were only examined for those species occurring in five or more survey plots. In this regard, impacts are likely only to be found for the more generalist species. To some degree this was compensated for by the EIS giving special consideration to rare or significant species.

Conclusion

The Flora Survey is based on the stratification of Forest Types and consideration of geology. This is considered to be appropriate, however, the Flora Survey has omitted to sample many of those Forest Types which have a limited occurrence in the K/WMA. Additionally, some of the old growth moratorium (TI(IP) Act) areas and isolated State Forests have not been surveyed. Consequently, some K/WMA habitats have not been sampled by the Flora Survey. Rare plant species are of concern in this regard. These limitations can be overcome by requiring pre-logging surveys for rare species in such

areas and the protection of the Mount Boss remnant area from logging or new roading disturbance.

3.2.3 Assessment of Environmental Impacts

Harvesting

The assessment of the impacts of harvesting on flora, including old growth, is presented on pages 199-205 of the EIS. The impact on weeds is addressed separately on pages 229-230. In relation to flora, the EIS considers the impacts of harvesting on vegetation structure, plant species composition, species abundance and diversity. This is done in rather general terms without identifying particularly susceptible communities or Forest Types. Impacts on vegetation structure are assessed in relation to old growth harvesting. Tables 5.7 (Post Logging Tree Diversity Survey) and Figure 5.1 (Post Logging Survey of Forest Structure) of the EIS are utilised well to support the discussion of these impacts. Consideration is also given to impacts on crown cover. As noted by the EIS, the change to forest structure resulting from logging varies greatly, depending on the Forest Type and logging history of the area.

The process of succession, and how this is affected by logging, is discussed for both Dry and Moist Hardwood Forests. The EIS (p.204) identifies that certain species are favoured by logging disturbance while others appear to be disadvantaged. It also identifies (p.205) that harvesting may cause an overall reduction in species diversity. Differences in floristic composition are also discussed with the EIS particularly noting that plant species composition may be affected by increased light, temperature, evapo-transpiration water losses, soil disturbance, frost and the changed biotic environment (e.g. increased animal browsing and insect attack). Impacts on epiphytes are considered (p.204), with the EIS noting that it could take 50 years for epiphytes to return. In this regard, the DOP is particularly concerned with those epiphyte species which are rare, notably *Schistotylus purpuratus* and *Papillilabium beckleri* (see Section 3.2.4). Impacts on species abundance and diversity are discussed with the EIS identifying several species (*Hakea eriantha, Persoonia linearis and Viola betonicifolia*) that occurred less frequently in logged forest. Kangaroo grass is identified as being more common in logged forest.

Several public submissions raise concern that eucalypt flowering and budding times have not been considered in the EIS, and that this aspect is important to the movement of nectivorous fauna. The harvesting of eucalypt species when they are in flower may locally affect nectivorous fauna movement. It should be noted that the SFNSW do not preferentially extract trees due to their flowering season. There may, however, be preferential extraction due to the timber value of certain species which may coincide with the flowering times of the particular species concerned. The DOP acknowledges that recently logged areas form part of a wider mosaic of old growth and regrowth trees, all of which have the potential to flower and set seed although older trees are likely to produce more blossom and seed. In addition to this, the DOP notes that the phenology of eucalypts is highly variable even when considering an individual species. Eucalypts may not flower every year, they can produce blossom for a period of 1-6 months (depending on the species) and buds may be set up to 2 years prior to blossoming (Clemson 1985). This makes the prediction of flowering time and blossom duration virtually impossible even though the frequency and quantity of flowering are strongly influenced by the quantity and timing of rainfall. The DOP considers that impact of logging on eucalypt flowering and associated nectivorous fauna movement is a localised

impact and is offset by the variability of eucalypt phenology, the retention of habitat trees and conservation areas, and the fact that the forest is comprised of a mosaic of old growth, regrowth and recently logged forest all producing different quantities of blossom.

Several public submissions express concern that the genetic pool of tree species is being weakened by leaving the more deformed, habitat trees to act as seed trees. Seed trees are fundamentally different to habitat trees. As the EIS (p.204) notes, the ideal seed tree has a full and healthy crown. The DOP notes that it has been unable to find any information which compares the genetics of healthy trees (e.g. seed trees) to those that are over-mature or under stress (e.g. habitat trees), so such claims cannot be evaluated.

In the assessment of harvesting impacts, rare species are given little attention. The EIS notes that most of the significant species are unlikely to be directly affected by logging because of their location on steep slopes, rocky terrain or in rainforest. The EIS, however, does not identify which particular species would be affected by logging operations. For some rare or significant species, the EIS does not clearly explain the conservation or protection measures proposed. Rare species are further discussed in Section 3.2.4.

The impacts of harvesting on rainforest are not addressed and there will be no harvesting in rainforest. This is further discussed in Section 3.2.7 of this report.

The impacts of harvesting on weeds is considered in Section 3.2.8.

Fire

Fire impacts on flora are considered in the EIS (p.263-265) including: impacts on geophytes, elimination of some sensitive flora species, the favouring of certain weed species, soil nutrient losses, changes in species composition, the susceptibility of rainforest to burning with consideration given to rainforest edge areas and impacts on rare plant species. The EIS (p.264) identifies the potential for an incorrect fire regime to eliminate some sensitive species. The EIS could have elaborated on this, identifying those species of concern and the optimal fire regime required for their existence. Consideration is given to fire frequency, intensity and season of burning, however, the range of intensities which comprise a high, medium or low intensity burn are not quantified. Such information could be provided to better compare the impacts of prescribed burning, post-logging burning and wildfire, on the flora resources of the K/WMA. The EIS (p.265) correctly identifies that more research is required to determine the long term impact of fuel reduction burning programs upon individual plant species, particularly those that are rare or endangered. This is given greater consideration in Section 3.2.4 of this report.

The EIS (p.264) with reference to King (1985) notes that post-logging burns can promote vigorous weed growth which in turn can overwhelm Tallowwood and Brush Box, whereas Sydney Blue Gum can overtop the weeds. The EIS also notes, however, that fuel (litter) may interfere with seedling regeneration of major canopy species such as Tallowwood, Sydney Blue Gum and Brush Box. The EIS should have made a conclusion as to which has the greater impact - rigorous weed growth from post-logging burning or retarded seedling regeneration from litter accumulation. It should also have considered these options in terms of the threat of wildfire and clarified why post-logging burning is desired. Further consideration of land management factors in relation to the control of lantana is provided in Section 3.2.8 of this report.

The susceptibility of rainforest to fire is recognised in the EIS (p.264). This is further discussed in Section 3.2.7 of this report.

The EIS (p.264) identifies that a fire frequency of a less than a five year interval, favours species such as Blady Grass, Kangaroo Grass, Grass Trees, Riceflowers, Stinkweed and the introduced Indian Weed and Fireweed. Impacts of weeds are further addressed in Section 3.2.8 of this report.

Roading

The EIS (p.249) identifies that major forest roads can cause impacts on vegetation structure (through the complete removal of the tree canopy), favour weed infestation, and damage rainforest. Impacts of the roading proposed over the next 10 year period are detailed in Appendix C of the EIS giving particular consideration to rare species, significant vegetation communities and rainforest. These aspects are given greater consideration in Section 3.10 of this report. Impacts of new roading on rainforest are discussed in detail in Section 3.2.7 of this report.

Grazing

The EIS (p.245) identifies that grazing has the potential to cause long term shifts in floristic composition by selectively removing preferred species. The DOP is primarily concerned with palatable rare species.

The following rare (Briggs & Leigh 1988) or significant species are likely to be palatable to cattle and occur in habitats (sclerophyll forest with grassy understorey) which are likely to be grazed: *Chrysocephalum* sp. aff. *semicalvum, Diuris disposita, Diuris pallens, Genoplesium* sp. *pumilum* and *Goodenia fordiana*. *Chrysocephalum* sp. aff. *semicalvum* occurs entirely within the Castles Flora Reserve (Carrai State Forest); *Diuris disposita* is currently not known to occur in the K/WMA, but may occur in Skillion Flat, Old Station or Mount Skillion State Forests; *Diuris pallens* is only known for one record near Mount Boss Trig in Mount Boss State Forest; *Genoplesium* sp. *pumilum?* is protected in Boogoolum Flora Reserve (Maria River State Forest); and, *Goodenia fordiana* occurs in Broken Bago State Forest. With the exception of *Diuris disposita*, all currently known localities where these species occur, are not subject to grazing leases or occupation permits for grazing as shown on Map 14 of the EIS. Grazing is currently permitted in Old Station, Skillion Flat and Mount Skillion State Forests where the endangered flora species *Diuris disposita* may occur. State Forests, in its submission, notes that if found, this species will require monitoring to determine appropriate grazing and fire management. The DOP concurs with this initiative. Rare species are given further consideration in Section 3.2.4 of this report.

It is worth noting that species which are palatable to cattle are also likely to be palatable to native fauna (e.g. kangaroos, wombats, etc). Impacts from cattle browsing are therefore difficult to distinguish from those resulting from browsing by native fauna.

Impacts of grazing are further dealt with in Section 3.20 of this report.

Beekeeping

See section 3.21 of this report.

Conclusion

The impacts of the proposal were considered with the EIS giving consideration to both changes in vegetation structure and floristics. Impacts on rainforest and weeds were addressed, however, impacts on rare plant species could have been given more attention. Grazing impacts on rare flora are considered to be minimal.

3.2.4 Rare and Significant Species

The Flora Survey identifies 38 rare or significant plant species [of which the EIS identifies 35, omitting the species: *Callistemon* sp. aff. *linearifolius, Diuris disposita* and *Genoplesium* sp. *?pumilum*]. The Flora Survey Report could have benefitted by providing more detailed descriptions of rare and significant species, their locations, their habitat and the protection measures afforded them. It should be noted that in certain instances (e.g. when rare or endangered species are endemic to a very small area of land) location details may necessarily need to be vague, as the provision of exact location details in a public document such as an EIS may aid in the unauthorised collection and trading in rare and endangered flora. The exclusion of detailed location information, in such circumstances, should not be viewed as a criticism of the EIS.

The EIS (p.17) states that *"appropriate protection measures will be taken to conserve any rare or endangered species of flora that may be discovered in State Forests in the Study Area in the future"*. Although the DOP concurs with this initiative, it notes that such protection measures need to be more specific. Such an approach is adopted in the following consideration of rare and/or significant plant species. All rare or significant species identified by the EIS or by public submissions including the NPWS submission, are discussed here. The DOP is primarily concerned with those species which have had their risk code assessed, although other species of significance are also considered. Unless otherwise indicated, risk codes are those used by Briggs and Leigh (1988). References to Briggs and Leigh (unpublished) refer to the latest unpublished Rare or Threatened Australian Plants (ROTAP) list (21/6/93).

The following provides the key to the symbols and abbreviations used in the risk codes:

1. Known from type collection only
2. Geographic range < 100 km
3. Geographic range 100 + km

X Presumed Extinct
x Presumed Extinct in a region
E Endangered
V Vulnerable
R Rare (not threatened)
K Poorly known
C Population reserved
a Adequately reserved
i Inadequately reserved

- Adequacy of reservation unknown
t Total population reserved
+ Species with natural distributions outside Australia
? Taxonomic status uncertain

Acacia tessellata (2RC-). This shrub/tree (2.5-15m high) grows in wet sclerophyll forest and on the edge of cool-temperate rainforest and in scrub in more exposed sites (Harden 1991). This species is often found regenerating in disturbed areas (Tindale and Kodela, 1991). Within the K/WMA, this species occurs in Mount Boss State Forest. It is protected in Banda Banda Flora Reserve and Lightning Ridge Conservation Area (PMP 1.1.7) where in excess of 1,000 plants are reserved. This species probably also occurs in Crown Road Conservation Area although this has not been confirmed. The Flora Survey Report notes that the total population of this species in the survey area is probably well in excess of 10,000 plants. The DOP considers that it is not necessary to reserve all locations of this species from logging, particularly as this species may be favoured by disturbance. The DOP considers that the preservation of this species in Banda Banda Flora Reserve and the Lightning Ridge Conservation area is sufficient to protect a representative sample of this species from logging.

Acianthus amplexicaulis (3RC-). This species is currently afforded no protection from logging in the K/WMA. Within the K/WMA, the only known population of this species occurs in a small gully of previously logged rainforest in Broken Bago State Forest. The DOP notes that this species shall be protected by the provision of no logging in rainforest (see Section 3.2.7). This species will also be protected from roading through the DOP provision of pre-roading surveys for rare plant species for those new roads crossing rainforest (see Section 3.2.7).

Amorphospermum whitei (3RCa). This small to medium-sized species of tree grows in littoral and warm-temperate rainforest (Harden 1990) and occurs at its southern limit of distribution in the Study Area. It is currently afforded no protection from logging in the K/WMA. There is only one record of this species for the study area, occurring in a recently logged plot in Nulla-Five Day State Forest. It is unknown if this recently logged area is rainforest or hardwood so the provision of no logging in rainforest (Section 3.2.7) may not protect this species. **In light of this, the DOP considers that the population of this species in the Nulla-Five Day State Forest should be reserved from logging.**

Bertya brownii (2RC-). This species of slender shrub (1-3m high) is found in deep moist sandstone gullies in rainforest and eucalypt forest (Harden 1990). The entire known population of this species within the K/WMA occurs within Lightning Ridge Conservation Area. **The DOP provision of no logging in conservation areas shall sufficiently protect this species (see Section 3.2.6).**

Boehmeria platyphylla var. *austroqueenslandica*. This species of shrub (0.5-2m high) often grows in open rocky places along water courses in rainforest (Harden 1990). It is not rare or threatened, i.e. not listed in Briggs and Leigh (1988). The Flora Survey Report, however, considers this species to be of considerable local significance. Reference is made in the EIS to two conservation areas protecting this species, neither of which was presented in a map. Table 3.5 of the EIS refers to this species being protected in the Boehmeria Forest Preserve, however the EIS (p.286) identifies this

species as occurring in Birdwood Conservation Area (PMP 1.1.7, logging allowed). The Birdwood PMP 1.1.7 area was not shown in the EIS, however, it is presented here in Map 1. Supplementary information from the SFNSW confirms that this species occurs within Birdwood Conservation Area. **The DOP is of the opinion that all occurrences of *Boehmeria platyphylla* var. *austroqueenslandica* within Birdwood PMP 1.1.7, should be protected from logging.**

Boronia chartacea. This species of shrub (0.4-2.7m high) grows in moist gullies (Harden 1992). This plant is a recently described species, hence it is not listed in Briggs and Leigh (1988). It appears to occur in disjunct populations. The Flora Survey Report notes that within the K/WMA, this species occurs on granite in the Bril Bril Creek area (PMP 1.1.7 - logging allowed). The DOP considers that the population in the Bril Bril Creek (PMP 1.1.7) area should be protected from logging.

Caesalpinia subtropica. This woody climber grows in or near rainforest (Harden 1992). It is not listed in Briggs and Leigh (1988). All known populations of this species within the K/WMA are protected as they occur in dry rainforest on limestone in The Castles Flora Reserve.

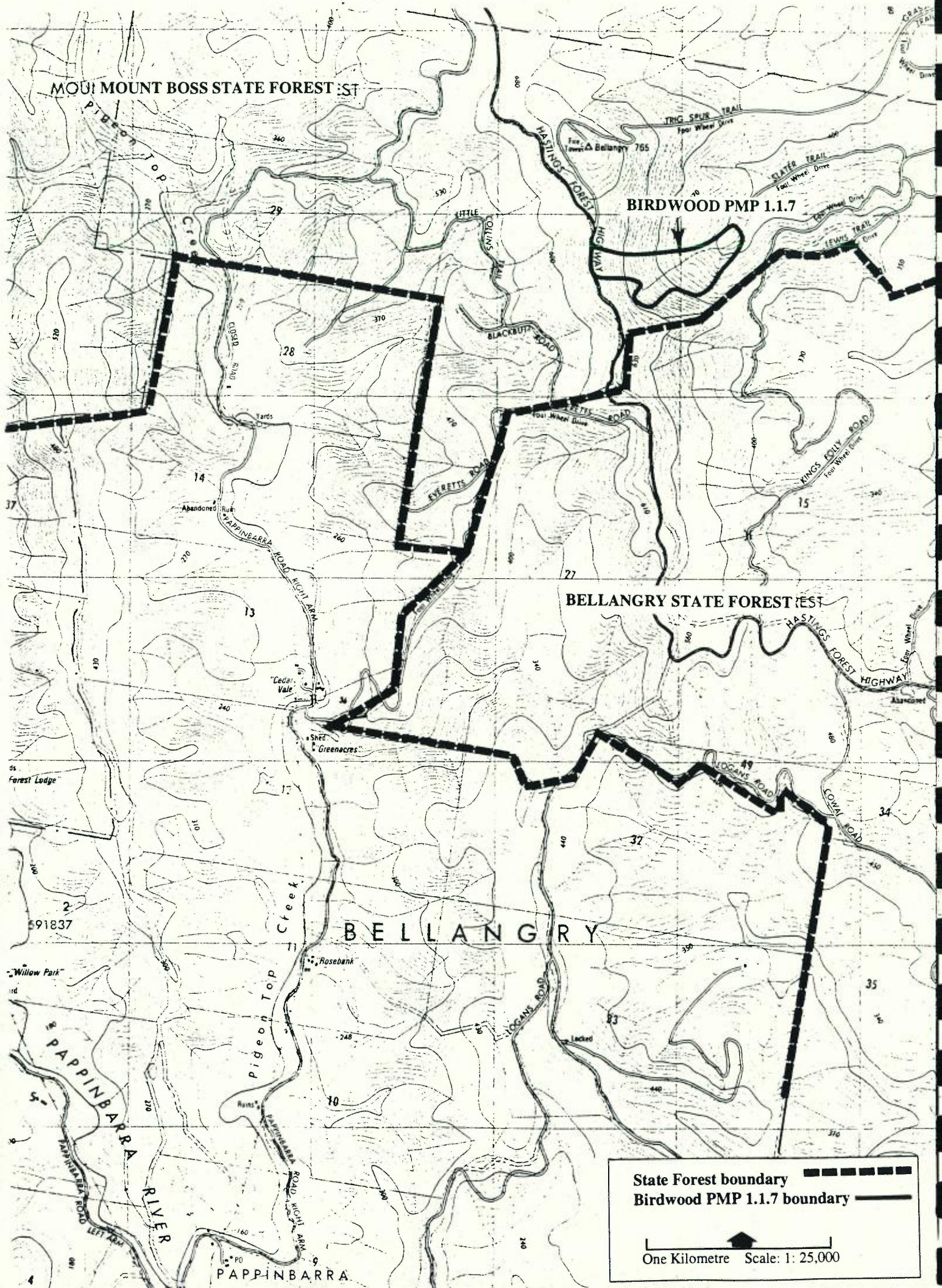
Callistemon sp. aff *linearifolius*. This species of bottle brush occurs in shrubland and on granite outcrops in the K/WMA and is known to occur in Kippara and Bril Bril State Forests. The Flora Survey Report notes that this species does not closely match any described species and its taxonomic status and conservation significance will remain uncertain until this genus is revised. For this reason, this species is not listed in Briggs and Leigh (1988). A population of this species occurs in the Bril Bril Creek (PMP 1.1.7) Area. The DOP considers that the location of this species in Bril Bril Creek (PMP 1.1.7) Area should be protected from logging.

Callitris oblonga (3VCi; 3VCa Briggs & Leigh unpubl.). This species of small tree usually grows in sand near banks of streams (Harden 1990). The EIS identified that this vulnerable species occurs in Werrikimbe National Park. The SFNSW, in its submission, notes that there are no records of this species from State Forests within the K/WMA. It further comments that its known habitats are necessarily excluded from logging. The DOP notes that much of its habitat will be excluded from logging by the provisions of the SEMGL.

Chrysocephalum sp. aff. *semicalvum*: This species is also known as *Helichrysum sp. aff. ambiguum*. This species of perennial herb is listed in the Kempsey Area Management Plan (1988) as risk Code 2VC, although no reference is provided as to this coding. The Flora Survey Report notes that this undescribed and previously uncollected taxon appears to be endemic to the Kempsey MA. It is known only from several hundred plants covering less than 1ha in the Castles Flora Reserve. Hence, all known locations of this species are reserved within the Castles Flora Reserve, Carrai State Forest.

Cryptandra lanosiflora. This stunted shrub (<30cm high) occurs in heath and open forest on exposed rocky sites at higher altitudes (Harden 1990). It is not listed in Briggs and Leigh (1988). Within the K/WMA, the entire known population of this species occurs within Spokes Conservation area. No further protection measures are warranted.

Map 1 Birdwood PMP 1.1.7



Cryptocarya nova-anglica (3RCa). This species of medium-sized understorey tree is found in cool-temperate rainforest (Harden 1990). In the K/WMA it is found in Banda Banda Flora Reserve although the best developed stands occur in the adjacent Werrikimbe National Park. The DOP is of the opinion that the Banda Banda Reservation and the DOP provision of no logging in rainforest (see Section 3.2.7) shall adequately protect this species.

Cryptocarya williwilliana (2RCi). This shrub or small tree is confined to dry rainforest on limestone in the Macleay River Valley from 250-800m altitude (Harden 1990). This species is afforded protection in the Castles Flora Reserve where in excess of 1,000 individuals are reserved. The DOP is of the opinion that this species is adequately protected by the Castles Flora Reserve and the provision of no logging in rainforest (see section 3.2.7).

Diuris disposita (2E, Jones 1991; 2K, Briggs & Leigh unpubl.). This species was identified in the Flora Survey Report as being significant but was omitted from the EIS discussion. This species of orchid has not been found in State Forests in the K/WMA although it has been found near Kempsey where it is regarded as threatened by urban development. Harden (1993) notes that this species grows in moist grassland in sclerophyll forest. The SFNSW, in its submission, notes that there is a high possibility of this species occurring in the Skillion Flat area. This area was not sampled by the Flora Survey. This species is evident in Spring when it flowers and can best be surveyed in early October. **Prior to logging the SFNSW should conduct spring surveys in Old Station, Mount Skillion and Skillion Flat State Forests to locate this species and protect from logging any populations found.**

Dodonaea megazyga (3RCa). This species has been removed from the current Rare or Threatened Australian Plant species (ROTAP) list. Within the K/WMA it is afforded protection in Feltons Flora Reserve. It also appears that this species is favoured by disturbance such as road construction. This species is adequately protected by the conservation strategy and warrants no further protection.

Dodonaea serratifolia (2RC-). Harden (1991) notes that this species of erect shrub (to 1.5m high) grows in dry sclerophyll forest on granitic soils. Within the K/WMA, this species is only known to occur on Kemps Pinnacle in Vacant Crown Land near Banda Banda Flora Reserve. From Map 17 of the EIS this area appears to be inaccessible. **The DOP considers that the SFNSW should not conduct logging in areas where populations of *Dodonaea serratifolia* are known to occur.**

Eriostemon difformis ssp. *smithianus*. This shrub (0.5-2m high) grows in dry sclerophyll forest (Harden 1991). The Flora Survey Report notes that this species is localised and rare in NSW. This is supported by Harden (1992), although the current ROTAP records do not list this species. Total known population in the K/WMA occurs within Cairncross Flora Reserve. It occurs in shrubland on granite outcrop and as such is very unlikely to be affected by logging operations. The DOP is of the opinion that no specific reservation of this species is necessary.

Eucalyptus ancophila (2R; 2K Briggs and Leigh unpubl.). This species of tree was not recorded during the survey but is known to occur in Collombatti, Tamban and Ingalba State Forests. It is known only from the Kempsey-Bellingen district of coastal NSW

(Johnson & Hill 1990). In the K/WMA, this species is not afforded any degree of protection. It usually occurs along creeks or valley bottoms in moderately dissected coastal range country in tall forest with a dense rainforest understorey. As such some of the habitat of this species will be protected by the filter strip and protection strip provisions of the SEMGL. Areas where this species coincides with *E. fusiformis* are, however, considered to be of most importance. *E. ancophila* is also given consideration in the conservation of the *E. grandis-E.ancophila* community type (see Section 3.2.5). **The DOP is of the opinion that a conservation area should be allocated for this species (see comments on *Eucalyptus fusiformis*, following).**

Eucalyptus fusiformis (2RC-, Briggs & Leigh, unpubl.). This species of tree was not recorded during the Flora Survey, however, it is known to occur in Tamban and Ingalba State Forests. It is currently afforded no protection in the K/WMA. **The DOP is of the opinion that a conservation area should be created in either Ingalba or Tamban State Forests to reserve populations of both *Eucalyptus ancophila* and *Eucalyptus fusiformis*, giving preference to the least disturbed area containing these two species. If these species are found not to occur together, then the State Forests shall reserve the least disturbed population of *Eucalyptus fusiformis*. In this situation *E. ancophila* will be protected by the provision of no logging in *E. grandis-E.ancophila* community (see Section 3.2.5).**

Eucalyptus largeana (3R). The total known population of this species within the K/WMA occurs in Yessabah Forest Preserve in Yessabah State Forest. No further protection is warranted for this species.

Eucalyptus michaeliana (3RCa). This species is localised but sometimes common in the K/WMA, occurring on steep rocky slopes at the edge of the Carrai Plateau (Binns and Chapman 1993). Such areas are unlikely to be affected by logging. This species is reserved in Northern Brittle Gum Forest Preserve and, outside of the study area, occurs in Oxley-Wild Rivers and Guy Fawkes River National Parks. The reservation afforded this species within the study area is sufficient and no further protection is warranted.

Gahnia insignis (3RCa). This decumbent perennial (50-200cm high) grows on slopes in forest and occasionally in heath, often on volcanic soils (Harden 1993). Several fairly extensive populations occur under *Allocasuarina littoralis*, on slopes immediately above rock outcrops, in granite areas of Kippara and Mount Boss State Forests. The majority of populations within the K/WMA are reserved in Wild Bull Flora Reserve in Mount Boss State Forest. The reservation of this species within Wild Bull Flora Reserve is considered sufficient and no further protection measures are required.

Genoplesium sp. (pumilum). Although not nationally recognised as rare or threatened, the Flora Survey notes that this species may be of significance. A few specimens have been collected from the Maria River State Forest and cannot be readily matched to any known taxon. This terrestrial herb (8-20cm high) is known to grow in sclerophyll forest as well as moss gardens over sandstone sheets and in heath (Harden 1993). All known locations of this species within the K/WMA occur within Boogoolum Flora Reserve. No further protection measures are warranted.

Goodenia fordiana. (2RC-, Briggs & Leigh, unpubl.). This is a prostrate herb which grows in sclerophyll forest (Harden 1992). This species occurs in Broken Bago State

Forest though is afforded no special protection in the K/WMA. It may be favoured by disturbance. The Flora Survey Report notes that its conservation status requires further investigation, however, it is identified on the current ROTAP list (Briggs & Leigh unpubl.) as being 2RC-. This species is fairly widespread within the K/WMA, and may be locally very common. **The DOP considers that the SFNSW should investigate the occurrence of this species in Broken Bago State Forest and, in consultation with the DOP, protect the least disturbed population of this species from logging.**

Grevillea linsmithii (3RCa). In the study area it is of restricted distribution but locally common, occurring in shrubland, rock outcrops and less frequently in open forest along creeks and in granite areas of Kippara and Mount Boss State Forests (Binns & Chapman 1993). Within the K/WMA this species is reserved in Wild Bull Flora Reserve. Populations of this species also occur in Werrikimbe National Park adjacent to the Wauchope MA. The conservation measures afforded this species within the K/WMA are considered adequate.

Grevillea obtusiflora ssp. *granulifera* (3RCa for species). Within the K/WMA this species occurs at the edge of the Carrai Plateau and in Banda Banda Flora Reserve. Harden (1991) notes that the species grow in dry sclerophyll forest or woodland on acidic substrates. As this species is coded as having an adequate conservation, the DOP is of the opinion that the conservation of this species in Banda Banda Flora Reserve is sufficient.

Hakea trineura (3KC-; now 3VCi). This shrub (to 7m high) grows in sclerophyll forest but is restricted to near the coastal ranges above 230m alt. (Harden 1991). Within the K/WMA, the total known population of this species is reserved in Wild Bull Flora Reserve.

Hibbertia hexandra (3RC-). This species of tall shrub or small tree occurs chiefly in heath, open forest or rainforest (Harden 1990). Most if not all of the known population of this species within the K/WMA is reserved within Wild Bull Flora Reserve. The DOP considers that this conservation measure is sufficient.

Hibbertia villosa (2RCa; 3KC-, Briggs & Leigh, unpubl.). This is a species of shrub (to 50cm tall) which grows in open forest on shallow soils (Harden 1990). This species is found in large populations in Werrikimbe National Park. In the K/WMA the entire known population of this species is reserved in the Spokes Conservation Area. The DOP considers that this conservation is sufficient.

Kunzea species A. The Flora Survey Report notes that this species probably should be listed as nationally significant. This species is often dominant in shrublands and occurs in rock outcrops in Cairncross SF where 500-1000 plants exist. Most of this species is reserved in Cairncross Flora Reserve. A small population also occurs in Bril Bril PMP (1.1.7) area. The DOP notes that this species is unlikely to be affected by logging due to its occurrence in rock outcrop habitat.

Leucopogon cicatricatus (3RC, Powell & Robertson; 1993; 3RC-, Briggs & Leigh unpubl.). This is a species of slender to erect sparsely branched shrub which grows in sparse, shrubby vegetation in rock crevices and on exposed plateaus on skeletal sandy soil over granite or other igneous rocks (Powell & Robertson 1993). Within the

K/WMA, it occurs in Carrai State Forest. The total known population of this species occurring within the K/WMA, is reserved in Spokes Conservation Area, Carrai State Forest. The DOP considers that no further reservation is warranted.

Leptopteris fraseri. This species of terrestrial fern grows in very wet places, often near waterfalls in cooler rainforest (Harden 1990). The DOP notes that this species will be protected by the provision of no logging in rainforest (Section 3.2.7).

Lycopodium myrtifolium. This species of Clubmoss is not nationally significant, however, Harden (1990) considers this species rare in NSW. This species grows in rock crevices or is epiphytic in rainforest (Harden 1990). Within the K/WMA, only a few plants have been recorded, and this has been from rainforest near waterfalls in Mount Boss State Forest. The provision of no logging in rainforest (section 3.2.7) will adequately protect these populations.

Marsdenia liisae (3RC-). This species of vine grows in wet sclerophyll forest and on rainforest margins (Harden 1992). Within the K/WMA, it occurs in the Upper Hastings River (Harden 1992) and Banda Banda Flora Reserve areas, Mount Boss State Forest (Williams 1989). Its occurrence in Banda Banda Flora Reserve has not been confirmed by SFNSW. **The DOP considers that the SFNSW should conduct searches for this species in Banda Banda Flora Reserve to confirm its occurrence. If not found in Banda Banda Flora Reserve, the DOP considers that prelogging surveys are necessary for this species in Mount Boss State Forest. These surveys shall be limited to an extent necessary to identify and protect a viable population of this species from logging and new roading.**

Melaleuca groveana (3VC-). This shrub or small tree (generally 2-5m) grows in heath, often on exposed sites (Harden 1991). Within the K/WMA, it occurs in Mount Boss, Kippara and Broken Bago State Forests. The majority of the K/WMA population occurs in the Bril Bril Creek (PMP 1.1.7 - logging permitted) area. **Because this species is listed as vulnerable, the DOP considers that all known locations of this species should be protected from logging.**

Papillilabium beckleri (3RC-). This orchid occurs in riparian and rainforest vegetation, predominantly along creek lines. No formal protection for this species has been afforded by the EIS. The DOP notes that this species will be protected by the provision of no logging in rainforest areas, and the adoption of the SEMGL which protects filter strips from logging.

Pseudanthus pimeleoides. This erect shrub (to 1m high) generally grows on sandy soils in moist gullies (Harden 1990). The Flora Survey Report notes that a distinct morphological form of this species occurs on granite outcrops in Bellangry and Bril Bril State Forests. The Survey Report notes that although it has no formal taxonomic status, it is of potential conservation significance. D. Binns (pers.comm. 1993) has indicated that all known populations occur within Bril Bril Creek PMP 1.1.7 area. The DOP considers that the areas of Bril Bril Creek Area (PMP 1.1.7) where this species occurs, should be protected from logging.

Pultenaea petiolaris. This procumbent shrub grows in heath to dry sclerophyll forest on sandy soil (Harden 1991). The Flora Survey Report indicates that this species, of local

conservation significance, occurs on coarse-grained granite soils in Bril Bril and Bellangry State Forests. D. Binns (pers.comm. 1993) has noted that all known populations occur within Bril Bril Creek PMP 1.1.7 area. The DOP considers that the areas of Bril Bril Creek PMP 1.1.7 Area where this species occurs, should be protected from logging.

Sarcochilus hartmannii (3VC-). The conservation code for this species was not provided in the EIS nor the Flora Survey. This semi-erect epilithic or terrestrial herb usually grows in sclerophyll forest or exposed sites, on volcanic rock with often shallow soil (Harden 1993). The NPWS, in its submission, notes that there are records of this species from Threadneedle Creek, Kunderang Brook area. The Flora Survey Report notes that this species is occasional to locally common on rock outcrops, scattered throughout the area along the escarpment, but especially in Mount Boss and Kippara State Forests. **Because this species is considered vulnerable the DOP is of the opinion that all known populations of this species should be reserved from logging.**

Schistotylus purpuratus (3RCi). This species of orchid is reserved in Werrikimbe National Park. Within the K/WMA, it occurs in Cochrane Flora Reserve. It also occurs in Doyles River State Forest in wet sclerophyll forest and rainforest. The DOP considers that this species will be adequately protected by the reservation in Cochrane Flora Reserve and the provision of no logging in rainforest.

Zieria species N. Within the K/WMA, this species occurs entirely within Banda Banda Flora Reserve. The DOP considers that no further conservation measures are warranted for this species.

The NPWS in its submission notes that the ROTAP records in the NPWS database indicates that a number of other rare plant species have been recorded either in State Forests in the K/WMA or in nearby areas. The DOP notes that this database does not necessarily make provision for land tenure so that the following listings may or may not occur on State Forests. The consideration of the following species is thus based on their recorded or likely occurrence within the K/WMA State Forests and known habitat characteristics.

Acomis acoma (3RC-): The NPWS, in its submission, notes that there is an old collection of this species from the upper Macleay and two collections dated 1954 from Valla, near Nambucca Heads within the Urunga MA. This annual or possibly perennial herb grows to 1m high, flowering summer to autumn. It grows on forest margins and roadsides (Harden 1992). The DOP considers that if this species occurs in the K/WMA, it may be favoured by logging disturbance. Consideration will also be given to this species during the assessment of the Urunga MA EIS where location details for this species are more specific.

Asperula asthenes (3VC-): Harden (1992) notes that this species of perennial herb grows in damp sites, often along river banks. The NPWS, in its submission, comments that within the K/WMA, this species is known from one collection near Mt. Boss Trig (1956). The SFNSW, in its submission, notes that the recorded locality of this species needs to be searched. **The DOP considers that the State Forests should conduct pre-logging searches for this species in Mount Boss State Forest, particularly in the vicinity of Mt Boss Trigg. Any populations found shall be reserved from logging.**

Bosistoa floydii (2RCi): According to the NPWS submission, this small tree species (15m high), occurs in Upper Taylors Arm area and Mistake State Forest in the Urunga MA. Harden (1991) notes that this species grows in sub-tropical rainforest. The DOP notes that if this species exists in the K/WMA, it will be protected by the provision of no logging in rainforest (Section 3.2.7). This species will be considered when assessing the Urunga MA EIS.

Callistemon acuminatus (3RC-): This bottlebrush grows on rocky dry slopes (Harden 1991). The NPWS, in its submission, acknowledges that this species is recorded from Broken Bago and Lorne State Forests near the southern part of the K/WMA. Prelogging surveys should be undertaken to locate this species. **A representative population of this species should be protected from logging when found.**

Cryptocarya floydii (3RCi): The NPWS submission comments that this small tree species is recorded from Kunderang Brook, Carrai SF. Harden (1990) notes that this species grows in dry rainforest on steep rocky slopes. The DOP notes that rocky areas are unlikely to be affected by logging and that dry rainforest areas will be protected by the provision of no logging in rainforest (Section 3.2.7).

Diuris pallens (synonymous with *Diuris pedunculata*) (2E): This species of terrestrial herb grows in moist grassy areas in sclerophyll forest, and flowering in August-September (Harden 1993). The NPWS notes that there is an old record (1923) of this species from near Mt. Boss Trig. The SFNSW, in its submission, notes that the recorded locality of this species needs to be searched. **The DOP considers that State Forests should conduct surveys for this species in Mount Boss SF, particularly in the vicinity of Mt Boss Trigg. State Forests of NSW shall reserve from logging any areas where populations of this species are found.**

Durringtonia paludosa (3RC, J. Briggs pers.comm., 30/11/93): The NPWS, in its submission, notes that several records exist from swamp forest in coastal areas. The DOP notes that such areas are unlikely to be affected by logging. NPWS records indicate that this species is found in the coastal Hat Head National Park. This species is unlikely to be found in the K/WMA.

Eucalyptus scias ssp. apoda (2K, J. Briggs pers.comm., 30/11/93): The NPWS, in its submission, comments that a small population of this species occurs on a rocky area between Forbes and Hastings Rivers in Werrikimbe National Park. The DOP notes that if this is the case, then this represents a large increase in the southern range of this species (cf: Johnson & Hill 1990). The SFNSW, in its submission, indicates that the species identified by the NPWS as *Eucalyptus scias ssp. apoda* is probably equivalent to what the Flora Survey has identified as *E. notabilis* in Mount Boss State Forest. These are fairly closely related species. The SFNSW notes that the Mount Boss stands are in steep rocky areas inaccessible to logging and that the most extensive stands are included in the Lightning Ridge Conservation Area. The DOP notes that this area will be protected from logging (see later).

Gonocarpus salsoloides (3RCa): The NPWS, in its submission, notes that this species of perennial herb is recorded in swamp in Limeburners Creek Nature Reserve. Harden (1991) identifies that this species is associated with swampy areas or sand. If this species occurs in the K/WMA, its habitat will not be affected by logging.

Haloragis exalata (3VCa): Harden (1991) notes that this shrub (1.5m high) grows in damp places near watercourses. The NPWS submission identifies that an old record (1907) of this species exists for the Upper Macleay. Verification of this occurrence indicates that this species was collected at Georges Creek via Kempsey. It may thus occur in the study area. The DOP notes that if this species occurs in the K/WMA it is likely to be protected by the provisions of the SEMGL. The SFNSW, in its submission, notes that further investigation of this species might be impractical as it often occurs as isolated small populations. The DOP is of a similar opinion but notes that this species will be provided for in the pre-logging and pre-roading searches conducted in various Forest Type areas and in Mount Seaview, Pee Dee, Dyke, Cowarra, Mount Skillion, Old Station and Skillion Flat State Forests (see Section 3.2.2).

Millettia australis (3VC+; 3RC-+, Briggs & Leigh unpubl.): The NPWS notes that there exists several records of this species from coastal rainforest. This species of climber grows in the warmer rainforest areas (Harden 1991). NPWS records of this species indicate that it primarily occurs in littoral rainforest. The SFNSW, in its submission, has indicated that it is very unlikely that the species occurs in the K/WMA State Forests. The DOP notes that if this species occurs in the K/WMA, it will be protected through the provision of no logging in rainforest (Section 3.2.7).

Neoastelia spectabilis (2RC-+): This tufted herb grows in rock crevices near waterfalls and in seepage lines on rocky slopes in *Nothofagus* forest at 900-1150m altitudes. The NPWS, in its submission, notes that this species is only known from New England National Park but may occur in the northern part of Nulla-Five Day State Forest. The DOP is of the opinion that given the habitat of this species, if it occurs in the K/WMA it will be adequately protected by the provisions of the SEMGL and the provision of no logging in rainforest (Section 3.2.7).

Ozothamnus whitei (3RC-): The NPWS, in its submission, notes that this shrub (1m) is recorded from Smokey Cape. This species grows in forest on rocky hillsides (Harden 1992). The SFNSW has indicated that it is unlikely that this species occurs in the K/WMA. The DOP is of a similar opinion.

Sarcochilus fitzgeraldii (3VC-): The NPWS submission notes that there are records of this species from the Threadneedle Creek, Kunderang Brook area, Carrai SF. The DOP notes that this species may have been confused with *S.hartmannii*. The SFNSW, in its submission, notes that this species is restricted to cliffs, usually near waterfalls. Harden (1993), notes that it usually grows on rocks or rarely on bases of trees, in subtropical rainforest, usually near streams, from 500-700m altitude. Given the habitat of this species, the DOP is of the opinion that this species will be adequately protected from logging given the provision of no logging in rainforest (see Section 3.2.7) and the provisions of the SEMGL.

Tasmannia glaucifolia (3VCi): The NPWS submission notes that a number of records of this shrub occur in the Point Lookout area of New England National Park and comment that it could occur in the Petroi Plateau-Diamond Flat area. Harden (1990) notes that this species mostly grows along small creeks or drainage lines, near or along the edge of *Nothofagus moorei* rainforest, between 1200 and 1550m. The DOP considers that if this species occurs in the K/WMA, it shall be protected through the provisions of the

SEMGL, no logging in rainforest (section 3.2.7) and the protection of a 20m buffer strip around cool temperate rainforest areas (section 3.2.7).

Thesium australe (3VCi+): The NPWS, in its submission, considers that this species may occur in the K/WMA, noting that several records of this species occur in coastal areas. Harden (1992) notes that this herb (40cm high) grows in grassland or woodland in damp sites. The majority of NPWS records for this species indicate that it is found on grassy hillsides particularly in the coastal Hat Head National Park. The SFNSW has indicated that it is very unlikely that this species occurs in the K/WMA. The DOP is of a similar opinion.

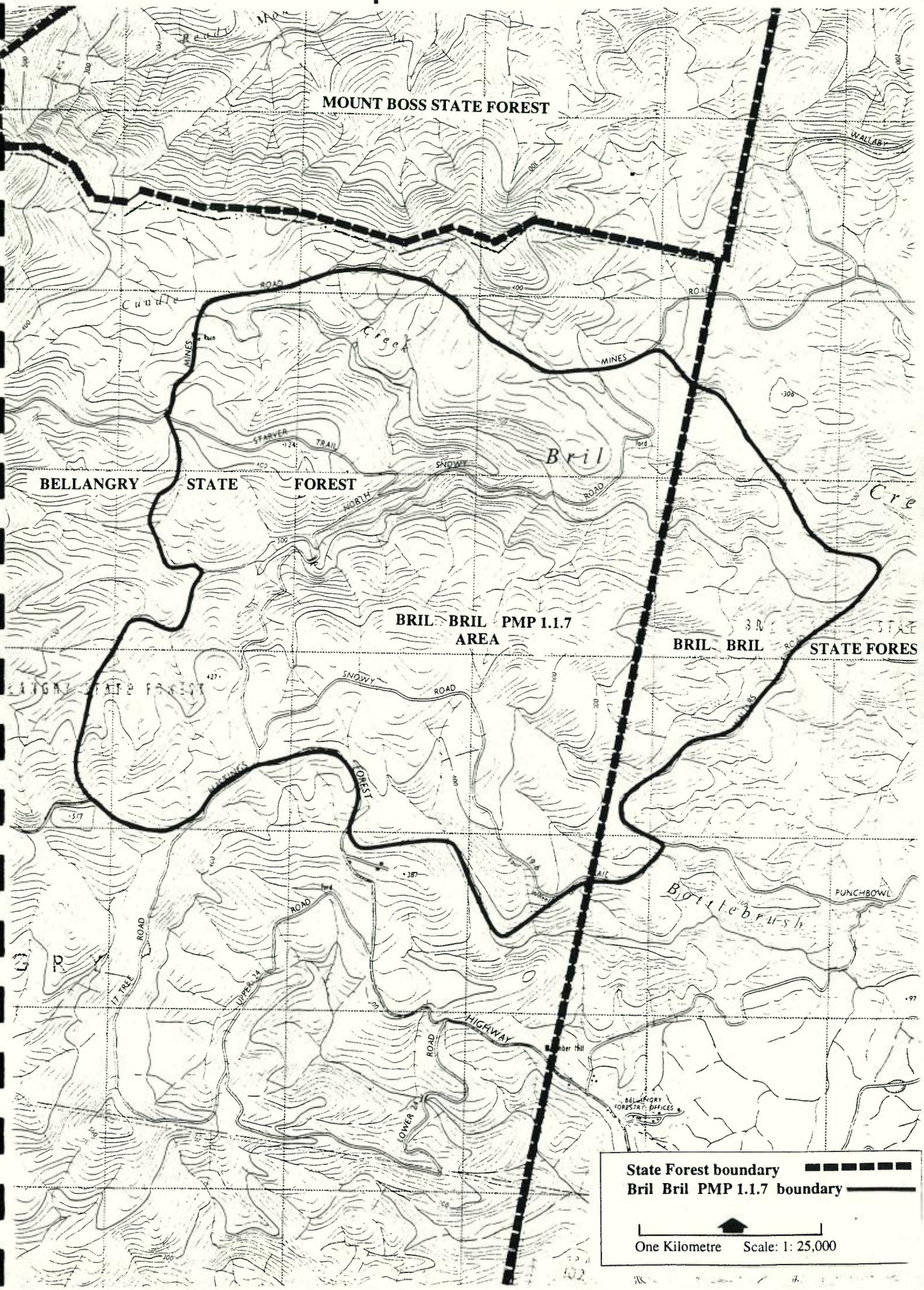
The EIS did not show the location of the Bril Bril Creek PMP 1.1.7 area. The location of this area is shown on Map 2 of this report. The Bril Bril Creek PMP 1.1.7 area does not exclude logging and it has been recently logged. This area is designated as PMP 1.1.7 so that fire frequency is compatible with the rare or significant flora in this area. Rare or significant species occurring in the Bril Bril Creek PMP 1.1.7 area include: *Boronia chartacea, Callistemon* sp. aff. *linearifolius, Kunzea species A, Melaleuca groveana, Pseudanthus pimeleoides* and *Pultenaea petiolaris*. Protection measures have been afforded all these species occurring within the Bril Bril Creek PMP 1.1.7 area except *Kunzea species A* which is considered to be sufficiently protected in Cairncross Flora Reserve.

The role of fire is of particular interest to the DOP in the preservation of rare and threatened flora species. This has been recognised in the Wingham and Glen Innes Management Area assessment reports. **The SFNSW should apply burning prescriptions to any land reserved from logging by the K/WMA EIS, as modified by the Minister's determination, where rare or significant species occur. These burning prescriptions should be designed to favour the germination and propagation of rare or significant plant species in such reserved areas. In developing these burning prescriptions, the State Forests of NSW should consult with the CSIRO Division of Plant Industry, particularly in regard to the information contained in the "National Register for the Fire Response of Plant Species", and take into consideration the information contained in this Register and advice provided by the CSIRO. The burning prescriptions developed should extend to a minimum of 20 metres from any direction where rare or significant plant species occur. Where there is no available information on the appropriate fire interval to facilitate the germination and propagation of a particular rare or significant plant species located in the reserved areas referred to above, then such species shall be afforded a minimum fire-free interval of 10 years. This recommendation, however, needs to make provision for those species adjacent to private property where prescribed burning may be necessary to reduce the fire hazard in such areas.**

Conclusion

The Flora Survey Report and the EIS identifies a large number of rare or significant plant species occurring in the K/WMA. More information on the location and habitat details of these species could have been provided. The NPWS, in its submission, identifies a large number of other rare species which it considers could inhabit the K/WMA. All of these species have been considered by the DOP in detail. The majority of the species identified by the NPWS either occur outside of the K/WMA or have

Map 2 Bril Bril PMP 1.1.7



habitats that will not be affected by logging. The DOP considers that vulnerable and endangered species should be afforded total protection from logging, while a representative sample of rare or significant species should be reserved from logging. Burning prescriptions which favour the germination of those species which are reserved, should be implemented unless such burning or lack of burning poses a threat to life or property.

3.2.5 Regional Significance of the Vegetation

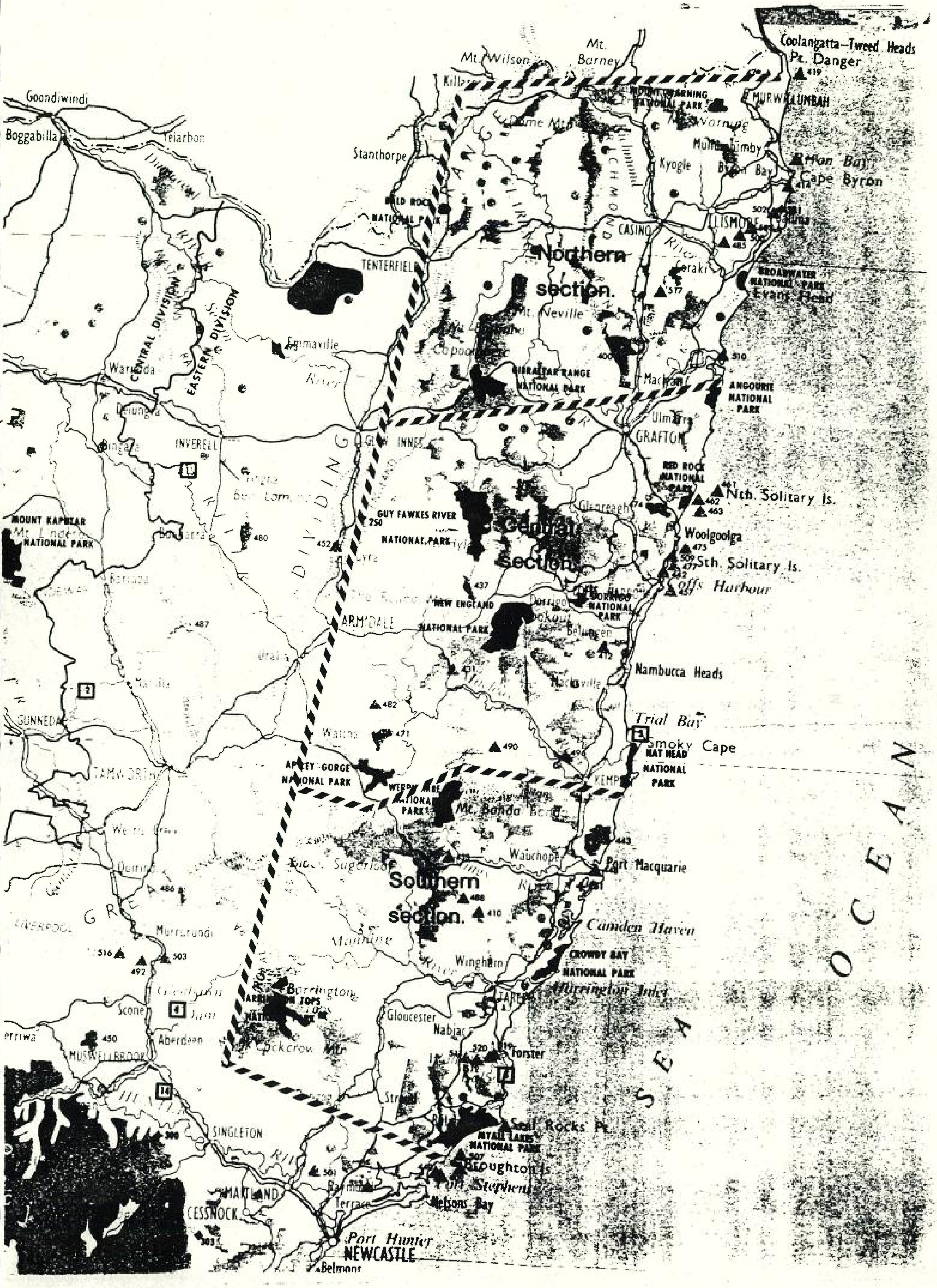
Table 3.19 (Regional Conservation Resources) of the EIS presented the regional conservation resources based on Forest Types. This table is of restricted usefulness as many Forest Types are grouped together. The groupings appear to have been made for convenience rather than for ecological reasons as they are not based on the composition of broad forest associations (as presented in Table 3.4 of the EIS). With the exception of Forest Types 36, 48, 53, 60 and 163 (which are treated as individual Types in Table 3.19), there is no way of examining the regional conservation measures afforded each of the individual Forest Types listed in Table 9.1 (Conservation Strategy) of the EIS. In addition, the regional conservation resources of the Taree MA, Kendall MA, Walcha MA and Urunga/Coffs MA as shown in Table 3.19, cannot be verified as the EISs for these Management Areas have not yet been submitted for assessment. The K/WMA EIS does not indicate if the conservation resources of these Management Areas are gazetted Flora Reserves, PMP areas or proposed conservation areas. In light of this, Table 3.19 is of limited use in assessing the conservation status of the Forest Types which occur in the K/WMA.

It should be noted that regional conservation resource estimates (according to Forest Type) for National Parks and the Wauchope, Kempsey, Taree, Kendall, Walcha, Urunga/Coffs Harbour, Dorrigo and Wingham Management Areas, have since been provided to the DOP by the SFNSW. In the absence of total resource estimates for the respective Management Areas, this inventory information cannot be effectively utilised.

In considering the regional conservation resources, the EIS examines an area bounded by Newcastle in the south to Coffs Harbour in the north and from the coast to the Great Dividing Range in the west. This is shown in Map 10 of the EIS. The area defined by the EIS for its consideration of regional conservation resources is considered by the DOP to be reasonable as there are no major biogeographical changes in the NE of NSW (Hunter River to Queensland border). For ease of assessment, however, the DOP will consider the zones distinguished by Hager and Benson (1992).

The DOP recognises that the ideal method to examine the conservation status of a community type is to consider the adequacy of reservation across that community's range. This information is not available and in its absence Hager and Benson (1992) provide the best method for assessing the conservation status of plant communities. They examine the adequacy of conservation of plant communities across the NE of NSW. Hager and Benson (1992) divide the NE NSW into three zones : north, central and south (see Map 3). This division is somewhat arbitrary and is made to examine the comparative reservation status over a north-south axis. Based on this division Kempsey lies within the central zone and Wauchope the south. As the division between zones is not based on biogeographic differences (for there are no major differences for the NE of NSW), the DOP is primarily concerned with those plant communities which are known to be inadequately conserved in the whole of NE NSW. Some attention is, however, given to the regional conservation

Map 3 Breakup of NE NSW into geographic zones (based on Hagar & Benson 1992)



significance (i.e. the occurrence of the communities within the central and southern zones; see Table 4). It is worthy to note that the Flora Survey Report utilised the Hager and Benson (1992) classification to consider the conservation status of the Flora Survey communities (i.e. the KWov communities presented in the Flora Survey Report). The DOP supports this approach.

It should be noted that the conservation status of plant communities is assessed here using Forest Types as these are mapped for the K/WMA and are the most practical management tool available for examining the distribution of plant communities. In some instances, Forest Types may not necessarily relate directly with Hager and Benson (1992) associations and in others may encompass many Hager and Benson associations. Table 4 of this report lists the commercial forest types known to occur in the K/WMA, including those found on 1:25,000 Forest Type Maps but not listed in the EIS. The adequacy of reservation of those forest types sampled by the Flora Survey has been derived by examining their closest relating Binns and Chapman (1993) community type(s) and relating this to their closest proximating Hager and Benson (1992) association(s). This method best examines and assesses the actual community composition of the Forest Types within the K/WMA. The adequacy of reservation of unsampled forest types has been derived by directly relating the forest types in question to their closest proximating Hager and Benson (1992) association. The following consideration is based on the information contained in Table 4 of this report, Table 9.1 of the EIS, Hager and Benson (1992), the Flora Survey Report, plus consideration of habitat. It should also be noted that the Hager and Benson (1992) report is currently under revision and comments regarding likely changes to the conservation status of various communities are made where appropriate.

Type 30-32. Swamp Mahogany, Paperbark and Swamp Oak. These forests have virtually no timber value and the majority of areas which occur as these Forest Types, are unlikely to be logged. As these Types occur in close proximity to water bodies, logging of these areas could potentially adversely affect the water bodies. The provisions of the SEMGL (Section 3.5) should protect many of these areas. The SFNSW in its submission notes that the protection of these Types could be formalised by the use of PMP 1.1.7. The DOP concurs with this initiative. As noted by the NPWS in its submission, dedication of secure reserves on a larger percentage of the area, particularly the State Environmental Planning Policy (SEPP 14) wetland areas would be preferred. SEPP 14 Wetland areas occur in Cairncross and Queens Lake State Forests. It is considered extremely unlikely that any timber of commercial value would occur in any area mapped as SEPP 14 wetland. **Nevertheless, the DOP considers that the Minister's determination should make provision for the reservation of SEPP 14 areas from logging and roading.**

Type 36. Moist Blackbutt. In the K/WMA, this Type is comprised of communities that are generally well conserved (<10-<25% reservation) in north-eastern NSW, but are considered to be inadequately conserved in the southern zone. The DOP considers that due to the adequacy of reservation in the whole of NE NSW and the SFNSW allocation of 12% of this Type for conservation in the K/WMA, no further reservation of this Type in the K/WMA is necessary.

Type 37. Dry Blackbutt. This is a heterogeneous Type. The communities that comprise this Type are generally considered by Hager and Benson (1992) to be inadequately conserved, though many of these have moderate areas located in reserves

Table 4 - Regional Conservation Status of K/WMA Forest Types

Forest Type	Hager and Benson Association	Reservation Status (Central) Kempsey	(South) Wauchope	NE NSW	Conservation Code
30-32	EF203	<1	<1-<5[b]	<1-<5	2
	WT102	<5-10	<10-25	<10-<25	4
36	EF115	<25->25	<5[b]	<10-<25	3
	EF117	<25->25	<5[b]	<10-<25	3
	EF118	<5-<10	<1[a]	<5-<10	3
	EF211	<25->25[b]	<5[b]	<10-<25[b]	3
37	EF115	<25->25	<5[b]	<10-<25	3
	EF117	<25->25	<5[b]	<10-<25	3
	EF118	<5-<10	<1[a]	<5-<10	2
	EF121	<5-<10	<1	<5	3
	EF123	<1	<1-<5	<1-<5	2
	EF138	<1	<1	<1	1
	EF211	<25->25[b]	<5[b]	<10-<25[b]	3
39	EF140	<1	<1	<1	1
40	EF115	<25->25	<5[b]	<10-<25	3
41	EF223	<1	<1	<1	1
45	EF138	<1	<1	<1	1
46	EF102	<1	<10-<25[b]	<5-<10	3
47	EF101	<10-<25	<5	<10-<25	3
	EF102	<1	<10-<25[b]	<5-<10	3
	EF103	<5-<10	<5-<25	<10-<25	5
	EF109	<1	<1-<5	<1-<5	2
	EF358	>25	<10-<25	<25->25[b]	5
	EF359	>25	<10-<25	<25->25[b]	5
48	EF100	<5	<1[a]	<1-<5[a]	2
	EF147	<5	<1[a]	<1-<5[a]	
49	EF138	<1	<1	<1	1
53	EF101	<10-<25	<5	<10-<25	3
	EF138	<1	<1	<1	1

Table 4 (contd)

Forest Type	Hager and Benson Association	Reservation Status (Central) Kempsey	(South) Wauchope	NE NSW	Conservation Code
54	EF316	<1-<5	<1-<5	<1-<5[a]	2
	EF346	<1	<1	<1[a]	1
60	EF110	<5	<5[b]	<10-<25	3
	EF204	<1[c]	<1[c]	<1[c]	2
	EF205	<1	<1-<5	<1-<5	2
61	EF210	<1	<5-<10[a]	<5-<10[a]	3
62	EF109	<1	<1-<5	<1-<5	2
	EF110	<5	<5[b]	<10-<25	3
	EF111	<5	<1[b]	<5-<10	3
	EF121	<5-<10	<1	<5	2
	EF123	<1	<1-<5	<1-<5	2
	EF138	<1	<1	<1	1
	EF204	<1[c]	<1[c]	<1[c]	2
	EF205	<1	<1-<5	<1-<5	2
	EF251	<1	<5-<10[a]	<5-<10[a]	3
	EF358	>25	<10-<25	<25->25[b]	5
	EF359	>25	<10-<25	<25->25[b]	5
	EF378	<25->25	N/A	<25->25	5
64	EF139	<10-<25	<1	<10-<25[b]	3
65	WT102	<5-<10	<10-<25	<10-<25	3
	EF111	<5	<1[b]	<5-<10	3
	EF146	<1-<5	<1	<10-<25	3
	EF378	<25->25	N/A	<25->25	5
70	EF121	<5-<10	<1	<5	2
73	EF125	<1	<1	<1	1
74	EF123	<1	<1-<5	<1-<5	2
85	WL116	<25->25	<5	<5-<10	3
87	EF144	<1	<1	<1	1
92	EF113	<5	<1[a]	<5-<10	3

Table 4 (contd)

Forest Type	Hager and Benson Association	Reservation Status (Central) Kempsey	(South) Wauchope	NE NSW	Conservation Code
97	EF212/213	<5-<25	N/A	<1-<5[c]	2
101	EF345	<1	<1	<1[a]	1
117	EF206, 207	<5-<10	<1-<5[a]	<5[a]	2
119	EF206, 207	<5-<10	<1-<5[a]	<5[a]	2
122	EF349, 351-356,	<1[c]	N/A	<1-<5[c]	1, 2
126	EF209	<1[c]	<1[c]	<1[c]	2
138	EF302a	N/A	<25->25	<10-<25	3
	EF303	<1-<5	<25->25	<10-<25	3
	EF323	<5-<10	<5	<5-<10[a]	3
140	EF302a	N/A	<25->25	<10-<25	3
	EF303	<1-<5	<25->25	<10-<25	3
	EF323	<5-<10	<5	<5-<10[a]	3
152	EF316	<1-<5	<1-<5	<1-<5[a]	2
159	EF308	<1	N/A	<1[a]	1
163	EF102	<1	<10-<25[b]	<5-<10	3
	EF316	<1-<5	<1-<5	<1-<5[a]	2
	EF323	<5-<10	<5	<5-<10[a]	3
	EF345	<1	<1	<1[a/c]	1
	EF346	<1	<1	<1[a/c]	1
	EF358	>25	<10-<25	<25->25[b]	5
	EF359	>25	<10-<25	<25->25[b]	5
164	EF368	<1	<1	<1	1
168	EF373, 374	<1-<5	<1	<5[b]	2

* Adjusted gross area includes other Crown-timber lands outside State Forests which are to be included in the Conservation Reserve System.

(a) Conservation status likely to improve marginally.
(b) Conservation status likely to worsen marginally.

(c) Conservation status likely to improve quite significantly (T. Hager pers.comm.)

The conservation codes are defined by Hager and Benson (1992) as:

1. Not/poorly conserved, because none or only miniscule areas located in reserves.
2. Inadequately conserved, because relatively small areas are located in reserves and major parts of its geographical range remain unprotected.
3. Inadequately conserved, because major parts of its geographical range remain poorly protected despite moderate areas being located in reserves.
4. Indeterminate, because moderate areas are located in reserves but additional information on the size of an adequate sample is required before conservation status can be reliably assessed.
5. Adequately conserved, because large areas and major parts of its geographical range are located in reserves.

(Conservation Code 3). The DOP notes that the SFNSW has allocated 5% of this Type for conservation purposes. The NPWS, in its submission, comments that Type 37 is poorly represented in NPWS reserves in the southern zone and that a reservation of 5% is barely adequate. The DOP is primarily concerned with the conservation status over the entire NE of NSW, as previously explained. Many of the communities that comprise this Type in the K/WMA have <10-<25% of their area conserved in NE NSW. It should also be noted that 22% (862.5ha) of this Type was reserved by the Wingham EIS determination, improving the reservation afforded this Type in the southern zone. An increase in reservation of this Type to 10% in the K/WMA would result in a significant reduction in yield (approximately 1,300ha of this Type) and has large socioeconomic ramifications. In light of this, the DOP accepts the conservation of 5% of this Forest Type for the K/WMA.

Type 39 Blackbutt-Spotted Gum. The EIS (p.278) justifies not reserving Type 39 on the basis that preferential removal of *Eucalyptus pilularis* (Blackbutt) may have converted Type 39 to Type 70 and thus Type 39 would be conserved in areas of Type 70. However, the DOP notes that only 5% of Type 70 (which is inadequately conserved) is proposed for conservation. Furthermore, the DOP notes that very little if any of Forest Type 39 occurs in National Parks or Flora Reserves within NE NSW. In a letter to the DOP (17/11/93), State Forests indicated that local knowledge was used to apportion areas of Blackbutt between Types 37, 39 and 40. This exercise resulted in 85ha of Type 39 being listed without a specific area being Typed accordingly. Future Typing of untyped areas may reveal locations of Type 39. **The DOP considers that the SFNSW should allocate a minimum of 10% of this Forest Type for conservation, giving preference to areas of old growth.**

Type 40. Blackbutt-Scribbly Gum. The EIS suggests that the reservation of Type 119 will result in the reservation of Type 40. The Flora Survey reveals, however, that the communities comprising these Types in the K/WMA are different. The communities comprising Type 40 in the K/WMA have a conservation status of <10-<25% for all of NE NSW, although have a low reservation status (<5%) in the southern zone. The DOP considers that because of the high conservation afforded this Type in NE NSW, no further reservation of this Type is necessary.

Type 41. Blackbutt-Bloodwood/Apple. This Type is not mentioned in the Conservation Strategy as presented in Table 9.1 of the EIS. However, this Type was recognised by the Flora Survey Report and the DOP has located this Type on 1:25,000 Forest Type Maps for the K/WMA area. This Forest Type is poorly conserved in NE NSW (<1%). The SFNSW (19/1/94), has indicated that a total of 102ha is known to occur in the K/WMA, although most of this is on Crown-timber land other than State Forest areas (see Table 1 of this report). In the Wauchope MA this Type (9ha) occurs on Cpt 98 Queens Lake State Forest, adjoining Lake Innes Nature Reserve. In Kempsey MA, this Type (5ha) occurs on Cpt 81, Tamban State Forest. Both of these areas have only been recently typed. It also occurs (88ha) on Vacant Crown-land south-east of Kempsey. The SFNSW, in its submission, noted that this Type does not appear to be well conserved in State Forest areas. The SFNSW submission further commented that areas of Type 41 would be protected by PMP 1.1.7 classification until Coastal National Parks in the region are fully investigated and the need for further reservation reviewed. **As PMP 1.1.7 does not necessarily protect these areas from logging, the DOP considers that these areas should be protected by the provision of no logging in areas of Type 41.**

Type 45. Tallowwood. According to Hager and Benson (1992), this Forest Type is poorly conserved (<1%) in NE NSW. This, however, may partly be due to the fact that this Type has only recently been identified (Forestry Commission of New South Wales 1989). The DOP notes that a small area (approximately 3 ha) of this Type occurs in Styx River State Forest. The DOP notes that the amended Map 7 of the EIS indicates that this area is unlogged. **Because this Type occurs in such a small area, the DOP is of the opinion that all of the currently known area of this Type should be reserved from logging. If future Typing of State Forest and Crown-timber land areas locates areas of this Type, then the SFNSW shall reserve 10% of this Type from logging, giving preference to old growth.**

Type 46. Sydney Blue Gum. This Forest Type has 5-10% of its area reserved in NE NSW although it has a low reservation (<1%) conserved in the central zone of which Kempsey is part. The DOP notes that the EIS has allocated 23% of this Type's area for conservation. The DOP considers that no further conservation measures are necessary.

Type 47. Tallowwood-Sydney Blue Gum. Within the K/WMA, this Type is fairly heterogeneous, comprising communities that are mostly well conserved in NE NSW. The Conservation Strategy has afforded this Type 13% reservation. No further conservation measures are considered necessary.

Type 48. Flooded Gum. This Type is inadequately conserved in NE NSW although its status is likely to improve marginally. The NPWS, in its submission, notes that all stands of Type 48 should be reserved with unlogged stands being given the most secure form of reservation. The DOP considers that such extreme measures are not warranted for this Type. The SFNSW (19/1/94) has indicated there are 242ha of this Type. **The DOP considers that 10% of Forest Type 48 should be conserved giving preference to old growth.**

Type 49. Turpentine. Type 49 is poorly conserved and unlogged areas of this type are of particular significance. This Type occurs in Cowarra State Forest yet it was not

identified in the EIS. The SFNSW indicates, in its submission, that Type 49 is included with Type 47 in Table 9.1 of the EIS and thus is more than adequately reserved in the study area. The DOP notes that Type 47 (Tallowwood - Sydney Blue Gum) has a different community composition to Type 49 (Turpentine) and should not have been amalgamated with Type 47. The DOP further acknowledges that the reservation of 13% of Type 47 (with Type 49) does not necessarily adequately protect areas of Type 49. **The DOP considers that the State Forests of NSW should reserve 10% of Forest Type 49, giving preference to old growth areas.**

Type 53. Brush Box. In the K/WMA this Type best relates to the Hager and Benson (1992) EF101 (*L. confertus-E. microcorys-E. grandis)* community which has <10-<25% of its area reserved in NE NSW. The DOP notes that the SFNSW has allocated this Type 15% reservation in the K/WMA. No further conservation measures are necessary. (The occurrence of the inadequately conserved community EF138 (*Syncarpia glomulifea-E. microcorys*) within this Type (see Table 4), is sufficiently catered for in the reservation measures afforded Forest Type 49.)

Type 54. White-topped Box. The NPWS recommends that all of this Type be reserved from logging. The DOP recognises that this Type is inadequately conserved but considers that such extreme conservation measures are not warranted, particularly as the Conservation Strategy affords this Type 32% conservation. The DOP considers that no further reservation of this Type is necessary.

Type 60. Narrow-leaved White Mahogany-Red Mahogany-Grey Ironbark-Grey Gum. The DOP notes that some of the communities comprising this Type are not adequately reserved in north-eastern NSW, however the conservation status of community EF204 (*Eucalyptus intermedia*) is likely to improve quite substantially in the revised Hager and Benson than what is currently shown on Table 4. The SFNSW has allocated this Type sufficient conservation in the K/WMA (12%). The DOP considers that no further reservation is warranted.

In its submission, the NPWS expresses concern that it is not possible to assess if unlogged examples are reserved. J. Fulton (pers. comm. 14/1/93) has indicated that unlogged examples exist in Banda Banda Flora Reserve, the Purchase Trail Conservation Area and the Glen Esk Conservation Area.

Type 61. Broad-leaved White Mahogany. This Type is inadequately conserved having a reservation states of <5-<10% in NE NSW. The status of this Type, however, is likely to improve marginally for overall NE NSW. The SFNSW have allocated this Type conservation of 34% of its area in the K/WMA. The DOP considers that no additional conservation is required.

Type 62. Grey Gum-Grey Ironbark-White Mahogany. The conservation status of this type is very difficult to assess for it is an extremely heterogeneous Type comprised of many different plant communities. This has been catered for by the Conservation Strategy, affording this Type a reservation of 19% of its area within the K/WMA. In light of this, the DOP considers that the current conservation measures afforded this Type in the K/WMA are sufficient.

Type 64. Grey Gum-Stringybark. Although this Type has less than 1% of its area reserved in the southern zone of NE NSW, the DOP notes that for overall NE NSW, its reservation status is <10-<25%. The SFNSW, in its submission, comments that 40ha of this Type occurs in a Flora Reserve on the adjoining part of Queens Lake State Forest in the Kendall Management Area. The DOP considers that because of its reservation status in NE NSW, no further protection measures are warranted for this Forest Type.

Type 65. Forest Red Gum-Grey Gum/Grey Ironbark-Roughbarked Apple. The NPWS comments that reservation of 19 ha of this Type is inadequate. The DOP notes that this Type is generally composed of communities that have a reservation status of <10-<25% in NE NSW (conservation Code 3), although it has a lower reservation in the southern and central zones of which Wauchope and Kempsey form part. The Conservation Strategy has afforded this Type a 5% reservation. The DOP considers that as the majority of plant communities comprising this Forest Type have a reservation status of <10-<25% in NE NSW, no further reservation is warranted.

Type 70. Spotted Gum. The NPWS considers that the reservation of only 42 ha (5%) of a Forest Type that is poorly reserved regionally, is inadequate. The DOP notes that for the NE NSW, reservation of this Forest Type is less than 5% with the southern region having a particularly low reservation (<1%). **The DOP considers that 10% of this Forest Type should be conserved giving preference to those areas containing old growth.**

Forest Type 73. Spotted Gum - Sydney Blue Gum/Bangalay. A small patch (<10ha) of Type 62a/73 occurs in Tamban State Forest. The SFNSW (19/1/94) indicate that this area has been mistyped and should have been recorded as Type 62a/74a consistent with the surrounding area. No conservation measures are warranted for this area, however, Type 73 may occur in the retyping of certain areas or the typing of areas which are currently untyped. **Type 73 is inadequately conserved and should be afforded 10% conservation.**

Forest Type 74. Spotted Gum - Ironbark/Grey Gum. Although not recognised in the EIS, small disjunct areas of Type 74 are found in Collombatti, Styx River, Maria River and Yessabah State Forests. Within the K/WMA, pure Type 74 occupies 104ha of land. Areas Typed 62/74 are very extensive in Collombatti, Ingalba, Tamban and Way Way State Forests. Type 74 is inadequately reserved in NE NSW (<1-<5%). **The DOP considers that a minimum of 10% of Forest Type 62/74 and 74 should be reserved from logging giving preference to old growth areas.**

Forest Type 85. (Coastal) Grey Box - Forest Red Gum. This Type occurs in the western section of Bulga State Forest. This Forest Type has <5-<10% of its area conserved in NE NSW, although approximately 25% of its area in the central region is reserved. In the southern zone, of which Bulga State Forest is part, this Type has a reservation of <5%. **The DOP considers that the SFNSW should reserve 10% of this Type, giving preference to old growth.**

Forest Type 87. Steel Box/Craven Grey Box. This Type is inadequately conserved and of high conservation significance. Only 1 ha of this Forest Type occurs in the K/WMA

and it is reserved. Future Typing may reveal more areas of this Type. In these instances, 10% of this Type should be reserved from logging.

Forest Type 92. Forest Red Gum. The NPWS comments that the reservation of 18ha (7%) of this Forest Type is inadequate. In NE NSW this Type has an overall reservation status of <5-<10% with the central and southern regions having a status of <5% and <1% respectively. The DOP notes that the status of this Type in the southern zone is likely to improve marginally in the revised Hager and Benson. **The DOP considers that 10% of this Forest Type should be conserved giving preference to old growth areas.**

Forest Type 97. Needlebark Stringybark. The NPWS states that this type is adequately represented in the proposed Conservation Strategy but comments that all areas are logged. The DOP notes that Table 4 shows this Type is inadequately conserved in NE NSW. The reservation status (<1-<5) of this Type is likely to improve quite substantially in the revised Hager and Benson. The EIS allocates 38% of this Type for conservation purposes. The DOP considers that no further reservation of this Type is necessary.

Forest Type 101. Blue Mountain Ash. This type is poorly conserved. The NPWS notes that there are limited occurrences of *Eucalyptus oreades* (Blue Mountain Ash) in the Banda Banda area of Mount Boss State Forest. Binns (pers. comm., 2/11/93) notes that Type 101 is relatively extensive in Banda Banda Flora Reserve where it is entirely mapped as Forest Type 163. The DOP notes that a small area (8ha) of Type 101 is mapped in Carrai State Forest. **As this Type is poorly conserved and is of limited occurrence, the DOP is of the opinion that the SFNSW should reserve all of the currently known area of Type 101 from logging. If future typing reveals other areas of Type 101, then 10% of its area shall be reserved, giving preference to old growth.**

Forest Type 117. Scribbly Gum. This Forest Type was not recognised by the EIS nor was it included in the Flora Survey. Small areas of this Type occur in Maria River, Tamban and Collombatti State Forests. This Type is inadequately conserved, although its conservation status in the southern zone and for the NE NSW as a whole, is likely to improve marginally in the revised Hager and Benson. **The DOP is of the opinion that as this Type is currently inadequately conserved in NE NSW, the SFNSW should reserve a minimum of 10% of this Forest Type giving preference to old growth.**

Forest Type 119. Scribbly Gum-Bloodwood. This Type is inadequately conserved in NE NSW. This has been recognised by the EIS which has afforded this Type a 65% conservation in the K/WMA. No further protection measures are warranted.

Forest Type 122. New England Stringybark. The conservation status of this Type is likely to improve quite considerably in the revised Hager and Benson. The NPWS notes that this Type is possibly adequately represented in National Parks but that areas on State Forest should not be logged. A small area (4 ha) of Forest Type 122 occurs in Doyles River State Forest. This is in close proximity to the Wingham MA where Forest Type 122 is more extensive and where the Minister's Determination for the Wingham EIS reserved 10% of this Forest Type. Given this reservation plus the limited area of this

Type in the K/WMA, the DOP is of the opinion that for the K/WMA, no reservation of this Forest Type is necessary.

Forest Type 126. Stringybark-Bloodwood. This Type is currently classified as poorly conserved, however, the conservation status of this Type is likely to improve quite considerably in the revised Hager and Benson. The EIS has proposed to reserve 58% of this Type in the K/WMA. The DOP considers this conservation measure sufficient to protect this Type.

Forest Type 138. Snow Gum. The DOP notes that this Forest Type was not recognised in the EIS but occurs in small areas in Cochrane and Carrai State Forests. The Snow Gum communities occurring in the K/WMA are generally well conserved (<10->25% reserved) in north-eastern NSW, although the Central Zone has generally <1-<10% of these communities conserved. Because of the reservation status of this Type for all of NSW, no further reservation is considered necessary. The SFNSW (19/1/94) has indicated that the stands of Type 138 within the K/WMA are not commercial and will not be subject to harvesting operations.

Forest Type 140. Snow Gum-Mountain/Manna Gum. The DOP notes that there is approximately 100-150 ha of this Type in Carrai which has not been recognised by the EIS. Nevertheless within the K/WMA, the communities comprising this Type are generally well conserved (<10->25% reserved) in north-eastern NSW, although the Central Zone has generally <1-<10% of these communities reserved. Because of the reservation status of this Type for all of NSW, no further reservation is considered necessary.

Forest Type 152. Messmate-Gum. The DOP notes that this Type is inadequately conserved in north-eastern NSW. The NPWS, in its submission, considers that the reservation of 3 ha of this Type is inadequate. The NPWS notes that there is virtually no basalt geology in Werrikimbe National Park (where some of this Type is represented) and considers that additional areas of Type 152 on soils derived from basalt, is needed. The DOP notes that Table 9.1 of the EIS has afforded 10% of this Type for conservation and is of the opinion that no further conservation is warranted in the K/WMA.

Forest Type 159. Mountain/Manna Gum. This Type is poorly conserved in NE NSW. This has been recognised by the EIS which has afforded this Type the conservation of 55% of its area within the K/WMA. The DOP considers that no further protection measures are warranted for this Type.

Forest Type 163. New England Blackbutt. This is another heterogeneous Forest Type. Areas of true Type 163 are adequately conserved, however, other community components of this Type may not be. The Conservation Strategy has afforded this Forest Type 21% conservation. The DOP is of the opinion that this is sufficient considering the heterogeneity of this Forest Type. The NPWS expresses concern over areas of Forest Type 167 that appear mapped as Type 163, particularly in Doyles River State Forest. This is considered later in this Section.

Forest Type 164. Eurabbie. This Type is poorly conserved in NE NSW, however, the DOP is of the opinion that this Type is adequately represented in the proposed Conservation

Strategy as it has been afforded 74% of its area for conservation. The DOP considers that no further conservation measures are warranted.

Forest Type 168. Silvertop Stringybark-Gum. This Type was not recognised in the EIS. It is inadequately conserved in north-eastern NSW. The SFNSW, in its submission, notes that Types 167 and 168 are quite common and probably occur on adjoining National Parks. The SFNSW comments that both Types are well conserved in Flora Reserves in the region. Regional resource estimates provided by the SFNSW to the DOP (19/1/94) do not confirm either of these claims. The DOP notes that an area of approximately 48ha occurs in the Carrai State Forest. Accessible parts of this stand have been harvested. **The DOP considers that the SFNSW should reserve a minimum 10% of Forest Type 168 giving preference to areas of old growth.**

Other Communities

There are some plant communities in the K/WMA which may not necessarily be protected by the provisions afforded the Forest Types. These communities are discussed here.

The *E. grandis-E. ancophila* communities identified by the Flora Survey Report are of interest to the DOP. *E. ancophila* is listed on the latest ROTAP (Briggs and Leigh unpubl.) list as Code 2K (see Section 3.2.4). The SFNSW, in its submission, noted that this community occurs in Ingalba State Forest which is not proposed for logging within the next 10 years, leaving time to investigate the appropriateness of conserving the scattered occurrence of this community. The DOP considers that such an investigation should be undertaken by the SFNSW. **The DOP is of the opinion that for this determination, all areas of *E. grandis-E. ancophila* should be protected from logging.**

There are a number of poorly reserved associations that are likely to occur in parts of Skillion Flat, Mt. Skillion and Old Station State Forests. These associations probably include *Eucalyptus amplifolia ssp. amplifolia-E.tereticornis-Angophora subvelutina* (EF112), *E.maculata-E.moluccana* (EF141) and *E.moluccana-E.siderophloia-E.propinqua* (EF143). These associations were not sampled by the Flora Survey and were not mentioned in the EIS. Furthermore, the NPWS notes that two of the characteristic eucalypt species of these areas, *E.moluccana (Grey Box)* and *E.amplifolia ssp. amplifolia (Cabbage Gum)*, were not recorded for the K/WMA in the Flora Survey. The SFNSW, in its submission, notes that it is possible, but not established, that the associations and specific species mentioned occur in these State Forests. These Types of forest have mostly been logged, grazed and burnt. The SFNSW submission comments that it was because of their altered condition and the fact that the proposal was to have very little effect in these areas, that such communities were given no special priority in the sampling survey. **The DOP considers that prior to any future logging occurring in the Skillion Flat, Mount Skillion and Old Station State Forests, SFNSW should investigate the occurrences of the *Eucalyptus amplifolia ssp. amplifolia-E.tereticornis-Angophora subvelutina* (EF112), *E.maculata-E.moluccana* (EF141) and *E.moluccana-E.siderophloia-E.propinqua* (EF143) communities, and if present, reserve 10% of their respective occurrences, giving preference to old growth.**

Of interest to the NPWS are parts of Skillion Flat, Mt. Skillion, Old Station Forests, which contain areas of dry forest with a dense understorey of *Lophostemon confertus* (Brush Box). The NPWS notes that these types of forests have been extensively cleared for

agriculture and that conservation of these remaining areas is critical. The DOP notes that *Lophostemon confertus* is adequately provided for in the reservation afforded Forest Type 53.

The Flora Survey Report comments that small patches of *Eucalyptus pyrocarpa* (Large-fruited Blackbutt)-*E. agglomerata* (Blue-leaved Stringybark) occur in Broken Bago State Forest. The NPWS, in its submission, notes that this area is near the southern limit for *E. pyrocarpa* and the northern limit for *E. agglomerata*. The NPWS suggests, in its submission, that this may be the only area where this community occurs. The SFNSW, in its submission, comments that, as mapped, Type 38 (Large-fruited Blackbutt) is represented in a Flora Reserve (28ha) in the adjoining Kendall Management Area (in Broken Bago State Forest). It cannot be deciphered from Table 3.19 of the EIS as to whether or not this is correct. **The DOP is of the opinion that a reserve should be created in Broken Bago State Forest to preserve the least disturbed population of this community type.**

It appears that Doyles River State Forest contains inadequately conserved plant communities within the areas generally mapped as Type 163. Of interest to the DOP are the inadequately conserved *Eucalyptus radiata* (best related to Type 111) and *E.laevopinea/E. laevopinea-E. nobilis* (Type 167) communities. The NPWS, in its submission, also notes that Type 168 is likely to occur in Doyles River State Forest. As noted previously, this Type is also inadequately conserved. The DOP notes that no areas of Types 111, 167 and 168 are shown on the Forest Type Maps for the areas of Doyles River State Forest. The SFNSW, in its submission, has indicated that Type 111, when located, will be protected at least by PMP 1.1.7. Details of the logging restrictions under PMP 1.1.7 in these areas were, however, not provided. In relation to Types 167 and 168, the NPWS notes that unlogged areas, particularly those on basalt are of highest priority for conservation. The DOP is of a similar opinion. **In light of the apparent presence of Types 111, 167 and 168, the DOP considers that Doyles River SF should be retyped, as required, to discern areas of these Forest Types. Following the retyping, 10% of Forest Types 111, 167 and 168 should be reserved from logging based on the total area extent of these Types in the K/WMA, giving preference to old growth, and in relation to Types 167 and 168, basalt geology.** Pre-logging surveys for rare and threatened species are not warranted in Types 111 and 167, as the habitats of these Types have been sampled by the Flora Survey.

No reserves are proposed in the western section of Doyles River State Forest and in Enfield State Forest in areas of basalt derived soils. The NPWS notes that such areas are likely to include forests of the poorly reserved tableland associations dominated by Messmate (*Eucalyptus obliqua*) and Silvertop Stringybark (*E. laevopinea*) and that these high nutrient basalt soils are poorly represented in conservation reserves. Most of these areas have been logged and provide little opportunity for further reservation in K/WMA. As an alternative to reserving logged forests on basalt in K/WMA, the NPWS considers that State Forests of NSW should give a commitment to reserving such areas in Walcha/Nundle MA (e.g. the Mummel Gulf area and compartments to the east of Daisy Patch Flora Reserve). The DOP notes that for the K/WMA, Table 9.1 of the K/WMA EIS currently shows that 10% of Forest Type 152 (*E. obliqua*) is reserved. Old growth areas of *E. laevopinea* on basalt geology are given consideration in the retyping of Doyles River State Forest as previously discussed. The DOP notes that it will also be giving consideration to basalt associations dominated by *E. obliqua* and *E. laevopinea* when assessing the Walcha/Nundle MA EIS. In light of this, the DOP considers that no further protection measures are required for these communities in the K/WMA.

The Flora Survey Report (p.23) comments that a small patch of Forest Type 93 (Eastern Red Gums) occurs in Cowarra State Forest. This area was not sampled by the Flora Survey. The SFNSW, in its submission, notes that Type 93 is not represented in Flora Reserves and there is therefore a case for preservation of good examples of this Type. The submission indicated that this may warrant further investigation in Cowarra State Forest. The DOP has been unable to locate the areas of Type 93 from the 1:25,000 map sheets. The Flora Survey report comments that *E. bancroftii* is dominant in a small area of woodland on serpentinite in Cowarra SF. It further notes that *E. seeanna* may also be present. The NPWS submission cites Harden (1992) as noting that the southern limits for these species is Kew and Telegraph Point respectively. The NPWS considers a community comprised of these species is of considerable conservation significance. The DOP is of a similar opinion. **The DOP considers that pre-logging surveys should be conducted in Cowarra SF to identify the *E. bancroftii and E. bancroftii-E. seeanna* communities. All such communities shall be reserved from logging.**

The NPWS, in its submission, notes that the population of Roundleaved Gum as identified in Research Note No. 17 (FCNSW 1989) in the Northern Brittle Gum Forest Preserve of Carrai area was not investigated. The NPWS notes that the species *Eucalyptus deanei* (Roundleaved Gum) has recently been split into two species (Johnson & Hill 1990). The populations north from Tyringham are now recognised as *Eucalyptus brunnea* and those south of Broke as *E. deanei* (Harden 1991). Thus, populations in the Carrai area would be geographically separated from the main distribution of either of these species and could be of interest. The DOP notes that neither of these species are rare but that it would be prudent of the SFNSW to investigate the occurrence of *E. deanei* in the Carrai area as the population will represent an increase in range for at least one of these species.

The NPWS submission expresses concern over *Eucalyptus nobilis* on the Petroi Plateau in Nulla-Five Day, Styx River and Lower Creek State Forests noting that the old growth areas containing this community should be reserved. Johnson and Hill (1990) consider that *E. nobilis* as a species, is not at risk. The SFNSW, in its submission, comments that *E. nobilis* occurs in filter strips and wildlife corridors and has proved itself quite persistent where it has been fully cleared in the past. State Forests have indicated API interpretation has confirmed that a stand of *E.nobilis* on Lower Creek State Forest of debatable logging history, is in fact regeneration from clearing in the 1930s. The DOP notes that the Hager and Benson (1992) association that best relates to stands dominated by *E. nobilis* is the EF 316 (*Eucalyptus obliqua-Eucalyptus nobilis*) association. This community is inadequately conserved. **In light of this, the SFNSW should reserve 10% of the *E. nobilis* populations giving preference to areas of old growth.**

Conclusion

The EIS provides a consideration of the regional conservation resources, although this is limited by the amalgamation of the Forest Types considered. The DOP has opted to consider the regional conservation of Forest Types by utilising Hager and Benson (1992) and by examining the community composition of those Forest Types that were sampled by the Flora Survey. Consideration is also given to unsampled Types and those Types of limited occurrence occurring in the K/WMA and not recognised by the EIS. In light of this consideration, the reservation of certain inadequately conserved Forest Types has been increased to 10%, predominantly based on the reservation status

of the plant communities/Forest Types for all of NE NSW. Forest Type 37 is not allocated such an increase due to resource implications and the EIS's allocation of 5% of this Type is appropriate. Certain communities which are not covered by the Forest Typing have been considered individually and conservation recommendations made where appropriate. Retyping of certain areas is required prior to these conservation measures being implemented.

3.2.6 Conservation Strategy

The area estimates of Forest Types presented in Table 9.1 of the EIS need to be discussed. As the digitising of Forest Types to Geographical Information Systems (GIS) has not yet commenced in the Kempsey and Wauchope Management Areas, Forest Type area estimates used in the K/WMA EIS were collated manually from existing sources of information. Area estimates for the two management areas were compiled by different means. Table 9.1 of the EIS relies heavily on the details from the Wauchope Management Plan. In Kempsey MA a different approach was used. Table 3 of the Kempsey Management Plan expresses percentages of various types and this was used to calculate the appropriate area of the Types. Minor Types listed as *"Miscellaneous Types"* and others recognised by field staff (Types 65, 70, 87, 216) were proportioned on the basis of local knowledge. Areas of Types within flora reserves/forest preserves were proportioned on the basis of local knowledge. The more widespread Types were distributed over the remaining area on the basis of percentages listed in the Management Plan (SFNSW pers. comm. 19/1/94). Hence a rigorous examination of Table 9.1 has highlighted some anomalies. These are discussed below.

The EIS should have clearly explained how Table 9.1 was derived. The EIS (p.28) identifies that 207,887 ha of State Forest and 93,732 ha of Crown-timber lands exist in the study area. Table 9.1 of the EIS (p.278) gives the total area as 190,962 ha. Admittedly this Table does not include rainforest (25,639 ha, Table 3.4 (a and b)) or non-forest and rock (7,576 ha, Table 3.4 (a and b)). This leaves 77,442 ha (presumably forest) unaccounted for. State Forests (19/1/94) has indicated that Table 9.1 is intended to indicate the extent of conservation resources in lands over which State Forests either has management control or proposes to have control in the longer term following proposed dedication. Accordingly, it does not purport to represent the percentage of reservation of all Crown-timber lands. This aspect, itself, would account for a large proportion of the apparent under-representation of the K/WMA resource presented in Table 9.1. This explanation, however, does not verify the resource estimates and percentage conservation afforded the K/WMA Forest Types. Given that the conservation strategy is based on reserving an adequate representation of inadequately conserved Forest Types, the actual percentage of reservation afforded the Types by the EIS (Table 9.1) could be questioned. **In light of this, the DOP considers that the Minister's determination should afford the following Forest Types (inadequately or poorly conserved and unlikely to improve significantly in the revised Hager and Benson) a minimum of 10% reservation, even though the EIS appears to have afforded these Types a greater than 10% reservation: 46, 54, 60, 62, 87, 119, 152, 159 and 164. The 5% reservation afforded Type 37 should be endorsed in a similar fashion.**

It is worthy to note that the conservation strategy for the EIS is based on the assumption that the conservation areas identified on Map 17 of the EIS will be protected from logging. The classification of some areas as PMP 1.1.7 and PMP 1.3, however, does not necessarily exclude logging and new roading. **The DOP considers that the Minister's determination should designate that all conservation areas presented on Map 17 be protected from**

logging and new roading except for the new roading allowed for by the recommendations from Section 3.10 (New Roads).

Conclusion

Forest Type resource estimates were collated manually to create Table 9.1 of the EIS. The resource estimates for this Table were proportioned on the basis of local knowledge and may not necessarily reflect the true extent of Forest Types as mapped. In light of this, it is considered that the Minister's Determination should ensure that inadequately conserved Forest Types 46, 54, 60, 62, 87, 110, 152, 159 and 164 are, in fact, allocated a minimum of 10% reservation for the life of the 10 year approval being granted this EIS. Similarly, the Minister's Determination should endorse the 5% minimum reservation afforded Type 37 by the EIS. Conservation areas shown on Map 17 should not be allowed to be logged as these areas have been allocated for conservation purposes by the EIS.

3.2.7 Rainforest

Definition

There has been some dispute over the SFNSW definition of rainforest. The Forestry Commission of New South Wales, Research Note 17 (1989) defines rainforest as:

> "*A closed, moisture-loving community of trees, usually containing one or more subordinate storeys of trees and shrubs; frequently mixed in composition; the species typically, but not invariably, broadleaved and evergreen; heavy vines (lianes), vascular and nonvascular epiphytes, stranglers and buttressing often present and sometimes abundant; floristic affinities mainly with the relic Gondwanan flora, for which both temperate and subtropical elements appear recognisable, and to a less extent with the later invasive Indo-Malesian flora; eucalypts typically absent except as relics of an earlier community.*"

The lack of agreement over this definition has primarily focused on the occurrence of emergent overstorey eucalypt and other sclerophyll species, most notably Turpentine (*Syncarpia glomulifera*) and Brushbox (*Lophostemon confertus*). These are conventionally regarded as sclerophylls, however, Brushbox has relatively large flat dark green leaves which are more mesic than those of either Eucalypts or Turpentine (Adam 1992). Its canopy is much denser than that of most eucalypts and its leaves are very similar to those of several fig species. Brushbox is particularly common in the K/WMA. The inclusion of stands with *Lophostemon* and eucalypt emergents within the definition of rainforest was of considerable debate in the early 1980s and the issue was addressed at length in the inquiry into logging at Terania Creek. The findings of this Inquiry took the view that Brush-box stands were separate to rainforest. The SFNSW definition of rainforest does not address whether Brushbox communities should be included as a rainforest association.

In the case of the K/WMA, the situation is made more ambiguous by the results of the Flora Survey which identified three *Lophostemon confertus* dominating communities, one of which (*Lophostemon confertus-Backhousia myrtifolia*) was identified as rainforest. The DOP notes, however, that this particular rainforest community occurs very extensively as

narrow strips along creeks, especially associated with rocky creek banks in granite areas, often on steep slopes. This community best relates to Forest Types 23 and 53. Type 23 is protected by the provision of no logging in rainforest. Type 53 has been afforded the protection of 15% of its area. The DOP also notes areas of *Lephostemon confertus-Backhousia myrtifolia* which occur along streams will be protected under the provisions of the SEMGL.

Another issue of rainforest definition is the presence of closed understoreys. Adam (1992) notes that there is general agreement that the closed understorey is, in some sense, rainforest and that there is a strong case for treating the whole mixed forest complex as rainforest, albeit one with special features. In terms of biomass the sclerophyll element is predominant, however, in terms of number of individuals, the rainforest element is by far the larger.

The DOP notes that rainforest definition is still an area of considerable debate. For the purposes of this EIS, the DOP accepts the Research Note 17 definition since the proposal is based on the identification of Forest Types as identified in Research Note 17 and as Type 53 (Brushbox) has been considered within the context of hardwood and afforded the reservation of 15% of its area.

Harvesting

There were some discrepancies in the EIS regarding the extent of rainforest in the two management areas and the area of each which had been logged. Table 5 shows the apparent corrected figures (provided to the DOP from State Forests 7/12/93).

Table 5 - Rainforest Extent in the K/WMA

	Wauchope	Kempsey	Total
Logged Rainforest	5,150	2,016	7,166
Unlogged Rainforest	8,932	8,909	17,841
Total Rainforest	14,082	10,925	25,007

The EIS (p.43) notes that rainforest covers 14,082ha in Wauchope and 9,858 ha (10,925ha from Table 5) in Kempsey. Four types of rainforest are identified for the K/WMA: subtropical rainforest (Types 1, 2, 3 and 6); warm temperate rainforest (Type 12); cool temperate rainforest (Type 17); and dry rainforest (Types 23 and 26). The areas of each of these individual Types were not provided. Forest Types B/L (including Types 2, 3, 11 and 17) and 22 (Yellow Tulipwood, a dry and depauperate rainforest type) also occur in the K/WMA. These types were not described and their occurrence was not recognised by the EIS. It is not clear if these Types have been included in the calculation of rainforest extent in the EIS and Table 5. Of interest to the DOP is Type B/L which can include warm temperate rainforest (Type 11) and cool temperate rainforest (Type 17). It is also unknown if the rainforest areas in currently untyped State Forest and Crown-timber lands have been included

in the figures presented in the EIS and Table 5 (above). Hence, the true extent of rainforest may be greater than that predicted by the EIS.

The EIS was not totally clear as to whether rainforest logging was intended. The EIS (p.69) noted that general purpose rainforest logging ceased in 1978 and since then has been restricted to very selective salvage of damaged trees for specialist use with the rainforest canopy and structure maintained. In contrast to that, the EIS (p.68) identified that: *"Since the 1982 Rainforest Decision, harvesting of rainforest has been confined to very selective logging in parts of Mount Boss and Carrai State Forests to satisfy State Government commitments"*. The EIS (p.111, 180 and 242) then notes that rainforest areas will not be subject to further general purpose logging and that the utilisation of rainforest logs will be limited to the removal of individual trees from within the road line during road construction or from within hardwood forest types in association with hardwood logging. The EIS does not consider environmental interactions nor identify or assess the impacts of selective rainforest harvesting. Rainforest is also not included in the EIS's consideration of regional conservation resources. Impacts of roading on rainforest were, however, given detailed consideration (this is discussed later in this Section). **In light of lack of clarity regarding whether or not rainforest logging is intended and due to the lack of consideration of environmental impact, the DOP considers that there should be no felling of trees in rainforest, other than for the minimum amount necessary for roading.**

The NPWS, in its submission, draws attention to small isolated stands of *Nothofagus moorei* in the Petroi Plateau area which, it considers should be protected. The DOP notes that *Nothofagus* stands will be adequately protected by the above condition of no logging in rainforest.

The only other rainforest community of concern is the *Sloanea woollsii-Doryphora sassafras-Orites excelsa-Caldcluvia paniculosa* community. This relates to Floyd's (1990b) *Ceratopetalum / Schizomeria-Argyrodendron / Sloanea suballiance* which Floyd considers to be inadequately conserved in the Carrai area. The DOP notes that this community type will be adequately protected by the provision of no logging in rainforest.

Buffers

Edge effects are particularly critical to rainforest as many rainforest areas are small and have a large boundary to area ratio. The removal of overstorey eucalypts surrounding rainforest areas can cause dieback of some rainforest species due to wind damage created by the uneven forest canopy causing turbulence. Increases in the amount of light penetrating the rainforest as a result of disturbance to the adjacent area can also lead to a change in the species' composition. Because such edge effects can occur in all rainforest types, the NPWS, in its submission, notes that buffers should occur around all rainforests to protect the core rainforest areas. In contrast to this, the EIS argues that there is evidence that the rainforest edge has been 'hardened' over a considerable period since disturbance (particularly fire and periodic natural sclerophyll tree falls). No references, however, are provided to support this claim. The only reference to such 'hardening', which the DOP has been able to locate is Unwin et al (1985) who consider 'hardening' in relation to fire effects on tropical rainforest-eucalypt boundaries of North Queensland. North Queensland tropical rainforest has a considerably different species' composition to the rainforest types occurring in the K/WMA and fire impacts are different to those incurred by logging. The relevance of this paper to

logging impacts on the rainforest types occurring in the K/WMA is therefore highly questionable.

The rainforest edge is a dynamic area, expanding and contracting in response to disturbance, be that natural tree fall, fire or logging. Of particular concern is the phenomena of crown dieback. In NSW, crown dieback is a problem associated with warm temperate, cool temperate and littoral rainforest (Friederich 1991). The Wingham Management Area Supplementary Director's Report (DOP 1993a) identified that for the Wingham Management Area, warm temperate rainforest was only of concern as cool temperate and littoral rainforest types were absent from that area. Cool temperate and littoral rainforest types were also absent from the Glen Innes Management Area. Both warm temperate and cool temperate rainforest occur in the K/WMA. The K/WMA EIS has considered the impacts on warm temperate rainforest, however, it has not given full consideration to cool temperate rainforest (littoral rainforest types do not occur in the K/WMA). Both these types are discussed below.

Dieback in warm temperate (coachwood type) rainforest has been documented by McCann (1970), Horne and Mackowski (1987), Floyd (1990a) and Baur (1991). Floyd (1990a) notes that logging of the sensitive coachwood (*Ceratopetalum*) alliance causes increased opening up of the vital canopy through dieback and produces consequent conditions that are unfavourable for regeneration. McCann (1970) indicates that coachwood is sensitive to dieback and that larger trees and those on the edge of larger gaps are most affected by dieback symptoms. The EIS (p.242) considers that total exclusion of felling within 20m of unlogged warm temperate rainforest edges is unnecessary for the purpose of rainforest protection. The EIS estimates that the additional loss of resource expected from applying such a condition to the K/WMA is 14,700m^3. It proposes that warm temperate rainforest areas would be adequately protected by the provision of not felling trees in rainforest areas. As has been discussed, the EIS is not clear in regard to whether rainforest harvesting would be permitted. The DOP also notes that the reliance on the provision of no logging in rainforest could still result in dieback of coachwood and other warm temperate rainforest species due to changes in the light regime and microclimate of warm temperate rainforest areas. Of particular interest are those areas which have not been previously logged and can be likened to old growth as the trees in these areas have not been subject to logging disturbances and associated dieback. In light of this, **the DOP is of the opinion that only areas of unlogged warm temperate rainforest should be protected by a 20m buffer in which no logging is to occur.**

Within the K/WMA there are areas of Forest Type 17 (Negrohead Beech-Coachwood). Floyd (1990a) notes that logging of the Negrohead Beech (*Nothofagus moorei*) alliance of the cool temperate rainforest poses special problems. Floyd identifies that where a species occurs at or near its climatic limits, small changes appear to produce major responses. Floyd notes that logging of overstorey trees can expose *N. moorei* which either die or dieback and reshoot from epicormics. The now newly exposed area may also experience frosts, inhibiting the regeneration of rainforest species. Floyd (1990a) notes that in an area of the Upper Hastings Catchment, removal of understorey Coachwood species has also resulted in dieback of the overstorey *Nothofagus* canopy. This appears to have been mostly related to damage associated with the snigging of logs by tractor and the building of logging roads. Even though rainforest will be protected by a provision of no logging, cool temperate rainforest areas may be affected by edge effects from roading, snig tracks and adjacent hardwood logging. Those areas which have not been previously logged and can be likened to old growth are of primary interest to the DOP. In light of this **the DOP considers that unlogged**

cool temperate rainforest should be protected by a 20m buffer in which no logging is to occur. Roading impacts and provisions are discussed later.

Fire

The EIS (p.264) identifies that rainforest is not adapted to any fire regime and notes (p.99) that rainforests generally do not support wildfires except in extremely dry conditions due to the combination of limited ground fuel, closed canopy, moist ground conditions and relatively fire resistant understorey. The EIS (p.269) comments that most primary rainforest trees and shrubs are killed by fire. It also notes that a suite of rainforest margin (ecotone) species will regenerate from lignotubers, coppice or epicormic shoots, after low intensity fire. The NPWS, in its submission, comments that rainforests generally do not support wildfires and that fire is probably the most severe threat to rainforest and the most common cause of rainforest boundary attrition. The DOP notes that the majority of rainforest species are fire sensitive and thus fire has the potential to alter the species' composition of the rainforest and favour the regeneration of more sclerophyllous species such as Eucalypts and Acacias. The EIS (p.271) identifies that, as a general rule, burning is completely excluded in rainforest. **The DOP concurs with this and considers that the SFNSW should avoid burning rainforest areas when carrying out prescribed (fuel reduction or post-harvest) burning.**

Roading

The EIS, in Appendix C, provides details of the individual roads proposed for construction during the next 10 years. The EIS (p.249-250) notes that for moister forest types, particularly rainforest, roading can alter the microclimate of the road edge and for some distance within the forest, alter light, temperature and humidity conditions. It notes that some rainforest species, such as Coachwood may be very susceptible, resulting in dieback or even death. The EIS (p.250) further noted that such changed conditions can favour many weed species which may retard or even prevent the rainforest pioneer species from forming a new protective edge.

The EIS (p.250) notes that due to the steep topography in which many of the roads will be constructed, it has not been possible to completely avoid all rainforest stands in determining the proposed alignments. The extent and nature of the rainforest that will be impacted is presented in Table 7.2 (p.250) of the EIS. This table distinguishes between logged, unlogged, warm temperate and other rainforest. A total of 10.00 ha of rainforest is to be affected by new roads. This represents 0.0004% of the total K/WMA rainforest resource. In terms of spatial impact, the DOP considers this new roading to be of very minimal consequence. A total of 0.45 ha warm temperate rainforest is to be affected by proposed roading of which 0.30 ha is unlogged. A total of 9.55 ha of other rainforest types is to be affected by roading, of which 6.68 ha is unlogged.

The EIS (p.253) notes that road construction will avoid rainforest patches as much as possible. However, this statement is not necessarily consistent with the maps presented in Appendix C. The DOP notes that Map R10 (Compartment 7) shows that some new roading follows the length of the rainforest area rather than crossing it at the narrowest point of the rainforest strip. Consultation with State Forests (S. Bishop per.comm. 6/1/94) has revealed that it is State Forests' intention to cross this rainforest area at its narrowest point contrary to what is presented in Map R10. **The DOP concurs with this initiative but also considers**

that there should be a general recommendation indicating that new roading should aim to cross rainforest at its narrowest point.

Also of concern to the DOP is the proposed new roading in Doyles State Forest which crosses several rainforest patches. The EIS (p.253) states that the proposed logging roads for 1998-2003 on Doyles River State Forest, near Mount Seaview (Map R1 of Appendix C), will require close environmental scrutiny to ensure potential impacts on rainforest are minimised. In Cpt. 191, W-SW of Mt Seaview Trig, the proposed main access road cuts through regenerating Coachwood rainforest, as does a proposed minor access road. In Cpt. 191, the proposed South Seaview Road is to be located off the existing ridge top 4WD trail to obtain a better grade. It will then pass through the head of one rainforest gully and through another at its widest point. The EIS (p.253) notes that as there is a possibility that these roads could damage the rainforest and therefore the route will be thoroughly investigated in order to minimise damage while obtaining an acceptable grade. This is acceptable to the DOP, particularly in light of the rainforest roading safeguard measures proposed below.

The EIS proposes that roading impacts through all rainforest areas will be minimised by:

- Conducting pre-roading inspections for rare plants;
- Minimising disturbance to rainforest canopy;
- Restricting road clearing width to the minimum required to allow construction of roads for safe vehicle passage;
- Removing felled trees by pushing them out along the roadline to reduce disturbance of vegetation on either side of the road;
- Draining earthworks or formations at each rainforest crossing, following the completion of use for minor roads, so as to facilitate vegetation establishment.

These initiatives are appropriate but in addition the SFNSW should aim to avoid large trees during road construction and undertake the planting of rainforest species following the completion of road use so as to further facilitate vegetation establishment.

Warm temperate rainforest (coachwood type) is susceptible to crown dieback (McCann 1970, Horne & Mackowski 1987). In the Minister's determination of the Wingham Management Area EIS it was stated that no roading would occur through unlogged warm temperate rainforest. This was in part a result of the EIS's lack of detail regarding the extent of roading through rainforest, particularly warm temperate rainforest. The K/WMA EIS provides details of all proposed roading through rainforest, giving particular consideration to warm temperate rainforest. This is supplemented by detailed information and maps presented in Appendix C which shows that roading only affects warm temperate rainforest in the area shown on Map R1 (South Seaview Road and associated permanent feeder roads). Roading through warm temperate rainforest is required to access 70,000m^3 of resource (EIS p.320). The DOP notes that in the next 10 years, only 10.0 ha of rainforest, of which 0.45 ha is warm temperate rainforest, will be affected by new roading (EIS p.250). It should also be noted that within the K/WMA Forest Type 12 (warm temperate rainforest) closely relates to Floyd's (1990b) *Ceratopetalum-Doryphora suballiance* which is regarded by Floyd as having an excellent conservation status. Given the excellent conservation status of the plant community type comprising warm temperate rainforest in the K/WMA, the protection of all rainforest afforded by the proposed condition of no logging in rainforest, the detailed consideration of warm temperate rainforest afforded by the EIS and the safeguard measures proposed plus the limited amount of roading proposed through this rainforest type, the overall impact of

roading through warm temperate rainforest will be minimal and therefore roading should be allowed to proceed.

Cool temperate rainforest areas (*Nothofagus* types) are also important. Floyd (1990a) notes that in the Upper Hastings catchment dieback of *Nothofagus* (Antarctic Beech, also known as Negrohead Beech) canopy has mainly been related to the snigging of logs by tractors and the building of logging roads. The impact of roading through this particular association has not been explicitly assessed in the EIS. In the K/WMA cool temperate rainforest occurs as Type 17 and possibly within some areas typed as B/L. From the information provided in Appendix C, the roading presented on Map R9 is of concern as a small portion of a new minor road passes through areas shown as warm temperate and cool temperate rainforest. These areas are actually predominantly cool temperate Types (Type 17) and all the Antarctic Beech in this area has been previously logged. It also appears that small pockets of Antarctic Beech are crossed from the proposed roading crossing the eastern section of Banda Banda Flora Reserve (Map R4 of Appendix C). New road impacts on Banda Banda Flora Reserve are given further consideration in Section 3.9.2 - New Roads and Section 3.2.6 - World Heritage Nomination. The DOP considers that the amount of roading passing through Antarctic Beech is minimal and the impacts can be offset by the safeguard measures proposed for roading through rainforest as previously discussed. No other roading is planned through cool temperate rainforest.

It should be noted that while the limited construction of roads through rainforest is considered reasonable in light of the EIS's assessment of this impact, no information has been provided on the construction of snig tracks through rainforest. It is considered by the DOP that the integrity of rainforest could be jeopardised by snig track disturbance, causing dieback of some species, particularly Coachwood and Antarctic Beech, and favouring weed infestation (e.g. lantana). Similarly, the integrity of the rainforest buffer strip could be compromised by the creation of snig tracks through rainforest buffer strip areas, particularly in locations immediately adjacent to warm and cool temperate rainforest stands. In light of this, the DOP is of the opinion that for the K/WMA, **no snig track should enter or cross rainforest or rainforest buffer strips.**

Monitoring

The monitoring of rainforest conditions was raised by the NPWS submission which considered that a management plan should be prepared for the protection and monitoring of rainforest conditions. As a result of this determination, the DOP notes that the Plans of Management for Kempsey and Wauchope will have to be revised. It would be prudent of the SFNSW to include provisions for the monitoring of rainforest conditions in this document.

Conclusion

The EIS is not clear whether or not selective rainforest harvesting is intended. The impacts of such an operation have not been assessed and therefore rainforest logging should not be allowed. Roading impacts, however, have been assessed and this activity should be allowed pending the implementation of certain mitigation measures. Warm and cool temperate rainforest areas are particularly susceptible to crown dieback and in light of this the DOP considers that unlogged areas of these Types should be protected by a buffer strip. The amount of new roading proposed through warm and cool temperate rainforest is very minor and should be allowed to proceed. Fire impacts

on rainforest have been addressed by the EIS and the DOP considers that prescribed burning (fuel reduction or post-harvest) burning should avoid rainforest areas.

3.2.8 Weeds

The EIS identifies a range of weeds occurring in the K/WMA including Native Grapes, Indian Weed, Tall Fleabane and Lantana. It notes that areas disturbed by roading and timber harvesting often produce vigorous weed growth on exposed loose mineral soil due to the increased light levels reaching the ground. The EIS (p.264) further comments that post-logging burns can promote vigorous weed growth that can overwhelm Tallowwood and Brushbox seedlings.

Of most significance, and as recognised in the EIS, is the presence of Lantana. The EIS (p.229) notes that the most desirable tree species will eventually emerge through the worst weed, Lantana, but their growth will be significantly reduced during this period of emergence. This may delay the production of sawlogs by several years. This weed appears to be affecting the timber resource and the rate of natural fauna and flora succession following harvesting. The EIS (p.229) notes that the Commission will continue to support efforts for biological control of this weed. It further comments that the Commission will carry out weed control by mechanical or chemical means as required on roadsides, in recreation areas and elsewhere in the Study Area where identified as of importance to neighbours and responsible public authorities. This was further emphasised in the State Forest's submission which commented that Lantana invasion is mitigated by active programs of mechanical slashing, chemical spraying and in some cases, physically clearing and replanting. Post-harvest burning may actually favour lantana rather than eucalypt regeneration and **the DOP considers that the SFNSW should liaise with NSW Agriculture with the view of developing a weed control plan for this species giving consideration to mechanical, chemical and land management means of control. Such a weed control plan should be completed and a copy sent to the DOP within 2 years of the date of the Minister's determination of the K/WMA EIS.**

The EIS also notes that native vines may occasionally strangle regeneration, particularly in burnt moist hardwood types. Freeing by mechanical means may have to be considered for localised chronic areas. The DOP considers that such methods are applicable. The decision as to whether such mechanised 'weeding' techniques are required are based on local knowledge and should be left to the discretion of the regional and district foresters of the SFNSW.

Conclusion

The EIS identifies a range of weeds occurring in the K/WMA. Of significance, is the presence of Lantana. The SFNSW should liaise with NSW Agriculture with a view to developing a weed control plan for this species.

3.3 Fauna

3.3.1 Fauna Survey and Analysis

The Plot-based Fauna Survey follows a similar design to that used in the previous EISs. This is an acceptable design provided that the plot placement and analysis take into account the

variability of the forest environment (i.e. slope, aspect, site quality etc.). Only the Glen Innes Fauna Survey analysis has previously taken these variables into account.

There is no indication from the current study that the placement of the survey plots or the analysis of the data has taken these additional factors into account. This would tend to weaken the strength of the statistical tests carried out as these other factors may be influencing the distribution of fauna to an extent that masks the impacts of logging.

Survey Intensity

Many submissions criticise the intensity of the Fauna Surveys carried out for this EIS, stating that there were not enough surveys to give an accurate description of the fauna of the MAs.

The NEFA submission compares the surveys for this EIS with those conducted by the Victorian Department of Conservation and Natural Resources for various Forest Blocks in East Gippsland, Victoria. Using three of these reports, NEFA notes that these surveys had an average of 1 bird plot per 43ha and or 100 times the density of plots in the K/WMA Fauna Survey.

The Department does not have access to the reports to which NEFA refers (DCNR Ecological Survey Reports 23 and 25 and Conservation Survey Report No. 17) but does have copies of Ecological Survey Reports 21, 31, 33 and 35 (DCNR 1988, 1990, 1991, 1992). These reports show that the comparison made by NEFA does not reveal all of the facts of the matter as the amount of survey effort made at each site was much smaller in the Victorian studies than in the K/WMA Fauna Surveys.

Taking the bird surveys as an example, the survey effort in the Victorian studies consisted of a single 20 minute rapid count within an approximately 3ha area of uniform vegetation. For the four studies available to the Department, this gives an average of one 20min count per 175ha. The surveys in the K/WMAs, however, consisted of a 10 minute count at each of 5 points along the transect for each of 4 days. This results in 20 ten minute counts at 64 sites (1280 counts) or 1 count per 262ha. Assuming that this was equivalent to one 20min count per 524ha (or only 3 times less intense), the difference between the survey efforts is obviously not as great as NEFA makes it out to be. Additionally, road based spotlighting transects were not carried out in the Victorian studies.

The terrestrial mammal trapping efforts are less easy to compare as different numbers of various sized traps were used at the Victorian study sites but, again, each K/WMA plot based site is more equivalent to 5 Victorian sites than to 1.

Opportunistic Sightings

These were sightings of fauna that were recorded as survey teams drove throughout the MAs. When comparing numbers found in logged and unlogged forest, opportunistic survey records were grouped with plot based survey records and it was *"assumed that there was no preference for surveying logged or unlogged forests whilst travelling through the MA"* (Fauna Report, p.112). This assumption is questionable as such roading would tend to exist only in areas that have been logged (as roading is not constructed until necessary). Thus a disproportionately high number of opportunistic sightings would have occurred in

This is especially the case for grazier-lit fires which Austeco (1992) consider to cause a more significant impact on these animal groups than logging.

If frequent fires are taken to be those less than 5 years apart (Catling 1991) then fires within the five years prior to the fauna survey should be considered. Analysis of the notes on fires history in Table 8 of the Fauna Survey Report reveals that only one unlogged plot had been burnt in that period, but 14 logged plots had been burnt. This would naturally bias the survey results toward finding a significant impact, thus results of no significant impact for species affected by frequent fire can be accepted on this basis at least. Table 8 of the Fauna Survey Report is not clear, however, as to whether it includes information on grazier-lit fires.

Slope

Slope is considered to be one environmental factor which can influence the habitat value of a site. Research Note 17 (Forestry Commission of NSW 1989) indicates that the structure of the same forest type can vary in response to topography and Lindenmeyer *et al.* (1991a) found fewer Leadbeater's Possum on steeper slopes, independently of other variables. This latter paper cited references noting that soils on steep slopes may be relatively shallow and lower in soil moisture, influencing the structure and quality of vegetation.

Lindenmeyer *et al* (1991a) also refers to other studies (Braithwaite 1983, Kavanagh 1987) that demonstrate higher arboreal marsupial densities in areas of low relief. While this response may not have been due to slope *per se*, it is possibly due to other factors related to slope such as high content of foliage nutrients on soils with high nutrient levels.

Thus it may be necessary to either control for slope in the placement of survey plots or consider slope during the analysis of the survey results. It is not evident from the Fauna Survey Report that either of these has occurred.

The way that slope should be considered varies with species. For highly mobile species, such as birds, bats, macropods and some gliders, the slope at the actual survey plot may be less important than the topography of the surrounding area over which they range while foraging. There may therefore be a need to consider or control for slope at the survey plot sites (for less mobile species) and the topography of the surrounding area (for wide ranging species).

There is no indication in the Fauna Survey Report that this has occurred.

Comparability of Plots

To truly test the impacts of harvesting using space for time substitution, as has occurred here, it is necessary that there be no significant difference between logged and unlogged plots prior to logging.

Submissions note that this is not always the case for the K/WMA Fauna Survey, however, and field inspection by the Department of Planning has confirmed this for Moist Low Altitude plots. Two logged, low altitude, moist hardwood (MLL) plots were found to be narrow strips of moist riparian vegetation surrounded by dry hardwood forest whilst the unlogged equivalents (MUL) were embedded in large expanses of moist hardwood forest. These are not considered to be equivalent and it is not valid to compare them in an attempt to determine the impacts of logging.

Unlogged Plots

During discussions with SFNSW it became apparent that, for the purposes of the survey, unlogged plots had been defined as those which had undergone no logging or had been logged more than 35 years ago. While this may be acceptable for fauna dependent upon understorey elements, pollen or sap exudates, or even invertebrates, this is not acceptable with regard to the assessment of impacts on hollow dependent fauna. Any habitat tree resources which were removed during the logging operation could not have been replaced within 35 years because any trees that could have developed hollows in the intervening period are likely to have been of prime quota sawlog size at the time of the operations (and thus harvested).

The Department has no information regarding the number of unlogged plots that fall within this category or the intensity of logging that has taken place. This is another circumstance supporting the counting of the number of habitat trees per hectare in the vicinity of plots to determine the impact that is being tested.

Context

Submissions are concerned that when survey plots were located near areas of forest of differing management history to the plots that these forests could influence the results of the surveys. This would increase the chances of the statistical tests failing to find a significant impact when one existed.

This would be of concern if logged plots were in small portions of logged forest surrounded by or adjacent to large areas of unlogged forest. In this case mobile species such as birds and bats could be relient upon the unlogged forest resource for survival but were detected as they passed through the logged plot. Given the progressive nature of logging, few logged plots are likely to exist within large areas of unlogged forest but they may exist adjacent to these areas. The Department is not in a position, however, to determine whether this was the case.

It would not be of concern, however, if logged plots were adjacent to remnant unlogged areas (i.e. areas which are not suitable for logging). This is because these plots would be typical of logged forest throughout the MAs and typical of forest to be logged in the future. Additionally if the arguments regarding the low suitability of these remnants (steep slopes, rainforest gullies, low site quality areas) to arboreal species are accepted, then these remnants are less likely to affect the results obtained from surveys in nearby logged plots.

SFNSW states that, in these cases, it is just as valid to argue that animals move out of logged plots into the surrounding unlogged area and that an equilibrium can be demonstrated. This misses the basic ponit, however, that logging reduces some resources in the forest and could be expected to reduce the populations of the animals dependent on these resources. For mobile species, higher populations could be expected in logged plots surrounded by unlogged forest simply because of the extra resources available in the unlogged area. Thus in cases where the surrounding unlogged forest is productive State Forest (ie. not unloggable remnants) the logged plot is unrepresentative of the forest as it is expected to be at the end of the cutting cycle.

Where unlogged plots exist in remnant unlogged vegetation within a larger logged area, the Department has some concerns. This is because these remnants would be forest that is considered unsuitable for logging due to steep slopes or low site quality for example, and would thus be atypical of the forest that is to be logged in the future. There are several plots where this appears to occur (NUH7, MUL7, DUH5, DUL6, BUL5, RUL4) and the results of these plots must be treated with caution.

No information is available to the Department to enable this to be investigated. SFNSW notes, however, that this (the impact of context on survey results) *"certainly cannot be true of sedentary or small animals"* and the Department agrees with this.

Conclusion

It is therefore concluded that, given all of the above, the results of the Fauna Survey in respect of the impacts of logging must be disregarded. Instead, the known or likely presence of species will be used to determine appropriate prescriptions for logging.

General Comments

The above discussion indicates the difficulty in designing a survey that could accurately assess the difference between logged and unlogged plots. The problem with the current design is that it has attempted to achieve two outcomes with one survey. The first is to provide a general description of the environment of the study area, which requires that the survey plots sample the full range of variability of the MAs, whilst the second is to test the difference between logged and unlogged forest which strictly requires that plots be paired. As the ability to define an experiment to definitively test the impacts of logging is considered practically impossible (Leong Lim, pers.com), the preferred approach would be to use the data gained from the surveys to describe the environment and to then use knowledge of species' requirements to determine prescriptions to be implemented. The following assessment performs this task.

3.3.2 Fauna Impact Assessment

The assessment of impacts has taken two paths, the use of the results of the Fauna Survey and analysis of the difference between logged and unlogged forest and the use of known habitat requirements to infer the impacts of logging.

Both are legitimate techniques but it is considered that the limitations of the survey and analysis mentioned above mean that reliance on the survey results is not appropriate. While the FIS has relied upon these results to some extent, there has also been consideration of known habitat requirements. This consideration, together with information available from other published sources, enables a suitable set of prescriptions to be developed.

3.3.3 Species Coverage

Many submissions state that the EIS is inadequate as there were many fauna species expected or known to be from the MAs which are not considered in the documentation. Some of these submissions provided extensive lists of such species. Other submissions are critical because the EIS documentation includes consideration of species which are not known or expected from the MAs.

For the vast majority of the extra species named, the submissions do not indicate how the consideration of these species would change any determination. Indeed, many of the species so listed appear to be generalists, species not dependent upon the forest environment or species of no conservation significance. Even where the species are considered by the submitters to be of conservation significance, in many cases no indication is given that additional management prescriptions are necessary.

While the Department appreciates the time and resources that many submitters have devoted to making submissions, and also finds much of the information provided very useful in its considerations, omissions such as these are inconsequential and do not make the document inadequate.

Where submissions identify species that are not considered in the documentation and recommend additional management prescriptions, these are considered individually elsewhere in this report.

3.3.4 Fauna Impact Mitigation Prescriptions

Habitat Tree Retention

The proposal calls for the retention of at least three habitat trees per hectare which would be in clumps of up to 12 with associated recruitment trees. As noted by Smith (1993) this would lead to an equivalent of only 1 habitat tree every 4 hectares, due to animal territoriality, and result in up to a 98% reduction in the abundance of arboreal mammals.

The Fauna Survey Report recommends the retention of 3 to 5 evenly spaced habitat trees per hectare and Smith (1993) notes that the retention of 4 to 6 habitat trees (and associated recruitment trees) per hectare is likely to maintain the density of well spaced hollow bearing trees at 50% of the upper limit required to maintain natural densities of all hollow using fauna. He also concludes that this will not or will only marginally affect timber yields.

The K/WMA EIS estimates that this will cause a further 2.6% reduction in timber yield in the current cutting cycles. It is considered, however, that the benefits gained by the use of the 4 to 6 habitat tree prescription are sufficient to justify its implementation and it is noted that this 2.6% is based on estimates of impact only, and not on field data. The DOP believes this figure to be highly exaggerated.

The NPWS suggests that understorey type is a better determinant of the required number of habitat trees than site height. It is noted, however, that Austeco (1992) found that the density of hollow-bearing trees was significantly related only to site height. The DOP agrees and considers that site height is a valid and practical determinant of the number of habitat trees to be retained.

As has been discussed elsewhere (NSW Department of Planning 1993a,b), sufficient habitat recruitment trees to maintain the prescribed density of habitat trees in perpetuity should also be retained and when the required density of habitat trees and suitable recruitment habitat trees does not exist, all habitat trees and suitable recruitment habitat trees should be retained.

It has been suggested that dead stags be counted as habitat trees but it is not considered that these are appropriate for this purpose. This is because it is important that habitat trees survive until recruitment habitat trees develop hollows and the increased chances of windfall in a logged forest would reduce the probability of dead stags remaining upright for that long.

Submissions and field inspections of these and other Management Areas have also highlighted the need to take action to ensure that habitat trees are not killed in post-harvest burning. This should be minimised by ensuring that logging debris does not accumulate about habitat trees or is removed to a safe distance where conditions are such that not doing so would create a fire capable of damaging the habitat tree. Such action is required prior to commencement of burning. While this is not a detailed prescription, providing no distances to which debris should be removed, SFNSW would realise that failure to prevent habitat trees from being killed during post-harvest burns would mean that more than the prescribed number would have to be initially retained to ensure that the prescribed number survives in perpetuity.

The NPWS recommends specific measures and distances for this issue but the DOP feels that these are too prescriptive. The DOP is confident that SFNSW staff can determine when conditions are such that post-harvest burns are likely to kill habitat trees and take appropriate action.

Conclusion

It is therefore concluded that:

- **The proposed habitat tree retention prescriptions are inadequate and six well spaced habitat trees shall be retained in each logged hectare of Moist, New England and high quality Dry Hardwood forest with four being retained in low quality Dry Hardwood forest, where these densities exist;**

- **sufficient recruitment habitat trees to maintain the prescribed density of habitat trees in perpetuity shall be retained, where this number exists;**

- **action to ensure that habitat trees are not killed by post-harvest burning is necessary; and**

- **dead stags cannot be counted as habitat trees.**

Yellow-bellied Gliders (YBG)

This species requires a variety of tree based resources including hollows, sap feed trees, trees with shedding bark to allow foraging for invertebrates, and nectar from flowers (Austeco 1992, Kavanagh 1984) and is therefore sensitive to forestry operations. The EIS/FIS proposes to retain all sap feed trees (identified by v-notched feeding scars) and *"nearby refuge trees"* but it is considered that this will not adequately cater for the requirements given above.

The K/WMA EIS notes that the prescription placed on the Wingham determination for YBG protection would cause a further reduction of 0.8% of the timber yield in the first cutting

cycle. It is considered that the low density of Yellow-bellied Gliders in NE NSW forests, the lack of predictibility of the utilisation of potential feed trees, the conservation status of this species and the relatively low impact on timber yield justify the implementation of a prescription the same as, or similar to, that implemented in Wingham.

Previous determinations have required the retention of an average of 10 sap feed trees per hectare and 5 mature bark shedding trees per hectare in the logging area about a known scarred tree. It is considered more appropriate, however, that tree retention for YBG be considered in two phases, those retained about scarred feed trees and those retained in the general area of a YBG home range.

Scarred Trees

In order to retain food resources in the immediate vicinity of sites where YBG are known to feed (ie. about scarred trees) it is considered that, within a 100m radius of known scarred trees, 30 trees of sap feed tree species (>10cm dbh) and 15 mature bark shedding trees (ie 10 and 5 per hectare respectively over approximately 3 hectares) should be retained. Any further scarred trees within that 100m radius need not have a futher 100m radius (and tree retention) implemented but known scarred tree outside that radius must do so. Where 100m radii overlap, however, the trees retained in the overlapping area can count as trees retained about both scarred trees. These trees need not be evenly spaced as the territoriality problems of clumped habitat trees are not relevant here.

The NPWS's recommended prescription is similar to this except that it requires an additional search within the 100m radius placed about the first scarred tree found for the tree with the most scars. This second tree is then taken as the centre of the 100m radius within which the tree retention prescriptions shall apply. The Department does not believe that this has any ecological benefit over the previously described prescription and is so much more labour intensive that it should not be undertaken.

YBG Home Ranges

The prescription stated above, however, does not account for that part of the YBG home range where nectar and insect foraging occurs but where no scarred trees exist. This area, even though its nectar and insect resources may be important to the YBG, would therefore be unprotected.

Given that YBG home ranges are approximately 50ha (Kavanagh 1987), it is considered that within a 50ha area about the scarred tree considered above, retention of an average of 5 mature bark shedding trees per hectare and an average of 10 trees (>10cm dbh) of sap feed tree species per hectare should be retained. These trees need not be evenly spaced and may therefore all be within retained unlogged remnants that occur within the 50ha area.

All trees retained for YBG within 100m of a scarred tree may count toward the total retained within the 50ha area. If several scarred trees are found closely associated, a single 50ha range may be placed over all of them as it is highly likely that they are all within the home range of a single YBG.

Reported YBG but no Scarred Trees

Where YBG have been detected (e.g. in surveys) but no scarred trees can be located, then tree retention within a 50ha area as described above shall occur, approximately centred on the location of the YBG record.

It is also noted that sap trees and bark shedding trees can be the same species (Kavanagh 1984) but the prescription is designed so that the resource necessary is given by the total of the feed trees and bark shedding trees. Thus sap feed trees retained cannot count as retained bark sheeding trees.

Impact on Timber Resource

It is considered that State Forests' estimate of the impact of the YBG prescription on timber resource can be revised downward, given the above express approval that trees retained for YBG need not be evenly spaced and may be located within unloggable forest remnants.

Thinning

The NPWS submission has recommended that no thinning be carried out in Yellow-bellied Glider habitat, claiming that thinning is an intensification of the proposal. The Department of Planning cannot accept this argument. If a logging prescription is considered sufficient to maintain Yellow-bellied Glider populations, then provided that that prescription is applied during thinning operations then no greater impact can occur. Thus thinning should cause no more impact than old growth harvesting.

Conclusion

It is therefore concluded that:

- **The proposed prescription is inadequate and it is more appropriate that, within a 100m radius of known scarred trees the following trees be retained: known scarred trees; an additional 30 trees (<10cm dbh) of sap feed tree species; and a minimum of 15 mature bark shedding trees.**

- **Additionally, within a 50ha area about a scarred tree an average of 10 trees (>10cm dbh) of feed tree species and 5 mature bark shedding tree pre hectare shall be retained. These trees may be located within unlogged remnants.**

- **Retained sap trees may not count as retained bark shedding trees.**

Koalas

This species is dependent upon a restricted number of food tree species (>10-15 yrs old) and refuge trees (which are not necessarily food tree species - F. Carrick, UQ, pers.com.). The size of an individual's home range varies according to site quality and the number of feed trees available (Carrick, pers.com.) and the species of feed tree varies with location. This makes the development of a prescription for this species difficult.

The FIS/EIS recommends the current prescription of *"where individuals are encountered ... the [occupied] tree and surrounds are avoided"*, together with pre-logging surveys in forest types where there is a high likelihood of Koalas being present. This is of concern as many trees frequently used by Koalas would be missed by this technique and trees in which Koalas are found are not necessarily feed trees. It is therefore recommended that retention of trees with signs of regular use by Koalas (scratchings, pellets) be implemented, together with the above surveys. It is considered that only trees with signs of regular activity should be retained, as trees which are used only once are not necessarily important.

The NPWS's recommended prescription involves determining the extent of habitat use by the "Asterisk technique" about known Koala records and then applying certain retention prescriptions based on the results of that assessment. Similarly to the Service's recommended Yellow-bellied Glider prescription, the Department feels that this recommended prescription is onerous in terms of time taken and should not be implemented.

There is, however, obvious debate about appropriate Koala protection prescriptions and the Department admits that its own recommendation should only be considered as an interim prescription. The State Forests of NSW should therefore develop a more appropriate prescription, which could be presented to the Minister for Planning to allow the conditions of the determination to be modified in accordance with S.9 of the TI(IP) Act.

Conclusion

It is concluded that:

- **All trees with signs of regular use by Koalas shall be retained;**

- **The State Forests of NSW shall develop a Koala protection prescription suitable for application to the forests of NE NSW. Implementation of this prescription in preference to the prescription recommended by this report will require the further approval of the Minister for Planning.**

Other Arboreal Marsupials

Other arboreal marsupials found in the MAs are the Sugar, Squirrel, Feathertail and Greater Gliders, and the Common Ring-tailed, Mountain Brushtail, Common Brushtail and Eastern Pygmy Possums. The Squirrel Glider and Eastern Pigmy Possum are considered in the section on Rare, Sensitive and Poorly Known Species. The others are considered to be common or generalist enough to require no particular prescriptions other than those already applied for other species. These will include hollow-bearing trees, Yellow-bellied Glider and Koala feed trees, filter strips, trees within identified potential Hastings River Mouse habitat, recruitment habitat trees and unlogged areas.

Conclusion

It is concluded that other arboreal marsupials will be adequately catered for by the trees and unlogged areas retained under other prescriptions.

Bats

21 species of bat are known from the MAs, of which eight (Large-footed Mouse-eared Bat, Eastern Blossom Bat, Yellow-bellied Sheathtail Bat, Eastern Mastiff Bat, Greater Broad-nosed Bat, Eastern Fabistrelle, Common Bent-winged Bat and Little Bent-winged Bat) are listed on Schedule 12 of the NPW Act. The habitat requirements of bats vary with species but include caves, hollows, dense vegetation and/or loose bark for roosting and food resources such as nectar, invertebrates and open water (Austeco 1992).

It is considered that other prescriptions such as habitat tree retention and the retention of unlogged areas and filter strips will ensure a continued, if reduced, supply of resources such as nectar, invertebrates and roosting sites. Known roosting sites, however, should be protected for some species and these are considered in the section on Rare, Sensitive and Poorly Known Species.

Major Pools

A prescription of an exclusion zone about major (>10m) pools was recommended by Austeco (1992) for the Glen Innes Management Area. This prescription is intended to protect those pools which are a foraging site for *Myotis adversus* and is also considered appropriate for implementation in the K/WMA. The introduction of the SEMGL, however, should give greater protection to these pools than the SEMC. For those rare situations where a major pool exists in a drainage line that is not protected by a protection or filter strip after the application of the SEMGL, then an exclusion zone is necessary, however.

NPWS Recommendations

The NPWS make three recommendations which were specifically related to bats. These are:

- that specific bat surveys using both harp traps and ultrasonic call monitoring be undertaken in the range of major forest types;
- that all forests within a 30km radius of the Willi Willi Caves be reserved; and
- that reserves should be linked using a system of 400-500m wide corridors involving a system of ridges, mid-slopes and gullies (N.B. this recommendation is given as a general fauna prescription at the beginning of the submission but the only discussion of it is in the section on bats (p.49)).

Study of the submission indicates that the first recommendation above refers to long term monitoring of the bat fauna, not pre-logging surveys. This is therefore discussed in the section on monitoring.

The second recommendation assumes that the bat population of these caves requires all of the forest resources within this 2,826km^2 area in a pristine condition. The Department cannot accept that this is the case, particularly as the Little and Common Bent Wing Bats are insectivorous and are not dependent upon old growth forest. It is also noted that the NPWS submission considered that the Little Bent Wing Bat appears to be associated with wet sclerophyll forest and rainforest. This report considers that no logging of rainforest shall be permitted and many areas of the Moist Hardwood association will be protected by other

restrictions such as the SEMGLs, steep slopes and corridors between reserves. The DOP therefore cannot accept this NPWS recommendation.

With regard to the third recommendation above, it is noted that G.C. Richards (an acknowledged CSIRO expert on bats) could make no such recommendations in his report on bats for the Wingham MA EIS (Richards 1992) due to the lack of knowledge of impacts. Additionally, Richards (1991), recommends that several problems, (involving forestry and bat conservation) could *"be alleviated if:*

- *rainforest fruit bat interactions receive immediate attention;*
- *pivotal rainforest trees are identified;*
- *eucalypt forest harvesting is modified to retain native trees over 80cm in diameter."*

The Department considers that these requirements have been met for the K/WMA EIS. No rainforest logging will occur (thus the first two are irrelevant) and habitat tree retention prescriptions are in place.

Conclusion

It is concluded that habitat retention and soil erosion/watercourse protection prescriptions put in place by this determination should cater for the majority of bat requirements except for the protection of known roost sites. An additional measure of an exclusion zone about major pools in drainage lines with no filter strips is necessary to protect the foraging habitat of *Myotis adversus*.

Hastings River Mouse (HRM)

Specialised surveys were carried out for this species at 14 sites within four State Forests in the K/WMA. There is no indication in the EIS that these surveys implemented the survey guidelines approved by the HRM Recovery Team (Tweedie undated - 1,000 trap nights per site) but HRM were detected at four of the sites. Information received from SFNSW shows that none of these sites has had 1,000 trap nights of survey effort, indeed the maximum was 250 trap nights per site. It is therefore considered that negative results from these surveys can not be considered definitive.

The EIS claims that the implementation of the HRM prescription of the Wingham determination will result in a further 0.5% reduction in timber yield. However, there appears to be no difference between the prescription proposed in the FIS and EIS and that of the Wingham determination. Therefore no timber resource impact can be possible.

Recent meetings of the Hastings River Mouse Recovery Team (Minutes of 20 July and 19 October 1993) reveal that, although sedge beds may be important to the HRM, they are certainly not the only habitat in which they have been caught. These meetings suggest the 20m buffer zone about potential habitat (identified by Juncaceae and Cyperaceae) should be extended up drainage lines to the tops of gullies for all streams in which these sedges occur.

The Recovery Team minutes also note that, as compartment boundaries are not necessarily the boundaries of catchments within which sedges occur, they should not be used to delineate the extent to which the prescription is applied. The Department notes, however, the limited mobility of the species and considers that, the continuation of the 20m buffer along gullies upstream from potential habitat will ensure that the implementation of the prescription crosses compartment boundaries where necessary.

The relatively large numbers of HRM that have been recorded on the Carrai Plateau indicates that this is an important population of this species, there being only one other area with a similar number of records (Hyland State Forest, Dorrigo MA). Most of the records from the surveys conducted for this EIS were between the proposed Bungawarrah Flora Reserve and Carrai State Forest. In order to protect this population it is recommended that the area shown by hatching on Map 4 be also included in the proposed Flora Reserve.

The NPWS has delineated the area of potential HRM habitat that exists adjacent to these records and recommended that this entire area be reserved. The Department cannot, however, justify such a large permanent reservation on the basis of so few records of HRM in such a restricted portion of the area. Instead, it is considered that this population is potentially of such importance to this species that the area of Carrai State Forest indicated on Map 4 should not be harvested until the importance of this population to the species' survival (and the importance of the area indicated to the survival of the population) has been further assessed. The further approval of the Minister of Planning will be required before harvesting can be carried out in this area.

The NPWS also recommends that grazing be excluded from Carrai and Cochrane State Forests to protect the habitat of the Hastings River Mouse. For the Service's submission to have had greater internal consistency this recommendation should have been restricted to the area proposed by the Service for reservation (Map 4). The submission gives no justification as to why restrictions on grazing should be extended beyond this area to cover all of Carrai and Cochrane State Forests.

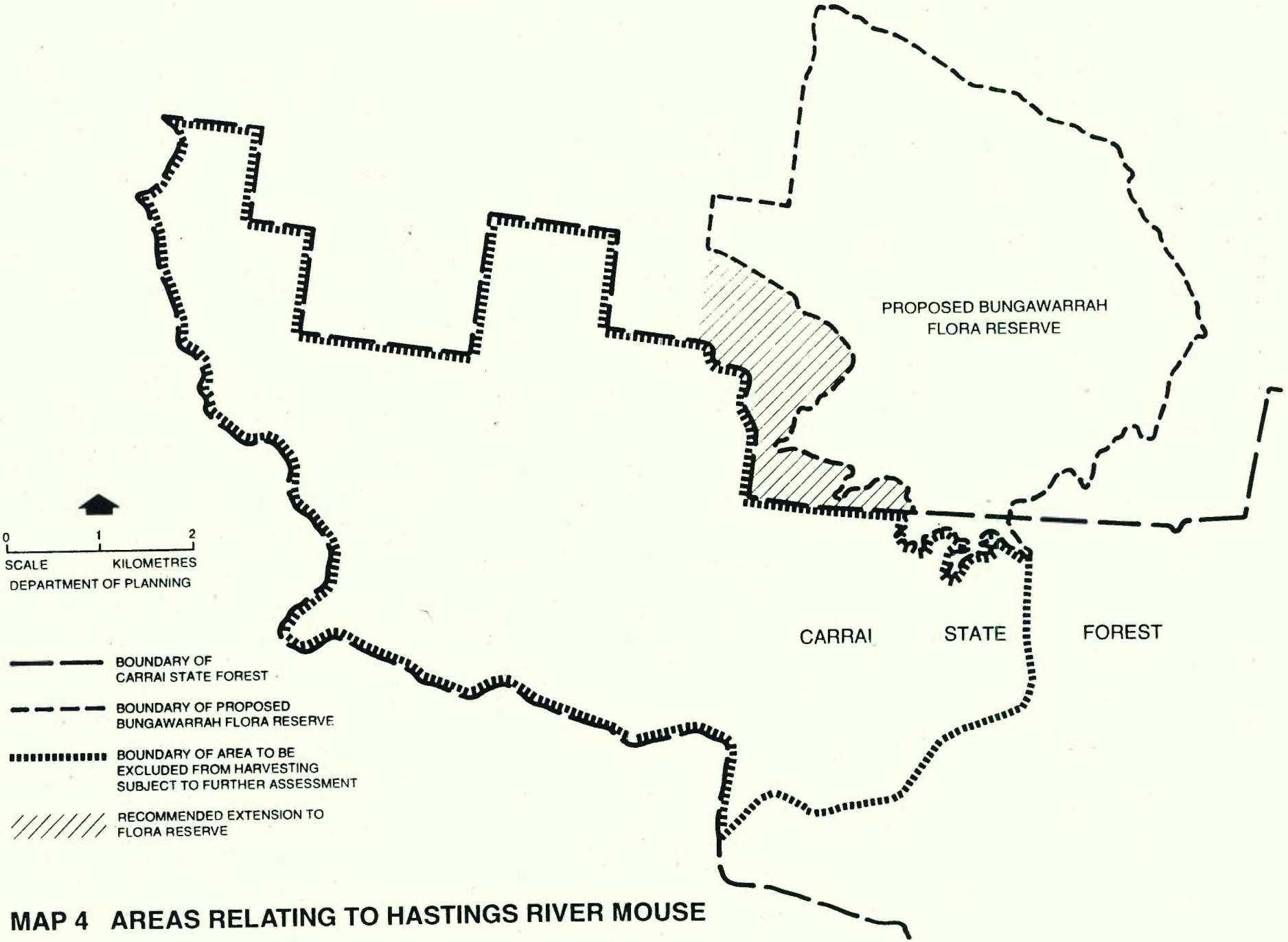
Additionally, the presence of HRM in most of the grazing area that exists within the northern portion of Carrai SF (Map 14, EIS) has not been proven and thus to exclude grazing from this area would be unnecessarily prescriptive. Instead, this area should be subject to surveys for HRM in likely habitat in accordance with the HRM survey guidelines (Tweedie, undated). Should HRM be recorded, then the sites where records are made should be protected from damage by grazing. It is noted that A. Townley has captured 4 HRM at one site within this permit area and it is considered that this site should be protected.

Conclusion

It is therefore concluded that:

(a) **the sites at which no HRM were caught can not be considered to have no HRM present.**

(b) **the prescription for HRM protection proposed in the EIS shall be implemented with the addition that the 20m buffer shall continue along all gullies upstream from potential habitat to the ridge tops within the compartment;**



MAP 4 AREAS RELATING TO HASTINGS RIVER MOUSE

(c) **the area shown on Map 4 shall not be harvested until further HRM assessment in this area has occurred; and**

(d) **the proposed Bungawarrah Flora Reserve shall be extended to include the area shown on Map 4.**

(e) **surveys for HRM should be conducted within the grazing Occupational Permit area shown on Map 14 of the EIS according to the methods in the survey guidelines (Tweedie, undated). Sites where HRM are located should be protected from damage by grazing.**

Terrestrial Mammals

This group includes the Long-nosed Potoroo, Tiger Quoll, Brush-tailed Phascogale, Parma Wallaby, Rufous Bettong, Black-tailed Rock Wallaby and Red-legged Pademelon, none of which are directly affected by the harvesting of trees but whose habitat is disturbed by logging and associated burning operations. They are also preyed upon by foxes which can be promoted by the opening up of the forest by logging operations. Burning operations by graziers will also impact on these species and the use of 1080 baits for wild dog control is thought to alter the dingo/fox balance in favour of foxes, which would impact on small terrestrial mammals.

Roads

It is therefore considered that allowing the revegetation of unused roads (to reduce access by foxes) should be implemented by closing these roads to the public. This is proposed in the FIS. Roads which are necessary for fire control are, by definition, not unused and shall therefore remain open.

1080 Baiting

The Fauna Survey Report recommends that 1080 baiting be curtailed until its impact on these and other species is ascertained but this has not carried through to the FIS and EIS. Austeco (1992/3) also proposes such a measure due to its possible impact on dingo/fox ratios, but only in specified areas. It is considered that such a measure is suitable here, though it is acknowledged that State Forests has no control over baiting should the Rural Lands Protection Board wish to direct any Crown leaseholders to lay baits.

The Fauna Survey identifies high terrestrial mammal counts in Doyles River State Forest, Mount Boss State Forest north of Banda Banda Flora Reserve, on the Petroi Plateau and in Mount Boss State Forest west of Marowin Flora Reserve and found *"high counts"* (sic) on the Carrai Plateau and Doyles River State Forest. Examination of Figure 1 of the Fauna Survey Report, however, reveals that there is scope for areas of high terrestrial fauna value to have been missed by these surveys, given the distribution of the plot based fauna surveys. These areas could be in southern Mount Boss State Forest, Cairncross State Forest, the Broken Bago group, Bulga State Forest, Nulla-Five Day State Forest, Pee Dee State Forest, the Collombatti group, Boonanghi State Forest and Yessabah State Forest.

Thus 1080 baiting approved by SFNSW should be excluded from the above areas until such time as its impacts on native terrestrial mammals has been fully assessed. The further

approval of the Minister for Planning will be required before this activity can be resumed in these areas.

Fire

It is also considered that burning activities by graziers should also be controlled. It is noted that State Forests has no legal authority over Crown leaseholders, but State Forests should make Occupation Permit holders responsible for fire control in their Permit area, with Permit withdrawal being an option. Previous determinations have stated that these graziers should be given a date by which they had to demonstrate that they can halt unauthorised burning in their Permit areas. This gives the graziers an opportunity to improve their practices before any restrictions are implemented. Legal advice, however, has noted that the most appropriate way of applying this prescription is to place a condition on all permits that no unauthorised burning take place.

Nesting Logs

Many terrestrial mammals require logs as nesting sites and the harvesting of large trees is likely to reduce the number of trees senescing and becoming ground logs. The Glen Innes FIS proposes that dead stags should not be culled, unless they are a safety hazard, so that they may fall and become logs at a later date. It is considered that this is an appropriate measure to take in the K/WMA.

Long Nosed Potoroo and Brush-tailed Phascogale

These species are further considered in the section on Rare, Sensitive and Poorly Known Species.

NPWS Recommendations

The NPWS submission recommends 20m buffers about rainforest in order to protect the refuge habitat of the Long-nosed Potoroo, Red-legged Pademelon and Parma Wallaby. Austeco (1992, 1993), however, found that the only sources of impact for these species were likely to be fox predation, burning and grazing, which have already been dealt with in this report.

The Service submission also recommends that no post-harvest or hazard reduction burning be undertaken in areas of critical habitat for these species. Given the recent large scale fires in NSW this recommendation needs some review. Catling (1991) only found that frequent burning (<5yrs apart) impacted on fauna. As post-harvest burning would only be carried out at 20yr intervals (when thinning and harvesting would occur) and would mainly be spot burns, especially in moist forest, this would not impact on fauna significantly. Additionally, the Service submission implies that the critical habitat for most of these species is in moist hardwood and rainforest which are burnt less often in broad area hazard reduction burning as their moist nature resists burning (Wingham MA EIS). This is further discussed in this report's section on hazard reduction burning.

Also recommended by the Service submission is the provision of stream side reserves of 50m on both sides of the stream in catchments over 50ha where the Tiger Quoll has been detected. Austeco (1992, 1993), however, consider that the long term threats to this species are

competition from foxes and habitat degradation by grazing and burning. These threats are already addressed here. Additionally, as this species primarily inhabits moist hardwood and rainforest, impact mitigation will occur through the exclusion of logging from rainforest and the provision of filter strips and refugia.

Conclusion

It is concluded that:

(a) **unused roads should be allowed to revegetate except where they are necessary for fire control;**

(b) **SFNSW approved 1080 baiting should be halted in the following areas until its impacts have been fully assessed: Mount Boss State Forest, Doyles River State Forest, the Carrai Plateau, the Petroi Plateau, Nulla-Five Day State Forest, Pee Dee State Forest, Cairncross State Forest, Bulga State Forest, Boonanghi State Forest, Yessabah State Forest and the Collombatti and Broken Bago groups. The further approval of the Minister for Planning is required before this activity is resumed in these areas;**

(c) **Grazing Occupational Permits should only be issued on the condition that the grazier halt unauthorised burning in the permit area; and,**

(d) **Dead stags may only be culled if they create a safety hazard.**

Eastern Quoll

This species has not been confirmed on the Australian mainland for 10 years (Strahan 1992). The NPWS submission recommends that surveys for this species be carried out in the Carrai, Styx River, Nulla-Five Day and Lower Creek State Forests *"where there has been recent unconfirmed sightings"*. The Service also recommends that it should then determine appropriate management prescriptions should this species be located by these surveys.

The Department does not like to recommend surveys where there is no prescription to be implemented should the surveys be successful and it is not possible for the Minister to prescribe an uncertain condition allowing the NPWS to develop appropriate prescriptions should the species be located.

Large Owls (Sooty Owl, Powerful Owl, Masked Owl)

This fauna group, requiring nesting hollows and small mammals as prey, is sensitive to logging as operations reduce the number of hollows and can indirectly reduce the amount of prey by changing habitat conditions. The FIS states that the areas around the nesting sites of these species may be subject to exclusion or modification of logging practices, depending on circumstances. This is in contrast to Glen Innes where all known nesting sites of these species were proposed to be protected by 200m radius disturbance free zones and a 50% canopy retention prescription was proposed for London Bridge State Forest.

Impacts of Harvesting

The implications of harvesting for this group of animals have not been accurately quantified for any area. The fauna consultant for this EIS notes, however, that the *"conservation requirements of [the Sooty Owl] will need more serious consideration, and will have more far-reaching consequences, than any other rare bird in the area"* (Fauna Survey Report, p.157) and Austeco (1992) notes that *"this species should be expected to decline in the short and long term in logged Moist Hardwood forests and High site quality Dry Hardwood forests with a mesic understorey"*.

Of the Powerful Owl, the Fauna Survey Report (p.155) notes that high prey densities and nesting hollows are important elements for this species' survival and Austeco (1992) notes that prey densities would be likely to fall by 50% in high quality forest after harvesting (based on the habitat tree prescriptions for the Glen Innes MA, which are the same as those recommended in this report).

Austeco (1992) felt that the Masked Owl would be less affected in the short and long term due to less specific diet and habitat requirements and an apparent preference for drier forests where logging activity is less intense.

Kavanagh (1992) found that gully forests seemed to be the most important habitats for owls since most nest and roost sites tended to be located in gullies and prey species were also expected to be most abundant in gully forests. Given the tendency for gully forests to also be otherwise unavailable for harvesting (due to the application of the SEMGLs or the presence of rainforest) then it is felt that the application of a habitat retention prescription to gully forests in the vicinity of Powerful and Sooty Owl records is appropriate. Kavanagh (1992) recommends the supplementation of existing measures for gully protection with just such a prescription in the SE forests.

The NPWS recommends that in sub-catchments where Powerful and Sooty Owl records are known, 100 metre wide riparian reserves be established along all second an third order streams and 20m retention strips be placed along first order streams to reserve moist gully vegetation as far as these types extend upslope. Additionally, all compartments within a 1km radius would have a 60% canopy retention prescription. This recommendation has some practical problems, one of which is the definition of sub-catchment. Apart from the 60% canopy retention, this is in keeping with the recommendations of Kavanagh (1992).

Such a prescription has the effect of sterilising considerable areas of forest resource and the situation regarding the population status of owls in the North East forests is (considerably) different to that in the South East forests. It is apparent that appropriate prescriptions to definitively deal with owl habitat have not been developed and tested within this North East Region. It is strongly recommended that State agencies co-operate in formulating and testing a workable and effective prescription for owl habitat retention.

Until this prescription is developed the DOP intends to adopt a similar prescription to that in the Glen Innes FIS, i.e. for Powerfull and Sooty Owls all known nesting and roosting sites will be protected by a disturbance free zone of 200m and 100m radius, respectively. This prescription should be seen as additional to habitat protection that will be afforded to Owls from other mitigating conditions such as the SEMGLs, habitat tree retention, rainforest

reservation, filter strip retention, the order of working for old growth harvesting and conservation and flora reserves.

Examination of Figures 1 and 2 of the Fauna Survey report indicate that significant large blocks of old growth forest have not been surveyed for owls. This is of more importance for owls than other species due to the potential impacts of logging and the fact that placing prescriptions is dependent upon the known presence of a Powerful or Sooty Owl. It is therefore considered that some of these large areas require pre-logging owl surveys. These areas are:

Kempsey M.A.	Branch Creek area of Nulla-Five Day SF
	Pee Dee SF and adjacent Nulla-Five Day SF
	Styx River SF adjacent to Flying Fox Mountain
Wauchope M.A.	Yessabah SF
	Kindee section of Mount Boss SF
	Apple Tree Mountain section of Bellangry SF
	Kennedy's Mountain sections of Mount Boss SF
	Northern end of Abbotsmith Ridge section of Mount Boss SF
	Mount Alabaster - Sawyers Creek section of Mount Boss SF
	Ballengarra SF south of Stockyard Creek
	Red Hill section of Doyles River SF
	Ralfes Peak section of Doyles River SF
	Doyles River SF south of Tobins River and west of Stockyard Creek
	Doyles River SF adjacent to Mount Seaview Nature Reserve
	Doyles River SF south of Fenwick's Road and adjacent to Fenwick's Scrub

It is not considered that such surveys are necessary in every compartment but, given the size of owl home ranges, an average of one survey per 1,000ha within these areas would suffice. Road based call playback surveys are considered to be sufficient for this purpose.

The protection of known nest and roost sites is considered in the section on Rare, Sensitive and Poorly Known Species.

Conclusion

It is therefore concluded that:

(a) **Pre-logging surveys for owls are required in 15 large blocks of unlogged forest throughout the K/WMA at an intensity of one survey per 1,000ha.**

(b) **A disturbance free zone of 200m radius shall be retained around known nesting and roosting sites of Powerful and Sooty Owls.**

Square Tailed Kite

This Schedule 12 species nests in Angophora woodlands and should not be impacted in the short or long term if nesting pairs are protected (Austeco 1992). Thus a 200m exclusion zone

about known nest sites should be implemented (see the section on Rare, Sensitive and Poorly Known Species).

Rufous Scrub Bird (RSB)

Seventeen territories of the Schedule 12 listed Rufous Scrub-bird were detected in the current study. State Forests of NSW has a policy of 250m radius undisturbed zones about those territories within productive forest with the proposed Spokes Conservation Area, an extension to Tinebank Flora Reserve, and the proposed Petroi Plateau C.A. also encompassing known territories. The NPWS submission felt that the proposed Spokes C.A. had unnecessarily missed some nearby RSB territories. This misunderstanding is now known to be due to inaccurate Australian Map Grid references in the Fauna Survey Report.

The territories along Cockerawombeeba Road have proposed 200m radius undisturbed zones. It is assumed that this is meant to be 250m, in line with SFNSW policy. The fauna consultant recommends further measures. As this area does not appear to be proposed for logging in the next 10 years (Map 16, EIS), it is considered that exclusion of deliberate hazard reduction burning in these territories should suffice until a further assessment is possible.

The Department also proposes that future pre-disturbance site inspections be conducted for this species between August and October in the year prior to any logging within the predicted range of the species (as per Ferrier 1985) in order to detect further territories. These would then be protected by 250m exclusion zones. All post harvest burning adjacent to any RSB protection zones shall be carried out so that it does not escape to the zones. These measures are in keeping with the Glen Innes determination.

The fauna consultant considers that the population of RSB along Botumburra Trail requires further consideration. The compartments which are adjacent to this trail are 12 and 18 (Styx River State Forest) and 119-121 (Nulla-Five Day State Forest). The Department considers that the possible importance of this area to the RSB, as flagged by the Fauna Survey Report, warrants its protection until further assessment has occurred. Thus no logging, roading or deliberate hazard reduction burning should be carried out in those parts of the above compartments which exhibit the habitat requirements of RSB until further assessment of the importance of these compartments to this population of RSB, and the importance of the population to the species. Austeco (1992) notes that Ferrier (1985) describes the habitat requirements of RSB as being defined as extremely dense cover 2-50cm above ground, moderate cover 50-100cm above ground, a moist micro-climate at ground level and abundant leaf litter.

The further approval of the Minister for Planning will be required before logging occurs in this area.

The NPWS submission recommends that the entire Petroi Plateau was a key area for the Rufous Scrub-bird and that it all should be provided secure reservation status. The discussion of this species in this submission, however, only indicated that the flat area immediately adjacent to the proposed Petroi Plateau Conservation Area was important. This is a far smaller area than that described in the recommendation. The area immediately adjacent to the Conservation Area is that discussed as compartments 12, 18, 119, 120 and

121 (above) and, as no justification is given for the further consideration of the whole Petroi Plateau, the Department cannot accept this recommendation.

Conclusion

It is concluded that:

(a) **Pre-disturbance surveys for this species will be carried out within the predicted range of the species;**

(b) **known RSB territories shall be surrounded by a 250m disturbance free zone with no post harvest burning being allowed to escape into the zone.**

(c) **no logging or deliberate hazard reduction burning shall occur in those parts of compartments 12 and 18 (Styx River State Forest) and 119-121 (Nulla-Five Day State Forest) which exhibit the habitat requirements of RSB until further assessment has occurred.**

Glossy Black Cockatoo

This Schedule 12 species is dependent on large nesting hollows and mature *Casuarinaceae* for food. Nesting hollows should be sufficiently provided for by habitat tree retention and other prescriptions.

As *Casuarinaceae* take 10 years to come to maturity and bear fruit (Austeco 1992) and are subject to significant damage by fire, the prevention of fire in areas of mature stands of this genus is considered desirable. As 33% of logging sub-compartments are to have no post-harvest burning, to protect reptile habitat, selection of these sub-compartments could also be based on the presence of mature stands of *Casuarinaceae*. It is accepted, however, that first priority for selection of these sub-compartments should be given to those where conditions mean that post-harvest burning would not normally be carried out due to fire danger.

The avoidance of damage to other mature *Casuarinaceae* where reasonable is also desirable.

Conclusion

It is concluded that general habitat tree retention prescriptions should cater for Glossy Black Cockatoo nesting requirements. Avoidance of damage to mature stands of *Casuarinaceae* by exclusion of post-harvest burning and by reasonable means should be undertaken.

Other Birds

The NPWS recommends pre-logging surveys for the Turquoise Parrot, Red Goshawk, Yellow-eyed Cuckoo Shrike, Black Bittern, Bush Thick-knee, Swift Parrot and Regent Honeyeater, with the extent of protection to be determined in consultation with the Service after any of these species are located.

Again, it must be pointed out that it is not possible for the Minister's determination to leave these details up to another body and the Department is loathe to require surveys where no prescription is in place to implement should the surveys be successful. Additionally, this recommendation must be rejected for six of these seven species for the following reasons:

- Turquoise Parrot - Austeco (1992) considers that this species rarely inhabits forests;
- Red Goshawk - protection of a home range of 5,000ha to 22,000ha (Austeco 1993) is not practical;
- Yellow-eyed Cuckoo Shrike - Austeco (1993) considers that the preferred habitat of this species is rainforest, which will be protected by this determination;
- Bush Thick-knee - this species inhabits open grassed woodlands and sparsely treed rangeland (Schodde and Tideman 1990). Thus even when occurring in low quality dry forests subject to the proposal, these will be subject to much lower intensity harvesting resulting in much lower impact;
- Swift Parrot - Schodde and Tideman (1990) report that this species breeds in Tasmania (thus not requiring tree hollows in NE NSW) and, feeding on nectar, lerps and insects, is not dependent on old growth forest;
- Black Bittern - this species inhabits waterside vegetation (Schodde and Tideman 1990) and thus would unlikely be significantly impacted by the proposal.

The Regent Honeyeater, however, was the subject of a prescription proposed in the FIS for Glen Innes, a prescription described as *"current SFNSW policy"* (Austeco 1992, p.27). This policy involves identification by SFNSW staff, protection of nest sites by a 100m disturbance free zone and retention of 10 Mugga Ironbark per hectare, and floriferous Yellow and Whitebox in the area where the species occurs. Austeco (1992) recommends that this policy could be strengthened by conducting pre-logging inspections to locate this species.

However, SFNSW contend that this prescription could not be implemented in the K/WMA as Mugga Ironbark, Yellow Box and Whitebox are virtually absent. Without any prescription, the Department will not request surveys.

Conclusion

No other prescriptions for these bird species are available for implementation.

Herpetofauna

The fauna consultant considers that most requirements of this group could be accounted for in the other prescriptions in place for mammals and birds, with the additional recommendation that parts of the catchments of Wilson and Tobins Rivers should be conserved because of their value to amphibians. A lengthy corridor has been placed along the Tobins River and Lightning Ridge C.A. reserves, part of the catchment of Wilson River.

Austeco (1992) notes the impact of post harvest burning on reptile habitat and the need for large logs as basking sites for reptiles. As a result a prescription to exclude post-harvest

burning from 33% of subcompartments and ensure log recruitment was implemented in the Glen Innes determination. This should also be implemented here.

Several rare and poorly known frog species are known from or expected in the K/WMAs and this report recommends placing various exclusion zones about known occurrences (see Table 6). In order to locate these species the Department considers that prelogging surveys should be carried out in likely habitat, a situation which was envisaged by State Forests in its submission. Given, however, that Austeco (1992) considers that the retention of filter strips should protect much of the habitat of most of these species, the Department is of the opinion that these surveys need only be carried out in drainage lines, bogs, soaks and other likely habitat that is not already protected by some other prescription recommended by this report, such as the SEMGLs or owl habitat retention strips.

Conclusion

It is therefore concluded that:

(a) **33% of sub-compartments should not have post-harvest burning conducted in them.**

(b) **Further surveys for rare and poorly known amphibians (Table 6) shall be carried out in likely habitat that is not otherwise protected from harvesting. Exclusion zones listed in Table 6 should be implemented when these species are detected.**

Rare, Poorly Known and Sensitive Species

Austeco (1992) recommends the placement of unlogged buffers about the known occurrences of rare and poorly known species (with less than 10 records in the Management Area) *"until sufficient information is available to ensure their survival"* for the Glen Innes MA. After 10 localities were identified it was proposed that the data be analysed to establish whether or not the current protection policy should be maintained. State Forests' staff were to be trained in the identification of these species and their habitats and would perform pre-logging inspections to increase the probability of detection and protection of undiscovered populations.

The Department of Planning considers this to be a sound option for the protection of these species as the low number of species and low number of occurrences ensures that the impact on timber resources are minimised. Additionally, so little is known of the species in question that other prescriptions, which could impact on timber resources to a greater or lesser extent, can not be justified.

Of the 15 species listed by Austeco (1992, Table 19, p.66), the following are not considered suitable for this prescription in these MAs:

* Koala - a temporary prescription has been developed for this species;

* Hoary Bat - not expected in the study area (Strahan 1988);

* Lewins Rail - not on Schedule 12 and is an occupier of vegetation in swamps and drainage lines. With most riparian habitat protected from logging, impacts should not be severe;

* *Litoria castanea* - endemic to the northern tablelands (Austeco 1992, Cogger 1992);

* *Philoria loveridgei* - not known in the MAs (Cogger 1992).

There is a need, however, for several other species to be added to this list for the K/WMA, these include the following amphibians:

* *Philoria sphagnicolus* (Sphagnum Frog) - known from 18 locations in the MAs (Fauna Report, p.215) but the Department is unaware how many of these are in the State Forests of the MAs, how old the records are or whether any of these sites have been logged subsequent to the records.

* *Mixophyes balbus* (Barred Frog) - 7 locations. Incorrectly noted by the Fauna Report (p.215) to be *"considered secure"* as it is listed on Schedule 12 of the NPW Act. Again the Department is unsure of the details of the records apart from one located in the current surveys.

* *Mixophyes iteratus* (Giant Barred Frog) - 4 locations, details of records uncertain. Schedule 12.

* *Litoria accrea* (Green and Golden Bell Frog) - 1 record over 10 years old. Schedule 12.

* *Litoria brevipalmata* (Green-Thighed Frog) - 1 record in State Forests of K/WMA. Schedule 12.

* *Litoria subglandulosa* (Glandular Frog) - 18 recordings during the present surveys. Schedule 12. The Fauna Report gave no details of these records, so the Department was unable to analyse them and develop a suitable prescription. Thus the species should remain on the list.

Please note that although *Litoria piperata* (Peppered Frog) has no recorded locations in the K/WMA and may be extinct there will be no additional survey effort required to locate it as unprotected habitat will already be being surveyed for frogs and any recordings of this species would be very important. Thus it is included here.

The Sphagnum Frog has similar habitat requirements to Loveridge's Frog (Cogger 1992) and thus it is considered that the prescription proposed for Loveridge's frog in the Glen Innes FIS (50m exclusion zone - Austeco 1992) is suitable to be applied to the Sphagnum Frog in the K/WMA. For the other frogs listed above, it is considered that the prescription proposed for other frogs by Austeco (1992) is suitable to be applied here. This involves the protection of all riparian habitat within a 200m radius of a known occurrence where riparian habitat is defined as vegetation communities dominated by streamside or wetland flora (A. Smith, pers.com.).

There are also several poorly known bat species expected or known from the K/WMAs which are on Schedule 12 of the NPW Act. These are shown in Table 6. In order to prevent disturbance to important roosting sites it is considered that, in common with the recommendations of Austeco (1993), roosts of these species with more than twenty individuals should be protected.

Table 6 : Recommended disturbance free zones for rare, sensitive and poorly known species

Species	Radius of Protected Zone	Number of Known Sites
Square-tailed Kite[a]	200[a,b]	?[d]
Powerful Owl[a]	200[a,b]/100[c]	?[d]
Masked Owl[a]	200[a,b]/100[c]	?[d]
Sooty Owl[a]	200[a,b]/100[c]	?[d]
Pacific Baza[a]	100[a,b]	?[d]
Large Footed Mouse-eared Bat	100[e]	?[f]
Beccari's Mastif Bat	100[e]	?[f]
Yellow-bellied Sheath-tailed Bat	100[e]	?[f]
Greater Broad-nosed Bat	100[e]	?[f]
Troughton's Eptesicus	100[e]	?[f]
Great Pipistrelle	100[e]	?[f]
Little Bent-wing Bat	100[e]	?[f]
Common Bent-wing Bat	100[e]	?[f]
Brush Tailed Phascogale	200[a]	3
Squirrel Glider	200[a]	2[g]
Eastern Pigmy Possum	100[a]	1
Long Nosed Potoroo	200[a]	3
Sphagnum Frog	50	18[i]
Barred Frog	200[h]	7[i]
Giant Barred Frog	200[h]	4[i]
Green and Golden Bell Frog	200[h]	1[i]
Green-thighed Frog	200[h]	1[i]
Glandular Frog	200[h]	18[i]
Peppered Frog	200[h]	0

a - From Austeco (1992)
b - About known nests only
c - About known roosts only
d - Not detailed in EIS documents
e - Only applies to known roost sites with >20 individuals
f - Only one bat roost site found in Fauna Survey, others are known to exist but details are not given in the EIS documents

g - These records are more than 10 years old and need not be reserved
h - Only applies to riparian habitat within this radius
i - The status (age, subsequent logging etc) of these records is unknown

Conclusion

It is concluded that the disturbance free zones indicted in Table 6 should be implemented for these species shown in that table. After 10 localities are known, the status of the species shall be reassessed and the condition may be reviewed. The further approval of the Minister for Planning will be required before the condition can be revoked or altered.

Corridors

The Fauna Survey Report recommends that reserves should be linked by 100m wide corridors of lightly logged or unlogged forest, which should not be restricted to watercourses, but some of which should cross ridgelines to link up other streamside corridors. The FIS (p.11) notes that there are seven proposed corridors linking conservation areas.

Of those conservation areas proposed for fauna conservation only Lightning Ridge C.A. is not connected to other existing or proposed reserves. It is noted that this C.A. is, however, connected to Wilson River F.P. and Wild Bull F.R. by a major stream (Cascade Creek) which would have a significant filter strip for the entire length between these reserves.

It is therefore considered that the widening of this filter strip into a 100m corridor would cause minimal loss of timber resource (particularly in the current cutting cycle) and provide a suitable benefit to the fauna of Lightning Ridge C.A.

The NPWS submission recommends that Cockerawombeebra Flora Reserve should be linked by a 400-500m wide wildlife corridor downstream to "*the area of old growth forest*". The old growth forest downstream of this Flora Reserve is, however, scheduled for logging and little benefit could than be achieved by this corridor. The area through which the corridor would pass is also regrowth forest and is not proposed for any further logging in the current cutting cycle.

The Service submission also recommends that the proposed corridor in Nulla-Five Day State Forest be extended to protect the major riparian habitat along the Styx River to protect 4 of the 6 endangered frogs and provide scope for movement into New England National Park. Although parts of Styx River State Forest occur within the Kempsey Management Area, the Styx River itself does not occur within the Kempsey Management Area and thus the Minister's determination cannot place conditions on the forest along this river. Additionally, none of the tributaries of the Styx River flow from New England National Park without passing through private land, making any corridor for this purpose incomplete.

Conclusion

It is therefore concluded that the only additional corridor required is a widening to 100m, of the filter strip along Cascade Creek, between Lightning Ridge C.A. and Wilson River F.P.

Refugia

The conservation of core areas of high quality fauna habitat within harvested areas is considered important. This was recognised in the Glen Innes and Wingham determinations by implementation of a prescription for the exclusion of 3 ha refugia, either as an expansion of a corridor or in isolation, which are prime habitat for Schedule 12 fauna.

The EIS has noted that this prescription would cause a further 0.6% reduction in the timber yields for the current cutting cycle. It is considered, however, that the potential benefits of this prescription outweigh this relatively minor loss of resource and this prescription should also be implemented here.

Conclusion

It is concluded that prelogging inspections should be undertaken to identify the prime habitat of Schedule 12 fauna and that 3 ha refugia should be placed about this habitat when it is detected.

Pre-Logging Inspections

Many of the prescriptions recommended by this report require the retention of habitat features for the protection of fauna. While it is believed that this would naturally result in pre-logging inspections by the SFNSW to identify these features, in common with the Wingham and Glen Innes MA Director's Reports, it is considered appropriate that the Minister for Planning's determination reflect the need for these inspections by placing a condition requiring these inspections.

It is intended that pre-logging inspections carried out under conditions placed on the proposal are done so in a thorough and rigorous manner. To interpret the meaning of the condition in any other way is to devalue this important pre-logging activity.

Pre-logging inspections for fauna should, to the fullest possible extent:

- be undertaken by a person or persons suitably qualified in identifying the habitat features, species and species' prime habitat that are the subject of recommendations made by this report;

- be made so that the range of habitats that exist within the compartment, and would be subject to harvesting, are visited; and,

- aim to identify, inter alia, owl roosts, Hastings River Mouse habitat, permanent water bodies >10m long, mature *Casuarina* stands, Yellow-bellied Glider feed scars, Koala markings, habitat trees and recruitment habitat trees, areas suitable for refugia, likely amphibian habitat not protected by other prescriptions and evidence of major bat roosts.

In identifying refugia for Schedule 12 species, habitat features which should be considered are, inter alia, availability of logs, ground cover, understorey development, hollow bearing tree density, availability of food sources (nectar, fruit etc) and quality of habitat for amphibians.

The pre-logging inspection report should indicate:

- which areas of the compartment were inspected, the type and quality of the habitat that was found;
- the suitability of the habitat to each of the Schedule 12 species likely to occur in the compartment;
- why, for example, no areas were chosen as requiring further surveys for Schedule 12 amphibians; and,
- why or why not the harvesting plan should be altered.

The DOP considers that these requirements could be achieved through the use of a pro-forma, which it is willing to discuss with SFNSW after the Determination is made. The inspection report should be attached to the harvesting plan.

The inspection report should indicate why, for example, no areas were chosen as requiring further surveys for Schedule 12 amphibians as recommended by this Director's Report or why no refugia were recommended. The inspection report should be attached to the harvesting plan.

Due to the variable nature of compartments and the large number of issues involved, the DOP is not able to recommend a condition which provides for the above. SFNSW should, however, use the above as a guide to designing, carrying out and reporting on pre-logging inspections.

Conclusion

It is concluded that pre-logging inspections should be carried out to identify all habitat features which are the subject of prescriptions recommended by this report. The implementation of the inspection should have regard to this discussion. Pre-logging inspection reports shall be attached to the harvesting plan.

Habitat Features Suitable For Several Prescriptions

Many of the habitat features which are the subject of prescriptions recommended by this report are suitable for use in more than one of these prescriptions. For example, habitat and recruitment habitat trees could also serve as Yellow Bellied Glider feed trees or Koala trees, provided that the trees met the requirements of all of the relevant prescriptions. Similarly, areas not subject to post-harvest burning for the protection of reptile habitat can also be those areas about RSB exclusion zones or areas of mature *Casuarinaceae* stands which receive no such burning.

Conclusion

It is concluded that any habitat feature which is the subject of any prescription recommended by this report can also be used toward the implementation of any other

prescription provided that the feature meets the requirements of all of the prescriptions in question.

General Fauna Conservation Reserves

The fauna consultant recommends reservations in the productive forests of the Doyles River, Carrai, Lower Creek and Nulla-Five Day State Forests. One reserve (principally for Rufous Scrub Bird) is proposed for Carrai State Forest, a long wide fauna corridor has been proposed along Tobins River in the Doyles River State Forest (principally for amphibian conservation) and a wide fauna corridor has been proposed on the western boundary of the Nulla-Five Day State Forest (principally for Rufous Scrub-Bird). None are proposed for the Lower Creek State Forest but State Forests of NSW (J. Mills, S. Bishop - pers com.) considers that the initial recommendation in the Fauna Survey Report was due to confusion and that it actually referred to the Styx River State Forest. Thus the proposed Petroi Plateau C.A. satisfies this.

Many submissions consider that most of the proposed and existing conservation reserves are in poorer quality forest or on steep land and would thus be of lesser benefit to a number of species than would reserves in high quality forest on flat land. Some of these submissions refer to work by Brathwaite (1993), Kavanagh (1987) and Lindenmayer et al (1991) who found more arboreal marsupials in areas of low relief.

The Department of Planning, however, is not able to conclude that additional reserves in flat, high quality forest are necessary in order to protect fauna in the K/WMA. It is noted that none of the above references have definitively quantified the effect of slope on fauna numbers and the Department is of the opinion that the information necessary to determine whether further reserves are required is not available. It is thought that such assessment would require such techniques as Population Viability Analysis which has not been attempted for the forests of NE NSW.

Thus it is considered that further, timber resource intensive, recommendations for reserves cannot be justified on the basis of the available information. Significant areas of high quality forest will remain at the end of the 10 years harvesting allowed by this approval, however, at which time further information and better techniques should be available. Thus the State Forests of NSW should be aware that further reservation may be necessary for the protection of fauna following the assessment conducted for the next EIS for these Management Areas.

In it's list of recommendations for fauna the National Parks and Wildlife Service recommends that:

- "all the Tobin's River in Doyles River State Forest old growth forest area should be reserved" (sic);

- "the Petroi Plateau conservation area should be extended to include all the old growth forest on the plateau and be included in a flora reserve"; and,

- "the Spokes Conservation Area should be classed as a flora reserve and include all Corrai State Forest south of Kunderang Road to the National Park boundary".

Additionally, the discussion of the fauna conservation strategy in the Service submission contains such recommendations as:

- "[all?] the area of old growth forest be reserved in Doyles River State Forest"; and,

- "productive forest be reserved in Carrai State Forest".

Appendix 1 of the Service submission does not indicate that the Service has inspected the upper reaches of Wilson's River, Carrai SF, the Petroi Plateau or any old growth in Doyles River SF. With no inspection data the DOP is unable to support the recommendations.

The Service relates these recommendations to recommendations made by the fauna consultant (Fauna Survey Report). At no stage, however, did the fauna consultant recommend such large reservations, only that some reservations need to occur in the productive State Forests of Doyles River, Carrai, Lower Creek and Nulla-Five Day, and in the upper reaches of Wilson's River. Apart from Lower Creek SF reserves have been placed in all of these forests and the Petroi Plateau C.A. adjoins Lower Creek State Forest.

Conclusion

It is concluded that no further reserves for fauna conservation can be justified on the available information but that significant areas of high quality forest will remain at the end of this 10 year approval, enabling further reservation to occur at that stage, if necessary.

3.3.5 Woodchipping and Timber Stand Improvement

Woodchipping

The EIS proposes to produce pulpwood from three sources; sawlog residues, regrowth thinning and silviculture, with only regrowth thinning to be carried out in the Kempsey Management Area.

Submissions raise concerns that this would lead to widespread clearfelling of old growth forest in the K/WMA. However, SFNSW indicates that the 115,000m^3 of pulpwood to be gained from *"silviculture"* (EIS Table 5.3) would not be taken in the 0-10 year period as current levels of pulpwood demand can be met from regrowth and recut stands. This means that old growth will not be harvested for the specific purpose of woodchip or pulp wood. Additionally, the major market for pulpwood is Sawmillers Exports Pty Ltd, who export from Newcastle and the EIS prepared for this export operation under the Environmental Protection (Impact of Proposals) Act (C'th) states that only 1,000-1,500 tonnes per annum of pulpwood is proposed to be taken from old growth forests from the entire north coast (Margules Groome Poyry 1993).

The DOP also considers that the fauna prescriptions recommended by this report will prevent clearfelling from occurring and will prevent significant adverse impacts on fauna. Any pulpwood extraction would, of course, have to comply with these prescriptions.

Timber Stand Improvement

The EIS proposes that timber stand improvement be carried out in the K/WMAs to improve regeneration rates and the growth rates of trees retained as future sawlogs. SFNSW has

provided the DOP with an assessment of the likely extent of Timber Stand Improvement in the next 10 years.

The general thrust of this assessment is that resources dictate that it is unlikely that more than a token amount of TSI will occur in the next 10 years and this will only occur in Wauchope MA. The maximum area that TSI is likely to be undertaken on is 300ha and it will principally be carried out in Forest Types 36 and 37. Also, should TSI have to remove more than $5m^2$ basal area per hectare then it would not be cost effective.

This all indicates that TSI will have very little impact on fauna overall. Thus TSI should be allowed to proceed as proposed. However, when considering the need for TSI, SFNSW may wish to take into account recent work by one of their own silviculturalist, Dr. Hui-quan Bi, which indicates that regeneration rates may be less effected by retained trees than had previously been believed (e.g. Incoll 1979). Also it should note that Incoll (1979) states that Squire and Edgar (unpubl.) found adequate stocking in 40m gaps, much smaller than the 70m gaps SFNSW currently believe are necessary for adequate stocking.

3.3.6 Fauna, Monitoring and Research

The Proposal

The FIS and EIS state that SFNSW is developing a database for records of fauna within the MAs and that SFNSW plans to undertake monitoring of populations within selected areas of State forest in NE NSW. Additionally, the EIS (p.305) states that specific fauna monitoring programs will be implemented in response to recommendations made in the FIS. These recommendations are that monitoring should include:

- specific surveys and development of management responses for the Brush-tailed Phascogale and Common Planigale in NE NSW;
- specialised surveys for the Rufous Bettong in the K/WMAs;
- annual monitoring of Rufous Scrub Bird populations and management responses to the results of this monitoring; and
- obtaining further information about the Broad-toothed Rat.

The EIS also states that the results of research into the impact of feral animals on native fauna and the impact of exotic bees on native species will be monitored and management adjusted where necessary.

Monitoring Requirements

The monitoring program should be designed:

- to concentrate on Schedule 12 species and species which are likely to be sensitive to the activities undertaken in the K/WMAs;
- so that the survey techniques and statistical analyses are powerful enough to not make Type II errors. Fairweather (1991) discusses this aspect of ecological study; and

- so that species which have not been adequately sampled by the surveys conducted for the EIS (e.g. amphibians) are targeted in pre-logging surveys. Other species which have not had enough records to allow further monitoring to not make Type II errors will also need to be targeted in pre-logging surveys.

The Department believes that SFNSW should be monitoring the impacts of feral animals on native species. This should include the collection of the scats of foxes and cats (when present) for identification of prey species, the recording of sitings of these species and the recordings of faunal native species' remains. Some specific work will need to be performed in unroaded, unlogged or unburnt areas as these areas are not often visited during normal operations. To not do so would be to bias the results toward showing impacts of operations. Nearby National Parks may be suitable for this purpose.

The other monitoring proposals should all be undertaken as proposed. Given the variability of the forest environment the DOP is unable to prescribe exactly how monitoring should be carried out, but SFNSW should have regard to this discussion when designing monitoring programs.

Research Requirements

There is an obvious need for further research which needs to be conducted beyond that which would be considered the monitoring of impacts prescribed as part of the conditions of a determination. Austeco (1993) recommends the research be conducted into, inter alia:

- the effects of honey production in State forests on native fauna;
- the effects of logging and tree age on nectar and pollen production;
- the impacts of logging on habitat tree dynamics;
- the dynamics of large log production and decay; and
- the ecology of amphibian species which breed away from permanent water.

In addition, the Department considers that research should also be conducted into:

- the survival of habitat and recruitment habitat trees;
- the effect of overstorey trees on regeneration; and
- the use of habitat trees by hollow dependent fauna, after harvesting.

These projects are not appropriate to be prescribed as conditions on a determination but the DOP would strongly encourage SFNSW to fund or undertake such research.

Conclusion

It is concluded that the impacts of logging, burning, grazing and feral animals on native fauna should be monitored, with the design of the program having regard to the

discussion given above. All fauna monitoring programs proposed in the EIS or FIS should be implemented. A number of research projects, the results of which would assist in the assessment of EISs, are suggested.

3.4 Old Growth Forests

3.4.1 Submissions

This is an issue of significant conflict, as can be seen by comparing submissions stating that old growth had to be logged on economic grounds with those stating that no old growth logging should occur. A larger number of submissions also supported the continuation of old growth logging as provided for in the existing Plan of Management.

Some submissions state that a proper old growth assessment (as envisaged by the NFP) should have been carried out for the MAs as part of the EIS and contended that there had been adequate time for this to occur. The Department does not agree with this for the simple reason that, even at the time of preparation of this report, methods to perform such as assessment in the forests of NE NSW had not been finalised.

Some submissions state that the EIS had misrepresented the amount of unlogged forest in the MAs, saying that some mapped as logged were in fact unlogged. In particular, Carrai State Forest was identified as an area with incorrectly mapped forest (though the precise location of this forest was not given). The SFNSW has confirmed, jointly with the NPWS, in a meeting of 18 November, 1993 in Taree that the only forests where such errors occurred were in the proposed Purchase Trail and Glen Esk CAs and a rocky area between Purchase Trail CA and Marowin Flora Reserve which was unsuitable for logging. As none of the areas would be subject to harvesting, these errors are inconsequential.

Submissions also consider that no old growth forest logging should be approved until a regional assessment of old growth values had occurred and a representative reserve system was in place. Given that there are not economically viable alternative timber supplies for mills to use, in the interim, and that one of the objects of the TI(IP) Act (s. 3) is to "*provide for interim protection for the employment of workers*" in the forests industries, the Department does not believe that this is an acceptable proposal.

3.4.2 EIS Assessment of Old Growth

State Forests of NSW conducted a preliminary old growth survey for this EIS and consigned those areas with high conservation value rankings on the results of that survey to not be logged within the next five years of the current cutting cycle (p.184). This is an approach that is to be commended as a suitable response to the determination of the Wingham MA EIS.

The methods used to assess and rank old growth, however, were not presented in the EIS. Appendix F lists all of the old growth forest in the study area as of September 1992 and notes 12 characteristics of each, including forest types, soils, elevation, fire history, logging history, etc. No assessment of this data that ranks the various compartments in terms of these old growth values has been presented in the EIS.

State Forests of NSW has subsequently supplied the Department and NPWS with data tables and an explanation of how this assessment and ranking was carried out.

It is noted that this assessment is based primarily on disturbance history and not conservation value. The National Forest Policy states that until regional assessments of old growth have been completed activities that may significantly affect those areas likely to be of high conservation value shall be avoided. Thus additional data such as the presence or absence of Schedule 12 animals, plants on the ROTAP list or plant communities listed as inadequately reserved in Hager and Benson (1992) would be of assistance in determining the order of working for old growth forest.

However, many of the large blocks of unlogged forest in the M.As were not subject to either flora or fauna surveys for this EIS or for previous studies. Thus it is not possible to rank the blocks using these criteria.

3.4.3 Further Assessment

The Department considers that some further assessment was necessary. The first consideration necessary was to determine which unlogged compartments would be logged in the interim between the production of the EIS and the Minister's Determination. SFNSW confirms that the following compartments will be logged by March 1994.

State Forest	Compartments
Ballengara	41, 42
Bellangry	89, 92
Mount Boss	144, 146, 147, 175, 177, 195
Doyles River	235, 236, 243, 244

These compartments should therefore be excluded from the assessment. Additionally, SFNSW has determined that some of the blocks of unlogged forest shown on Map 16 of the EIS can be further subdivided. The final blocks for this assessment are shown in Tables 7 and 8. Missing numbers in these Tables are due to compartments that will be logged by March 1994 or were larger blocks that have subsequently been sub-divided. The two Management Areas will continue to be assessed separately as future management will also do so.

TABLE 7: UNLOGGED BLOCKS OF FOREST, WAUCHOPE M.A

Block No.	State Forest(s)	Compartments
2	Mount Boss	94, 95, 96, 97, 117
3	Mount Boss	153, 155
5	Mount Boss	133, 134
6	Mount Boss	141,142,143,145,148,178,179,180,196
8	Mount Boss	189, 190, 191, 203, 204
9	Mount Boss	123-132, 336, 337
10	Mount Boss	264-272, 302, 304, 305
11	Mount Boss	299, 315, 318-322, 325, 326, 335
12	Yessabah	309,311,312,327,328,329,330,331,332,333,334
14	Kippara	15, 17

15	Kippara	4
17	Ballengara	39, 40, 43, 44, 45, 47, 48, 49
18	Ballengara	46, 50, 51, 52, 53
20	Doyles River	257-260, 264
21	Doyles River	51-55
22	Doyles River	247, 248, 250
23	Doyles River	203, 204, 209-213, 216
24	Doyles River	175, 176, 181-195, 200-202, 205-208
27	Doyles River	217, 218, 220, 238, 241, 242, 222
29	Doyles River	147-159
30	Doyles River	165-174
32	Bellangry	52
34	Doyles River	245, 246
35	Doyles River	162

TABLE 8: UNLOGGED BLOCKS OF FOREST, KEMPSEY M.A

Block No.	State Forest(s)	Compartments
1	Nulla-Five Day	101, 102, 123, 124, 139, 144, 145
2	Nulla-F.D./Pee Dee	88-94
3	Nulla-Five Day	119, 121
4	Lower Ck/Styx River	12, 18, 29
5	Styx River	14, 15
6	Lower Creek	1, 6, 7, 11, 27, 30
7	Styx River	16,17
8	Nulla-Five Day	110, 113-116
9	Nulla-Five Day	108, 109, 111
10	Nulla-Five Day	106
11	Nulla-Five Day	21, 22, 104, 105, 147-150
12	Styx River	19, 20, 23
13	Styx River	24, 25, 26, 31
X	Willi Willi VCL	See Map 16 of EIS

For these blocks, SFNSW has provided the Department with estimates of the topography and predicted yield and the NPWS has provided calculations of the average conservation status of the blocks in regard to the environmental units with in those blocks.

Topography

Several authors (Braithwaite 1983, Kavanagh 1987, Lindemayer et al. 1991) found the number of arboreal marsupials to be correlated with topography, with fewer arboreal marsupials being found on land of steeper slopes. This unlogged forest on steeper slopes can be considered to be of lower conservation value for these fauna than equivalent forest on land of low relief. The NPWS submission states that "steep and inaccessible areas are likely to be less suitable for wildlife".

Predicted Yield

Braithwaite et al. (1984) found positive relationships between foliar nutrients and the numbers of arboreal marsupials and Braithwaite et al. (1989) has found a positive relationship between foliar magnesium and bird species richness (which was suggested as indicating a positive correlation between bird species richness and forest productivity). Recher (1985) has also suggested a positive correlation between insects, and other bird foods, and forest productivity. Recher (1992) states that there is now abundant evidence that high biological diversity is correlated with forest productivity.

Given the assumption that yield levels are a result of forest productivity, predicted yield can be used as a substitute for conservation value to fauna, with lower yield forests being of lower conservation value.

Environmental Units

The NPWS has developed a database of environmental data for the entire north cost of NSW. Using the environmental variables, mean annual rainfall, mean annual temperature, geology and slope, the service is able to calculate the status of land in relation to the NE of NSW. For example, level of low rainfall, high temperature, intermediate fertility and flat topography has a 0.1% reservation status (ie only 0.1% of the land with these attributes in NE NSW is in a secure reserve).

For this exercise the Service has calculated the average regional reservation status of each of the unlogged blocks. This is calculated by calculating the area of each of the units within a block, determining its reservation status and averaging these throughout the block.

Limitations of These Data.

The Service's report to the Department on the average regional reservation status of the blocks has noted the following limitations with using environmental units:

- it does not include biological data, which should be used for final assessment;
- the units are mapped at a coarse scale;
- some of the blocks had a pronounced heterogeneity and should have been further sub-divided; and
- this assessment does not adequately consider the disturbance history of land already reserved.

It is noted here that the blocks were those which SFNSW considers are the smallest units which can be logged as separate parcels of land. This is related to the costs of road building and the costs of constantly moving logging operations about the Management Area.

The Topography and Predicted Yield data are limited as they are only estimates and no definitive qualification of the relationships between these attributes and fauna has occurred. However, they are useful as general indication of the conservation value of forest. They are also useful as they can indicate the extent to which logging will impact on old growth values. Thus logging of steep blocks with low yields will have less impact on old growth values than will logging of flat blocks with high yields.

Results and Discussion

The data supplied by SFNSW and NPWS for the K/WMA are presented in Tables 9 and 10 respectively. These orderings are based mostly on the yield and topography data. The reservation status of the environmental domains was generally not influential in changing the ordering as the DOP considers that the retention of areas of high biological diversity was of primary importance. Additionally, the limitations of using environmental domains raised in the Service's report and the comment by Bedward et al (1992) that *"floristic classification represents the distribution of species considerably better than the environmental classification at all scales"*.

Some concern could be raised that these methods are biased toward catering for the requirements of fauna, rather than flora. However, the recommendations of this report also specifically cater for the reservation of areas of land representing floral diversity (Forest Types, poorly conserved communities) with preference to be given to old growth.

Also shown in these tables are the groups of similar conservation value as evidenced by the yield and topography data (column headed *Group*). Based on these groups, the order of working would proceed alphabetically from group to group. The order within each group would not matter as the data was not precise enough to allow blocks to be ordered within a group.

It has been decided not to restrict any compartments to any particular period of the approval (e.g. 0-5 or 5-10 years) as the impacts of the other recommendations of this report may cause some shortfall in any particular period. Thus, by simply stating the order of working, operations will be able to continue without interruption.

The orders of working developed in Tables 9 and 10 only consider environmental factors, however, other factors such as economic and social impacts need to be considered. Those factors relevant to these two management areas are discussed individually below.

Wauchope MA

When presented with the draft order of working shown in Table 9, SFNSW raised the following issues:

- extensive resources had already been expended in planning (road surveys, consideration of SEMGLs, application for temporary s.120 licenses) for blocks 5, 6 and 35, with block 6 already having s.120 licenses issued;

- block 5 is the only potential source of tallowwood for Beechwood Timbers, which required this species to remain open;

- block 32 already has a temporary s.120 license;

- it is essential that the area available for logging at any particular time allow for wet weather logging (Doyles River State Forest is operable when Mount Boss State Forest is not), species mix and the operation of the SEMGL (Mount Boss State Forest now being seasonally unavailable due to high rainfall erosivity, which peaks at a different

Table 9 - Assessment of Unlogged Forest Blocks in the Wauchope Management Area

Block No.	State Forest(s)	Topography	Yield	Environmental Domain[1]	Wilderness[2]	Group
17	Ballengara	Mod. Steep	Low-Mod	4.3	No	C
18	Ballengara	Mod. Steep	Low	1.3	No	C
32	Bellangry	Steep	Low-Mod	2.7	No	A
5	Mount Boss	Mod. Steep	Mod	11.6	No	D
6	Mount Boss	Steep	Mod	14.7	No	B
27	Doyles River	Undulating to V.Steep	Mod	14.8	No	D
34	Doyles River	V. Steep	Low-Mod	14.6	No	A
22	Doyles River	Flat-Steep	Low-Mod	25.6	No	C
23	Doyles River	Undulating - V. Steep	Mod	19.0	No	D
35	Doyles River	Undulating	High	4.2	No	G
24	Doyles River	Steep-V.Steep	High	17.8	No	F
2	Mount Boss	V. Steep	High	43.1	Yes	F
3	Mount Boss	V. Steep	High	25.2	Yes	F
12	Yessabah	Steep	Low-Mod	19.8	Yes	E

Table 9 - Assessment of Unlogged Forest Blocks in the Wauchope Management Area (Contd)

Block No.	State Forest(s)	Topography	Yield	Environmental Domain[1]	Wilderness[2]	Group
14	Kippara	Undulating-Steep	Low-Mod	5.0	No	C
15	Kippara	Mod-Steep	Low-Mod	7.9	No	C
8	Mount Boss	V. Steep	Mod	20.2	No	B
9	Mount Boss	Steep	Low-Mod	9.3	No	A
10	Mount Boss	V. Steep	Mod	34.4	Yes	E
11	Mount Boss	V. Steep	Mod-High	16.9	Yes	E
20	Doyles River	Flat-Undulating	Low-Mod	20.8	No	D
21	Doyles River	Mod-Steep	High	16.7	No	G
29	Doyles River	Steep	High	11.5	No	F
30	Doyles River	Steep-V.Steep	High	16.6	No	F

1 - reservation status of environmental domains
2 - identified as wilderness by NPWS

Table 10 - Assessment of Unlogged Forest Blocks in the Kempsey Management Area

Block No.	State Forest(s)	Topography[1]	Yield[2]	Environmental Domain[3]	Wilderness[4]	Group
2	Pee Dee	71	22	11.1	No	A
1	Nulla-Five Day	53	20	20.1	Yes	B
5	Styx River	32	79	19.5	Part	F
3	Nulla-Five Day	0	111	26.9	Yes	G
4	Lower Ck/Styx River	0	71	26.3	Part	G
11	Nulla-Five Day	40	17	9.4	Part	D
6	Lower Creek	50	39	10.6	Part	D
X	Willi Willi VCL	50	20	17.3	Yes	C
9	Nulla-Five Day	25	30	9.9	Yes	D
10	Nulla-Five Day	63	21	12.5	Yes	C
12	Styx River	47	17	15.4	Yes	D
13	Styx River	71	16	9.8	Part	C
7	Styx River	60	18	12.4	Yes	C
8	Nulla-Five Day	37	35	8.7	Yes	E

1 - %age inaccessable
2 - m^3/ha from nett area
3 - reservation status of environmental units
4 - identified as wilderness by NPWS

time to wet weather). Thus SFNSW proposes that block 27 be elevated in the order to account for this.

Thus SFNSW preferred option would be blocks 5, 32, 35, part of block 6 (compartments 141, 142, 143, 145, 178, 179 and 180, hereafter called block 6a) and half of block 34 (compartment 245 - block 34a) in Group A and blocks 8, 9, 27, part of block 6 (compartments 148, 196 - block 6b) and part of block 34 (compartment 246 - block 34b) in Group B. The remainder of the order of working would be as per Table 9 with the exception of Blocks 5, 27 and 35 which would be elevated in the order of working as given above.

The promotion of block 6a from Group B to Group A and the demotion of block 34b from Group A to Group B is not considered to have a significant impact on the order of working. Similarly, the promotion of blocks 5 and 27 to Groups A and B respectively is not considered to have a significant environmental impact as these two blocks have only a moderate yield and have steep to very steep sections (Table 9). It is more important that areas of high yield and flat topography are not logged until after the regional assessment of old growth forests.

The promotion of block 35 from last to first group is of more concern if only the yield and topography are taken into account. However, this block is only a single compartment (162), and is adjacent to the Oxley Highway and some leasehold property which would increase the disturbance to the block, and is isolated from other unlogged forest.

Therefore, given the planning constraints of an ongoing activity (the delay in operations and temporary contractor unemployment that would occur if planning had to be done for alternative compartments), the need for access to wet weather logging areas, and the relatively low environmental impacts of these changes, the suggestions of SFNSW are accepted.

SFNSW also notes that some overlap between Groups had to occur as more than one logging area was operating and the end of the blocks could not necessarily be timed so that the entire Group finished at the same time. Thus the order of working must only be closely followed, not absolutely. The final order of working for Wauchope MA is given in Table 11.

Table 11 - Recommended order of working for Wauchope Management Area

Group	Block	State Forest	Compartments
A	5	Mount Boss	133, 134
	32	Bellangry	52
	35	Doyles River	162
	6a	Mount Boss	141,142,143,145,178,179,180
	34a	Doyles River	245
B	6b	Mount Boss	148, 196
	8	Mount Boss	189-191, 203, 204
	9	Mount Boss	123-132, 336, 337
	27	Doyles River	217,218,220,222,238,241,242

C	14	Kippara	15, 17
	15	Kippara	4
	17	Ballengara	39, 40, 43, 44, 45, 47-49
	18	Ballengara	46, 50-53
	22	Doyles River	247, 248, 250
D	20	Doyles River	257-260, 264
	23	Doyles River	203, 204, 209-213, 216
E	10	Mount Boss	264-272, 302, 304, 305
	11	Mount Boss	299,315,318-322,325,326,335
	12	Yessabah	309, 311, 312, 327-334
F	2	Mount Boss	94-97, 117
	3	Mount Boss	153, 155
	24	Doyles River	175,176,181-195,200-202,205-208
	29	Doyles River	147-159
	30	Doyles River	165-174

Kempsey Management Area

When presented with the draft order of working shown in Table 10, SFNSW raised the following issues:

- the long term wood supply agreement with Boral specifies a certain mix of moist and dry forest timbers must be supplied. The draft order working presented did not allow this to happen. Promotion of block 5 was suggested.

- the draft did not allow for wet weather logging, which was only available in block 6; and

- access to some blocks was through others. Thus to prevent the constructions of long roads through unlogged forest to service unlogged forest at the end of the road, block 6 should be logged before block 7 and block 11 needs to be logged before block 12 which needs to be logged before block 13.

This third request is considered acceptable as the blocks are not greatly different in terms of yield and topography and to construct roading through unlogged forest to access other forest would be economically onerous and also cause greater environmental impacts than accessing the blocks along the roading sequence.

The need for wet weather logging areas is acknowledged and SFNSW notes that compartments 12 and 29 are suitable and sufficient to cater for this need as they are already roaded and are flat. As compartment 29 is leasehold and not required for further Rufous

Scrub Bird assessment, then this compartment should be used for wet weather logging before compartment 12.

The promotion of block 5 was of more concern as it had high yield and low topography. However, the majority of this block has been rejected as wilderness, it is adjacent to private land and thus subject to disturbance, and has existing roading and previous logging. It is also a narrow section of forest and would have been difficult to manage as old growth. The final recommended order of working is given in Table 12.

Table 12 - Recommended order of working for Kempsey Management Area

Group	Block	State Forest	Compartments
A	2	Nulla-Five Day/Pee Dee	88-94
B	1	Nulla-Five Day	101,102,123,124,139,144,145
C	6	Lower Creek	1, 6, 7, 11, 27, 30
	10	Nulla-Five Day	106
	11	Nulla-Five Day	21, 22, 104, 105, 147-150
	X	Willi Willi VCL	Flat Top Mountain
D	5	Styx River	14, 15
	7	Styx River	16, 17
	9	Nulla-Five Day	108, 109, 111
	12	Styx River	19, 20, 23
	13	Styx River	24, 25, 26, 31
E	8	Nulla-Five Day	110, 113-116
F	3	Nulla-Five Day	119, 121
	4	Lower Creek/Styx River	12, 18, 29*

* Compartments 29 and 12 (in that order) may be logged out of order with the order of working if no other supplies are available from the Kempsey MA due to wet weather.

Conclusion

To ensure that the impact of logging on old growth forests is minimised until the regional assessments, envisaged by the National Forest Policy, are carried out, the Department of Planning has amended the order of working so that for the term of the

approval, logging will occur in the old growth areas considered to be of lowest conservation value.

3.5 Salvage Logging of Areas Affected by Wildfire

3.5.1 Unlogged Forest

Wildfires occurring in the study area before or during the approval period may necessitate alteration of the order of working adopted in the Minister's determination if salvage of fire-affected trees is to be completed before serious deterioration of the timber occurs. Such alteration is considered to be reasonable provided that certain environmental constraints are adhered to.

The order of working recommended by the Department aims to limit the impacts of logging on old growth forests until the regional old growth assessment proposed in the National Forest Policy has been carried out. Before this order of working may be altered, it is necessary to define a damage threshold beyond which old growth values are judged to be so seriously impaired that the forest can no longer be considered to be old growth. Unfortunately, there is no generally accepted approach to identifying such a damage threshold although an attempt is being made in the East Gippsland old growth study. There, significant disturbance is considered to have occurred if there is evidence of measurable changes to crown cover or growth stage ratios or to the floristic composition of the stand.

It is also noted that forests where trees are killed may take up to a whole growth cycle to recover to old growth status, but if salvage occurred then this recovery could take longer due to the lasting effects on crown cover, growth stage ratios and floristics. Indeed full recovery may not be possible, although this would depend on many factors including the type of floristic vegetation being logged and the extent, duration and intensity of the salvage operation. The presence of tree stumps, log dumps and road remnants would be evidence of the rate of recovery following disturbance. However, while there are legitimate cultural perceptions of what is old growth, the Department is of the opinion that salvage logged forest would still be functioning ecologically as old growth at the end of a single growth cycle which is the same period of recovery as if no salvage logging had occurred. Thus salvage logging should be able to proceed in these areas.

While the Victorian experience in assessing disturbance is of great interest, it would be unwise to apply it uncritically to the different eucalypt species and Forest Types of the Kempsey and Wauchope Management Areas where Blackbutt, for instance, is known to have the most favourable general reaction to fire and Tallowwood the worst (Jacobs 1955). Rather, the Department prefers that a methodology be developed specifically for north-coastal NSW for application if and when wildfires occur in unlogged stands. The Department, State Forests of NSW and the National Parks and Wildlife Service should co-operate in developing such a methodology.

Environmental Constraints

Environmental constraints on these operations are necessary as, while these areas will not initially support large fauna populations, in the long term the recovery of the fauna populations will depend upon the resources retained after salvage logging.

The Department considers that the logging prescriptions already recommended by this report for general harvesting should be adhered to for salvage logging, with the following changes:

- the koala recommendation will not apply as no signs of regular use will remain after fire;
- where there are not the prescribed number of live habitat trees remaining then dead, hollow bearing stags shall be retained to make up these numbers. This is considered necessary as it is likley that there will be fewer recruitment trees available to replace those trees killed in the fires and it is unlikely that these trees will have great timber values. Of course, stags which cause a safety hazard may be felled;
- the yellow-bellied glider prescription will only apply to those areas where post-fire feed scars are present or where records are known;
- where no other post fire refuges exist in the compartment that would remain after logging (e.g. filter strips, unloggable areas), then loggable post fire refuges (areas missed by the fire for whatever reason) shall be retained. This is important as these are the areas from which species will recolonise the forest as it regrows;
- habitat features need only be retained to the extent that they remain after fire (except for habitat trees above).

3.5.2 Regrowth and Recut Forest

Salvage of fire affected trees may also be necessary in regrowth or recut stands from time to time. Even though there is no need to assess the level of disturbance of old growth values in such cases, the environmental constraints described above should still apply.

Conclusion

The order of working recommended by the Department of Planning aims to limit the impacts of logging on old growth forest until the regional old growth assessments proposed in the National Forest Policy are carried out. Should old growth values be diminished significantly by wildfire then variation of the order of working should be permitted so that salvage logging can occur before serious deterioration of the timber value results.

The threshold beyond which old growth values are judged to be so seriously impaired that the forest can no longer be considered to be old growth requires further consideration by the National Parks and Wildlife Service, Department of Planning and State Forests of NSW.

Any salvage logging of forest affected by wildfire should still be subject to environmental prescriptions.

3.6 Wilderness

Two wilderness proposals directly affect State Forest and other Crown-timber lands within the study area. For the purpose of assessment, the definition of wilderness contained in the Wilderness Act 1987 is adopted here. The relevant section is quoted below.

"An area of land shall not be identified as wilderness ... unless the Director is of the opinion that:

a) the area is, together with its plant and animal communities, in a state that is not substantially modified by humans and their works or is capable of being restored to such a state;

b) the area is of a sufficient size to make its maintenance in such a state feasible;

c) the area is capable of providing opportunities for solitude and appropriate self-reliance recreation".

A proposal for the declaration of a Werrikimbe Wilderness was submitted by the Armidale Branch of the Wilderness Society in April 1991, covering some 74,000ha of land between the Hastings and Macleay valleys. The nomination was assessed by the National Parks and Wildlife Service which found that a revised area of 68,830ha satisfied the criteria established in s.6 of the Wilderness Act (NPWS 1992a). Of this area, 20, 712ha (or 30%) is State forest, comprising parts of Mount Boss, Yessabah, Doyles River and Carrai State Forests. The preferred option recommended by the Director of the National Parks and Wildlife Service to the Minister for the Environment was that *"all of the identified Werrikimbe Wilderness be reserved under the National Parks and Wildlife Act 1974, to be declared and managed as wilderness areas according to the provisions of the Wilderness Act 1987"* (NPWS 1992a).

Similarly, a proposal for the declaration of a New England Wilderness was submitted, also by the Armidale Branch of the Wilderness Society, in February, 1992. This nomination covered some 73,000ha of land on the eastern edge of the New England Tableland but, as 28,000ha of New England National Park was declared a wilderness under s.59 of the National Parks and Wildlife Act shortly after the initial proposal from the Wilderness Society was received, the nomination was regarded as a proposal for additions to the declared New England Wilderness (NPWS 1992b). Following assessment by the Service, it was reported that 57,500ha satisfied the established criteria, nine nominated areas having been excluded and four areas not nominated having been added (NPWS 1992b). Of the revised area, 25,680ha (or about 45%) is State forest, comprising parts of Nulla-Five Day, Lower Creek, Styx River and Oakes State Forests. However, it should be noted that not all the affected parts of these State forests are within the Kempsey Management Area. The preferred option recommended by the Director of the National Parks and Wildlife Service to the Minister for the Environment was that *"all of the identified New England Wilderness Area be reserved under the National Parks and Wildlife Act 1974, to be declared and managed as wilderness areas according to the provisions of the Wilderness Act 1987"* (NPWS 1992b).

The EIS estimates of the resource loss should the identified wildernesses be declared is as follows:

	Quota Sawlogs (m^3 gross)	Other Sawlogs (m^3 gross)
Werrikimbe Wilderness	208,000	23,000
New England Wilderness.	175,000	107,000
	383,000	130,000

Although the Wilderness Act does not require the National Parks and Wildlife Service to consider the resource implications of wilderness declaration as part of its assessment process, State Forests of NSW undertook its own economic assessment of all wilderness proposals likely to have an impact on State forests (Halkett et al n.d.). The SFNSW concluded that, if the Werrikimbe Wilderness was to be declared within the boundary initially nominated, six sawmills would be adversely affected resulting in the direct loss of 26 jobs and the loss of a further 55 jobs regionally with the total community impact estimated to be $62 million. If the New England Wilderness was to be declared within the boundary initially nominated, the report concluded that five sawmills would be adversely affected, resulting in the direct loss of 42 jobs and the loss of a further 88 jobs regionally with the total community impact estimated to be $96 million. While the DOP does not necessarily accept the SFNSW estimate of social and economic impacts, the report does serve to highlight that social and economic consequences may indeed arise from wilderness declaration.

Comparison of EIS Map 16 and Table 5.2 with Map 3 in both the Werrikimbe Wilderness and New England Wilderness Assessment Reports provides a general indication of which old growth compartments satisfy the s.6 wilderness criteria in the view of the Director of the National Parks and Wildlife Service but also shows that the identified wilderness areas include logged forest and steep, inaccessible areas. Table 13 indicates old growth compartments within identified wilderness to be logged in the first 10 years of the proposal.

The log resource available within the Wauchope MA in the remainder of the first cutting cycle is sufficient to permit some flexibility in the proposed order of working. Thus, only one old growth compartment within the identified Werrikimbe Wilderness is to be logged in the period 1993-1997 while 44 old growth compartments outside the identified wilderness are to be logged (excluding logging proposed on other Crown-timber lands). In the period 1998-2002, the corresponding number of compartments to be logged is 18 and 29 outside. In both these periods, the DOP is of the view that the old growth wilderness compartments should be logged last, consistent with the National Forest Policy (Commonwealth of Australia 1992) which directs that forest management agencies are to avoid activities that may significantly affect areas of old growth forest or wilderness likely to have high conservation value. This strategy assumes that, within the identified wilderness areas, old growth stands have the highest conservation value and is compatible with the proposed order of working in Table 12 (see Section 3.4.3 of this report).

In Kempsey MA, 21 old growth compartments are scheduled for logging in the period 1993-1997, nine of which are within the identified New England Wilderness and 12 outside. In the period 1998-2002, all but one of the old growth compartments to be logged are within the identified New England Wilderness. Thus, while it may be desirable to adopt a strategy similar to that recommended above for the Wauchope MA, the restricted availability of log

resources indicates that this is not practical. Instead, the order of working proposed in Table 12 of Section 3.4.3 of this report should be implemented, noting that wilderness value was one of the factors considered in determining the conservation value of old growth forests and the ranking of old grwoth compartments shown in the table.

Table 13 - Old growth compartments proposed for logging within identified wilderness

	KEMPSEY MA		WAUCHOPE MA	
	Within Identified Wilderness	**Outside Identified Wilderness**	**Within Identified Wilderness**	**Outside Identified Wilderness**
1993-1997	101, 102, 121, 123, 124, 139, 144, 145, 119	91, 92, 88, 89, 90, 93, 94, 14, 15 12, 18, 29	97	52, 89, 92, 133, 134, 141, 142, 143, 144, 145, 146, 147, 148, 175, 177, 178, 179, 180, 195, 196, 39, 40, 41, 43-50, 52, 53, 212, 213, 217, 218, 220, 235, 236, 241-244
Total Compartments	9	12	1	44
1998-2002	104, 105, 106 108, 111, 147, 148, 149, 150, 19, 21, 22 1, 6, 7, 11, 18, 27, 30	146	94, 95, 96, 117, 151, 153, 155, 309, 311, 312, 327-334	175, 176, 181-195, 200-209, 211, 216
Total Compartments	19	1	18	29

Arrangement of the order of working as recommended above will minimise the impact of the proposal on identified wilderness should declaration proceed. Of course, the DOP's assessment and recommendation should not be seen as pre-empting in any way any later decision of Government. The impact of forestry operations on wilderness values is further mitigated by the fact that, even within the identified wilderness boundaries, some areas will not be logged or otherwise disturbed because topographic or other constraints make them inaccessible or because they have been reserved as part of the conservation strategy as

amended by the Minister for Planning. Indeed, even logging itself does not mean the loss of all wilderness values as logged forests are certainly capable of ensuring the continuation of biological processes and may still be considered wilderness (according to the Wilderness Act definition) provided they may be restored to a condition *"that is not substantially modified by humans and their works"*. It is clear that the National Parks and Wildlife Service is of the opinion that logged forest is capable of being restored to such a condition as both the Werrikimbe and New England identified areas include some logged forest. Nonetheless, it is acknowledged that forest values important to the enjoyment of solitude and self-reliant recreation are impaired by disturbance such as that caused by logging. Lastly, the impact of forestry operations on wilderness is mitigated by the arrangement of harvesting into three periods, the first two of which comprise the approval period of 10 years. At the conclusion of the approval period, it is expected that 9,000 ha of old growth forest will remain within the Wauchope MA and 1,960ha will remain within the Kempsey MA (excluding conservation reserves) although not all remaining areas are within the identified wilderness boundaries. Although not given in the EIS, the Department estimates that the remaining areas of old growth forest within the identified wilderness areas to be 1,800ha (20%) in the Wauchope MA and 1,860ha (95%) in the Kempsey MA at the conclusion of the proposed approval period.

Several submissions comment on wilderness issues. Some, such as submission 10, oppose any further loss of timber resources for any reason as a matter of principle. Another (147b) expresses the view that declaration as wilderness of those areas identified as meeting the criteria for wilderness established in the Wilderness Act should have been considered as an alternative rather than being rejected on the grounds that wilderness management *"is not part of the activities which the Commission proposes to carry out in the Study Area"* (EIS p.163). The National Parks and Wildlife Service submission (152) criticises the EIS for its lack of reference to the current wilderness literature, its failure to mention or discuss the preferred options advanced in the wilderness assessment reports and the absence of any consideration as to how the impact of forestry operations on wilderness values may be mitigated. In view of these perceived deficiencies, the Service advocates the exclusion of logging and road construction from identified wilderness areas pending the completion of the National Wilderness Inventory and a Government decision on the wilderness assessment reports' recommendations.

Conclusion

Recommendations that two wilderness areas be declared within the study area are currently before Government. Although social and economic impacts would be a consequence of wilderness declaration in either or both cases, the magnitude of those impacts has yet to be accurately quantified. It is the Department's view, however, that such impacts may be mitigated by permitting logging to occur while ensuring that wilderness values are preserved to the greatest extent possible. This shall be achieved by the exclusion of logging from conservation reserves and generally inaccessible areas, by the capacity of disturbed forest to recover over time and by the staging of logging such that some areas of forest with high conservation value within the identified wilderness boundaries remain at the conclusion of the 10 year approval period.

3.7 World Heritage

The IUCN has recently completed its technical evaluation of the Central Eastern Rainforests of Australian World Heritage Nomination which included properties in the Management Areas.

In its report on the nomination, the IUCN notes that the inclusion of the *"Carrai plateau and escarpment adjacent to Werrikimbe National Park to include major examples of 'Macleay' dry rainforest"* would add value and *"strengthen manageability"* of the property. Review of the nomination document indicates that this refers to the area shown in Map 5. Within this area there is a small amount of regrowth logging scheduled in the first 10 years of the proposal (EIS Map 16).

Given that the nomination is based upon the conservation values of rainforest and that the proposed logging is regrowth of hardwood stands, then operations should have little impact on the World Heritage values of the identified area provided that 20m buffers are placed about unlogged rainforest.

Conclusion

It is concluded that operations within the area shown on Map 5 should not occur within 20m of unlogged rainforest, as mapped on SFNSW harvesting plans.

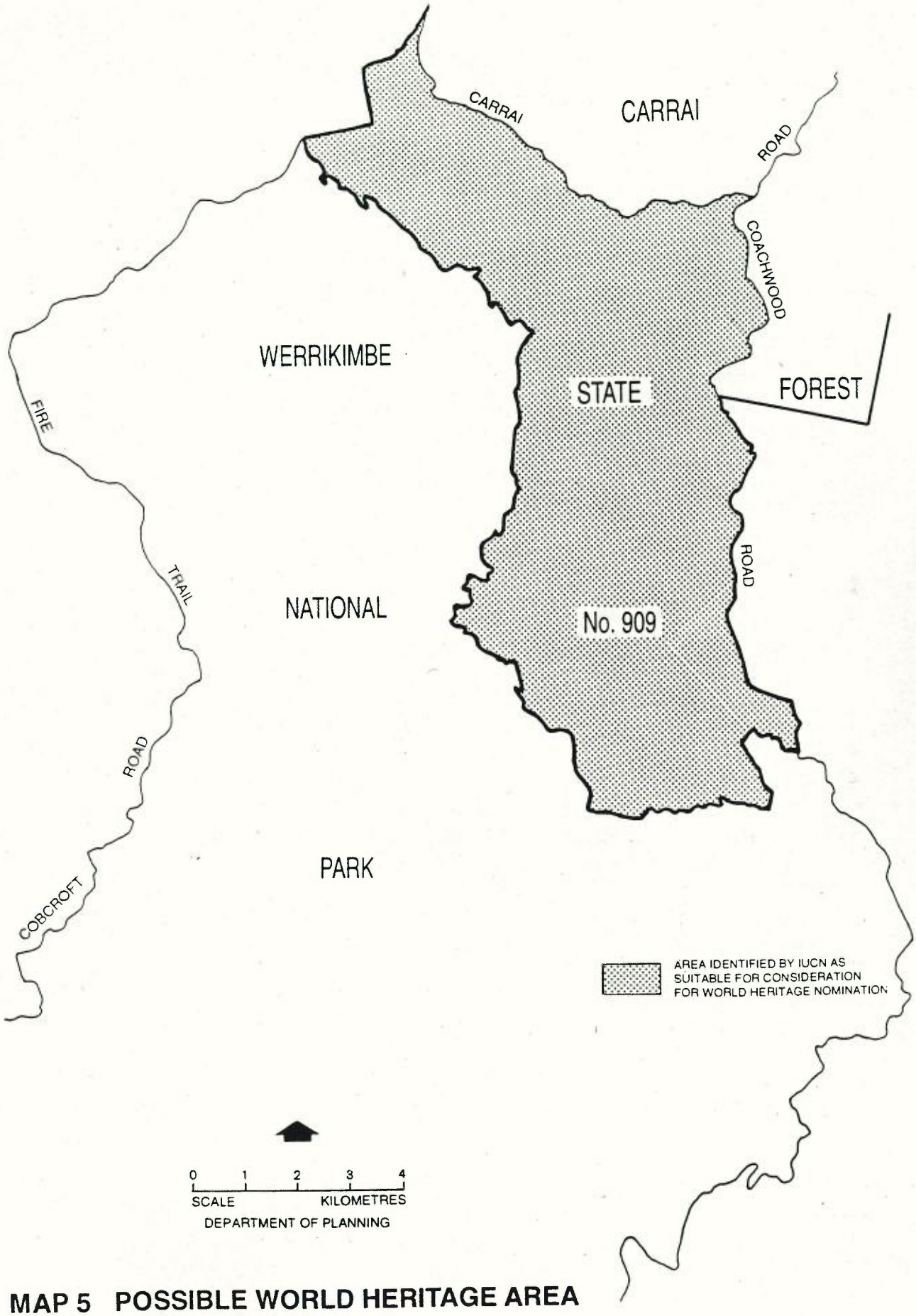
The IUCN report also accepted Banda Banda Flora Reserve as being worthy of inscription on the World Heritage list. It is noted, however, that the EIS proposes a road just inside the eastern boundary of this Flora Reserve (EIS Appendix C, p.C-12). The State Forests has noted that this road was included in the working plan for the Reserve that was approved by the responsible Minister.

Given that:

- the Banda Banda trail already follows some of the alignment of the proposed road as it passes through Banda Banda Flora Reserve;
- very little rainforest is mapped on SFNSW forest type maps (Map Sheet - Banda Banda East) along the proposed alignment of the road;
- that rainforest which does exist along the alignment is not the significant stands of *Nothofagus* for which the Reserve was identified (DASET 1992, p.41);

it is considered that the proposed road will not harm to the World Heritage values of the Reserve.

It is also noted that the nominating committee would have been aware of this planned road as the working plan for Banda Banda FR pre dates the nomination by at least 2 years and previous working plans dating from 1984 included this road. Therefore, if the nominating committee thought this road likely to significantly affect the World Heritage values of the property then the nomination should not have included this section of Banda Banda Flora Reserve. Roading through the reserve is given more consideration in Section 3.10.



MAP 5 POSSIBLE WORLD HERITAGE AREA

Conclusion

It is concluded that the proposed road through Banda Banda Flora Reserve should be allowed to be constructed as provided for in the EIS.

Three other properties (Fenwisks Scrub Flora Reserve, Mount Seaview Nature Reserve and Werrikimbe National Park) have been accepted as deserving listing by the IUCN and all four such properties share boundaries with State Forests in the K/WMA. The issue of buffers about these properties then arises.

The Department considers, however, that logged State Forest provides a very suitable buffer to World Heritage properties, especially in comparison to the activities that could be carried out on the private land that borders three of the properties. The properties have been nominated for their rainforest stands and any light sensitive rainforest (warm or cool temperate) that exists on the borders of these properties will be protected by the recommendation of this report that these rainforest types, when unlogged, will be protected by 20 metre buffers. Additionally SFNSW management of these State Forests would be to prevent fires escaping from State Forests to these properties even without the World Heritage Listing.

Again it is noted that the nominating committee would have been aware of the State Forests surrounding these properties.

Conclusion

No changes to the management of State forests that have boundaries in common with the property is necessary to protect the World Heritage values of the property.

3.8 Soils Assessment

The Kempsey/Wauchope Management Area EIS presents a dispute about the Standard Erosion Mitigation Guidelines for logging (SEMGL). On the one hand the soil consultant for State Forests of New South Wales believes that the derivation of the SEMGL is flawed and the results achieved are both economically onerous and not as mitigative as the previously used Standard Erosion Mitigation Conditions (SEMC). On the other hand the Department of Conservation and Land Management (CaLM), the State's expert body on soil erosion, argues that the SEMGL are soundly based on scientific research objective and the most appropriate mitigative measure to adopt at the site specified operational level.

While science both theoretical and applied has a rich history of dispute and debate, it is unusual for the EIS process to be the vehicle for the resolution of such disagreements. Nevertheless, the debate serves the very important function of focussing peoples minds on the appropriate information tools and measures needed to assess and mitigate environmental impact in a large area, dynamic system where operations are occurring in a highly differentiated spatial and temporal framework. The information that has been provided in the EIS begins that focus, the submission from CaLM sharpens it. When additional scientific information is considered the issues can, in the view of the Department of Planning, be resolved.

The Department of Planning has entered this debate for another reason as well. It has long considered that the real value of the EIS and EIA process is not mere compliance with the legal requirements but rather, that significant benefits can accrue to the proponent and the community if the opportunity is taken to use the process to develop and later implement an environmentally sound management system.

The essence of the following discussion on environmental impact assessment on the soil environment is that the Department of Planning agrees that the SEMGL are the most appropriate means to achieve effective and practical mitigation of erosion and sedimentation at the site specific operational level.

Other soil issues specifically addressed in this report include:

* Description of the Environment
* Soil Mapping
* Soil Profile Description
* Soil Landscape Information
* Soil Erodibility
* Erosion Hazard
* Assessment of Impacts
  - Erosion
  - Soil nutrients
  - Soil compaction
* Standard Erosion Mitigation Guidelines for Logging
* Harvesting Plans
* Training
* Monitoring

3.8.1 Description of the Environment

Landform

The EIS's provides a map of elevation classes within the K/WMA and a table showing the different slope classes. Benefit would also have been gained from provision of a slope map and explicit identification of terrain. Slope and terrain have a significant impact on the physical capability of the land to sustain the forestry operations intended and are required for the detailed mapping of erosion hazard. This will be necessary to facilitate the preparation of an Erosion Hazard and Sediment Control Strategy (see Section 3.8.9) and adoption of the Standard Erosion Mitigation Guidelines for Logging (SEMGL, see Section 3.8.8), at the harvesting plan level of management.

Geology

The EIS identifies the geology of the area although more use could have been made of this to identify potential geological hazards such as areas prone to landslip and mass movement. The Department of Planning notes that more recent geological maps for the area are available. The submission from the Chamber of Mines, Metals and Extractive Industries (NSW) notes that there is a high probability that the K/WMA area will continue to be subject to mineral exploration. The DOP notes that any mining proposal for the K/WMA would be subject to the provisions of the EPA Act (1979).

Climate

The EIS provides information on average rainfall and rainfall intensity drawing attention to the extreme rainfall intensities encountered in the K/WMA. It is also important to recognise the episodic manner in which erosion events occur and the importance of such extreme erosion events. CaLM, in its submission has drawn the Departments attention to the *"subtropical"* features of climate and that this has consequences for the effect of logging on the soil environment, particularly in relation to soil erosion hazard and physical hydrology (short and long term effects). CaLM also draws attention to the fact that climate has implications for the stability of the soils (particularly the effect of *"rainfall erosivity"*); planning and implementation of field operations; the physical hydrology (on-site and off-site); and revegetation, particularly from a land management perspective. The DOP notes that rainfall intensity has been considered by the EIS in determining Soil Erosion Hazard, however, it is important to recognise that the hazard may vary at different times of the year due to the seasonal and episodic nature of rainfall events.

Information on rainfall erosivity has been provided in the EIS in a tabular form. Provision of such information in a graphic form i.e. rainfall erosivity map, would also have been useful. The Department is aware that at a broad level the Rainfall Erosivity factor has been quantified for NSW by Rosewell and Turner (1992). CaLM notes in its submission, however, that it is presently preparing a map of rainfall erosivity for the coastal areas of NSW and across the study area. When finalised, this map should be used for deriving [R] (rainfall erosivity) value in determining erosion hazard calculations.

CaLM notes that the discussion on *"rainfall"* should have been directed more effectively toward the specific soil and hydrological features of the K/WMA EIS Area and considers that rainfall must also be discussed in the planning and operational components of Harvesting Plans such as that shown in Appendix D of the EIS. The DOP notes that these concerns can be addressed at the Harvesting Plan scale of operations through the implementation of the DOP's proposed Erosion Hazard and Sediment Control Strategy and the implementation of the SEMGL (see Section 3.8.8).

Conclusion

The EIS provides information of the physical aspects of the existing environment focussing attention on the impacts of rainfall intensity. Although more information could have been provided in the form of rainfall erosivity and slope maps, this can best be addressed for operational forestry at the Harvesting Plan level of management.

3.8.2 Soil Mapping

Important aspects of soil mapping relate to its scope, scale and the methods adopted. These are discussed in greater detail below.

Scope and Scale of Soil Mapping

The EIS provides soil mapping at a scale of approximately 1:500,000. While it is recognised that a larger scale would have provided more detailed information, the Department of

Planning acknowledges that the EIS covers a particularly large area and that this may affect the feasibility of preparing larger scale maps.

The scope of the soil survey relates to both the land it covers and the survey intensity. The Soils Survey Report addresses both State Forest and other Crown timber lands, albeit with only one soil description on Crown timber lands outside of State Forests. The low sampling intensity of Crown-timber lands other than State Forest, may be because the Report identifies the area under consideration as consisting of approximately 207,000 ha of State Forest and Crown timber areas rather than 207,887 ha of State Forests and 93,732 ha of other Crown timber land as identified in the EIS.

CaLM also raises the issue that there is very little sampling of steep terrain. This is of some concern as many of the problems associated with erosion and sediment control in forests are on the steeper land and the majority (60%) of the Wauchope MA contains slopes in excess of 20^{o} with 15% of the slopes being in excess of 30^{o}. Nevertheless, it is unlikely that very steep land will be logged particularly as more detailed assessment of erosion hazard is required in the development of an erosion hazard and sediment control strategy. This also makes provision for upper slope limits for logging, in accordance with the erosion hazard of the area and the ground cover management techniques available to minimise the erosion hazard.

With regard to the sampling intensity of the survey, the Soils Survey for the K/WMA EIS sampled soils at 130 sites. While it is recognised that this is less than the sampling intensity recommended by CaLM (1 full soil profile description per 800ha), it does provide a limited description of soils in the K/WMA.

Methods Used for Soil Mapping

The Soil Survey adopted an approach that delineated Soil Mapping Units on the basis of geology. The main reason for conducting a soil survey for an EIS is to determine the limitations that soil may present to proposed operations. Soil mapping units based on geology alone do not enable this to occur. As topography has a major influence on soil erosion and the determination of soil erosion hazard, the omission of this factor from soils mapping severely restricts detailed assessment of the impact of forestry operations on the soil resource. Nevertheless,the information generally points to areas of critical geological importance (e.g. granite areas) which can be examined and addressed by additional analysis.

The DOP is of the opinion that a Soil Landscape Mapping approach incorporating both geology and topography, is more applicable to assess the soils of the K/WMA and their constraints to operational forestry, than a Soil Mapping Unit approach based on geology alone. A Soil Landscape approach is used and endorsed by CaLM. Soil Landscapes are defined by Houghton and Charman (1986) as: *"areas of land that have recognisable and specifiable topographies and soils, that are capable of presentation on maps and can be described by concise statements"*. Soil landscapes are used because of strong relationships between soil distribution and landform in Australia (CSIRO, Division of Soils, 1983) and because they allow the integration of both soil and landform related constraints into a single mapping unit.

The EIS's reliance on geology alone to distinguish Mapping Units may in part be due to the scale of the EIS, however, the description of the units could have been supplemented by the

presentation of toposequences for each unit, thus indicating the variation in soils according to topography within each mapping unit. CaLM notes that *"the toposequence concept used in describing soil distribution in soil landscape mapping is useful in all landuse contexts because it provides an indication of the range of soil types and soil forming materials which may be encountered within a given geological/topographic region."* Each soil profile description identifies eight to nine layers of soil materials which could have been linked through occurrence-relationship diagrams. Information such as this should be presented through the presentation of toposequences for each unit.

CaLM notes that an effective soil survey takes a necessarily limited amount of field data and extrapolates this in a meaningful way so that useful predictions can be made about the distribution and behaviour of soil. This extrapolation is based on the establishment and testing of hypotheses about factors influencing the formation and therefore the distribution and behaviour of the soil. As CaLM notes, there are a number of hypotheses about soil distribution that are commonly successful in soil mapping because they have been shown to be related to soil formation processes. These are related to geology, climate, time, geomorphology and the biosphere (particularly vegetation) (Paton 1978). The Soils Survey Report would have benefited from consideration of all of these factors.

Conclusion

The Soils Survey has primarily sampled State Forest areas, with other Crown-timber lands being afforded only one soil profile description. The Soils Survey has adopted a soil mapping unit approach which delineates units on the basis of geology. Although this identifies areas of geological importance, a Soil Landscape Unit approach (incorporating both geology and topography) would have been more useful for assessing the physical constraints to operational forestry. This approach can be adopted at the Harvesting Plan scale of operations to which the SEMGL apply (see also Section 3.8.9)

3.8.3 Soil Profile Descriptions

Five full soil profile descriptions are provided in the EIS, one for each of the Soil Mapping Units identified. While this is less than the number recommended by Morse et al (1991) (they consider that a minimum of three full profile descriptions should be presented for each soil constraint mapping unit) it does provide some information on soils in the K/WMA.

The Soil Data Cards contain information (in handwritten form) on parent material lithology, slope angle and landform element. The soil profile descriptions, however, in the Soils Survey Report (Appendix I), however, contain little site physiographic data such as the terrain element, elevation, aspect, slope or vegetation association and no record of existing erosion conditions, profile permeability, site drainage or profile drainage. It has thus not been possible for the EIS to establish whether any relationships exist between soil type/attributes and environmental attributes, e.g. lithology, terrain, elevation, aspect, slope or vegetation. Nevertheless, such information can be obtained prior to logging when the harvesting plan is being prepared.

CaLM has also drawn the Departments attention to the fact that the Soil Mapping Units of the EIS are highly variable in terms of their soils, particularly Soil Mapping Unit D. CaLM

notes that when soil mapping units become more complex, more soil observations should be undertaken until a predictable pattern of soil types occurs within the soil mapping unit. Chapman and Murphy (1989) note that Soil Survey Units require that *"sufficient field sampling be undertaken within each soil landscape to identify the range of soil materials present and to enable their occurrence and relationships within the landscape to be described"*. This line of argument supports the need for further analysis at the harvesting plan scale of operations.

Conclusion

The soils within the Soil Mapping Units identified in the EIS are highly variable. More soil profile descriptions should have been provided and undertaken until a predictable pattern of soil types occurred within each of the Soil Mapping Units. The soil profile description could have given more emphasis to site physiographic information. Further soil analysis is required at the harvesting plan scale of operations.

3.8.4 Soil Landscape Information

Approximately one third of the K/WMA has been mapped for soil landscape units by CaLM (Atkinson in prep.). This mapping includes the Boonanghi, Skillion, Yessabah, Kalateenee, Kippara, Bellangry, Maria River, Bril Bril, Cairncross, Papinbarra and part Cowarra and Broken Bago State Forests. The CaLM maps identify forty-five soil landscapes within the study area and 330 soil profile descriptions have been recorded. CaLM notes that this data is available on the NSW Soil Data System. In its submission, CaLM further identifies that full laboratory data is available for 228 soil samples collected in the area. While the former Forestry Commission apparently obtained a copy of the CaLM Soil Landscape Map and tabulated data, the K/WMA EIS and the supporting Soil Survey Report have not used this information in a constructive or informative way. While there has been considerable debate over the usefulness and accuracy of this information the Department of Planning is of the view that it would have been beneficial to fully utilise this information in the EIS. Nevertheless, it is considered that this information will be useful in undertaking more detailed analysis at the harvesting plan stage and preparation of an erosion hazard and sedimentation control strategy (see Section 3.8.9).

One of the specific criticisms of CaLM's soil landscape mapping that warrants comment is the contention that its main use is for urban and rural development. CaLM notes that while soil landscape mapping is intended to be general purpose mapping, it addresses all the attributes relative to forestry operations. The DOP notes that nowhere in the literature does it suggest that a soil mapping unit approach is more appropriate than a soil landscape unit approach for forest management issues. Indeed, the available literature (e.g. Morse et al 1991; Chapman and Murphy 1989; Atkinson 1991; CaLM 1993) would suggest that the opposite is the case.

Conclusion

More information on the soil constraints in the Study Area could have been obtained if the CaLM Soil Landscape Information had been incorporated in the Soils Survey Report. CaLM Soil Landscape information, however, has not been utilised in a constructive way. This information can, however, be used in a constructive and informative way at the harvesting plan scale of operations.

3.8.5 Soil Erodibility

The Soil Mapping Units are considered in terms of their *"erosion potential"*. No definition of *"erosion potential"* is provided in the glossary nor is it defined in Houghton and Charman (1986). CaLM notes that the consultants incorrectly use the term *"erosion potential"* rather than erodibility. The potential of a soil to erode is determined by a combination of the ability of the erosion agent to cause erosion (erosivity) and the resistance of the soil to that agent (erodibility). A soil of low erodibility when exposed to very erosive rain will have a similar potential to erode (erosion potential) as a soil of high erodibility exposed to rain with low erosivity. Hence the use of laboratory data only to derive erosion potential, is incorrect.

Both the Emerson Aggregate Test (EAT) and the dispersal index (dispersion percentage) are measures of the dispersibility of the soil. Two points are relevant in regard to these tests. Firstly, particle size analysis, dispersion and EAT tests were not conducted for C horizons of the soils sampled. Secondly, as pointed out by CaLM, these tests have never been tested against actual erosion measured under standard conditions. Many scientists in Australia would consider soil dispersion as an important predictor of the erodibility of some of our soils. It needs to be noted, however, that dispersion alone is not always a good indicator of erodibility. For example, self mulching black earths which are non-dispersible, have a high erodibility. Similarly, dispersible soils and non-dispersible soils which surface seal rapidly and then yield high runoff, may cause little erosion (e.g. Kinnell 1983, Mah et al, 1992). These problems, however, can be overcome when adopting the USLE upon which erosion hazard assessment of the SEMGL is based. The most successful method developed so far to relate the erodibility of soils to more easily measured soil properties, is the USLE soil erodibility nomograph (Wischmeier and Smith 1978) which has been validated for a small range of Australian soils (Rosewell 1992, Loch and Rosewell 1992). CaLM notes that although this method is not perfect, it would seem preferable to assess the erodibility of forest soils with a method that has at least been tested and found useful for some Australian soils rather than methods which have never been tested. The DOP supports the use of the USLE in the adoption of the SEMGL. (A critique of the USLE is provided in Section 3.8.8 of this report).

High dispersion percent (D%) values and low EAT values indicate soil instability. For some of the K/WMA soils, a high D% coincides with a high EAT value (i.e. the tests give opposite results in terms of soil stability). In such instances, the EIS does not give due regard to opposing results. The results of these tests should be used in conjunction to ascertain the susceptibility of a soil to erosion and bring attention to any potential problems. Based on the D% and EAT values, particularly for several soils in the Granitoids (Soil Mapping Unit B, profiles 1601 and 1803) and Metasediments (Soil Mapping Unit C, profile 1404), it appears that some of the soils are inherently unstable. This has not been recognised by the Soils Survey report or the EIS as the Soils Survey report (p.57) considers that all of the soils within the study area are stable, under their current land use and land management regime.

Conclusion

The EIS appears to have confused erosion potential with soil erodibility. Soil erodibility is assessed using the Emerson Aggregate Test and the dispersion percentage. These measures are considered appropriate, however, CaLM considers assessment

using the USLE soil erodibility nomograph is more appropriate. With the soil erodibility information obtained by the EIS, more consideration could have been given to these profiles/areas which were identified as being inherently unstable.

3.8.6 Erosion Hazard

Houghton and Charman (1986) define erosion hazard as *"The susceptibility of a parcel of land to the prevailing agents of erosion. It is dependent on a combination of climate, landform, soil, land use and land management factors"*. Because erosion hazard is dependent on so many factors, CaLM advocates the use of objective procedures such as those provided by the USLE to help forest managers who are not used to assessing erosion risk. The DOP endorses this approach noting that it potentially avoids errors associated with a subjective assessment of erosion hazard such as what appears to have occurred in Oakes State Forest (Atkinson et al 1992).

The Soils Survey Report discusses erosion hazard in relation to two different scales. Initially, the Soils Survey report discusses erosion hazard in terms of one rating over the entire K/WMA. In Appendix 3 of the Soils Survey Report (Appendix I) erosion hazard is then assessed in relation to the individual mapping units and the various slopes and rainfall erosivities which occur within them. This scale is considered more appropriate for assessing erosion hazard as the full range of erosion hazards is likely to be encountered throughout the MA when examined at a scale appropriate for harvesting operations. However the information would have been more useful if it had been presented in the form of erosion hazard map(s) for the various State forests and other Crown-timber lands within the K/WMA.

The SEMGL utilise soil erosion hazard assessment to identify the physiographic constraints of the soil resource to operational forestry. The Soils Survey criticises the SEMGL on the basis of its derivation of erosion hazard, however, it neglects to note that certain provisions of the SEMC also relate to erosion hazard. The Survey did not indicate how soil erosion hazard was derived for the SEMC. The derivation of erosion hazard based on the SEMC has been proved to be erroneous (cf. Atkinson et al 1992). Based on their study of Oakes State Forest, Atkinson et al (1992; section 11.2), comment: *"better methods need to be adopted to determine the potential erosion hazard of a proposed logging operation"*. They suggest adoption of the Soiloss program which utilizes the USLE. Atkinson et al (1992) also note that the SOILOSS equation allows *"the impact of a proposed variation in practice of location to be immediately evaluated"*. The Department of Planning considers that the derivation of erosion hazard based on empirical data is more applicable than a subjective identification based on only visual observation. Therefore erosion hazard as defined by the SEMGL, utilizing quantitative data is more applicable than the subjective assessment of erosion hazard allowed for by the SEMC.

CaLM notes that the section on soils in the EIS could provide a conceptual framework to objectively consider environmental interactions and impacts, and appropriate management practices. CaLM notes that of fundamental importance in considering erosion hazard assessment is the cover factor as used in the SEMGL. CaLM notes that the EIS gives this factor no consideration in determining or minimising erosion hazard. As such, the EIS appears to have predicted the erosion risk (Houghton and Charman 1986) of the area (the hazard occurring without consideration of land use and land management (cover) factors). This should not necessarily be viewed as a criticism of the EIS as by considering the landform, climate and soil factors first, the physiographic limitations of the landscape are

predicted. The role of forestry operations (land use) and subsequent ground cover management (land management) factors in influencing erosion hazard can then be assessed individually. The land use factor (forestry) is currently estimated by the SEMGL as a value of 1 (bare ground equivalent to a snig track area). The land management (cover) factors are going to be locally variable depending on existing vegetation cover and land management techniques employed. Hence the full consideration of erosion hazard for operational forestry, is best assessed at the harvesting plan level of operations (see Sections 3.8.8 and 3.8.9).

Undisturbed forest soils are characterised by the presence of many fine roots in the topsoil. When using the USLE, this is accounted for in the cover management factor by reducing the bare soil cover-management factor from 1.0 to 0.7. This 30% reduction is also intended to account for the high organic matter content of forest soils. CaLM notes that it may be giving too much credit for organic matter by using the SOILOSS nomograph equation and the reduction in the bare soil cover-management factor and this aspect will be considered when the SEMGL are reviewed.

The Soils Survey Report concludes that the erosion hazard assessment procedures provided in the SEMGL seemingly do not take into account the soil which moves within the area, or that which moves onto the area from outside it. This is true, however, the SEMGL's use of soil erosion hazard is to compare the relative hazard of areas proposed for forestry operations rather than to quantify, in exact terms, the soil loss and soil movement occurring in an area. In this regard, soil erosion hazard in assessment is meant to be used as a tool to examine the physiographic constraints of the landscape to operational forestry. The SEMGL also clearly indicate that the Guidelines should not be viewed as a means of preventing soil movement or water turbidity as these are consequences of natural processes. They are intended to mitigate against erosion which might lead to soil movement and water turbidity and sedimentation in excess of natural levels.

Conclusion

Erosion hazard is assessed by the EIS at two different scales, the more appropriate being that which considers the hazard at a more refined scale giving consideration to a range of slope classes and rainfall erosivities. The EIS would have benefitted by providing an erosion hazard map for the various State forests and other Crown-timber lands. In determining erosion hazard, the DOP considers that an objective assessment based on the USLE is more applicable than a subjective assessment. Erosion hazard assessment can best be determined at the harvesting plan scale of operations to which the SEMGL apply. The DOP clearly supports the SEMGL and its use in harvest management planning at a site-specific (operational) level.

3.8.7 Assessment of Environmental Impacts

Erosion

The main impacts of harvesting operations on the soil environment are soil erosion and sedimentation. These aspects should have been given greater attention. Soil erosion is a natural process, however, the EIS should have explained that logging has the potential to cause soil erosion rates far in excess of those which occur naturally. In regard to this the EIS should have referenced the available literature where appropriate (e.g. the CaLM report on Oakes State Forest (Atkinson et al 1992)) although it is recognised that the practicality of

doing so may have been influenced by the timing of the preparation of the EIS. The State Soils Policy (1987) considers that the State's soil is a finite resource, which in view of the low rates of soil formation in Australia, must be regarded as non-renewable. It is CaLM's opinion that soil erosion is a detrimental impact under any land use circumstance, and any soil erosion in a forest situation greater than the equivalent of 1 tonne/ha/yr is unsustainable, and certainly not reversible in the short term. It could be considered that any rate of soil erosion, greater than the natural soil formation rate, is unsustainable. It has not been possible to ascertain the sustainability or otherwise of the logging in the K/WMA (in relation to soil loss) as the EIS does not provide any information on the measured rates of soil formation and their relationship to soil erosion rates.

The different types of physical disturbance identified in the EIS should have been objectively estimated preferably in terms of intensity and the area likely to be affected. As noted by CaLM, the EIS does not comprehensively address disturbance of the soil environment because the potential impacts of the proposed operations have not been fully identified and assessed.

The EIS examined current erosion using Aerial Photograph Interpretation (API). Limitations of examining erosion through API need to be acknowledged. Areas of sheet erosion and sediment deposition can be identified with some success through API but their magnitude and relative importance as co-determinants of sediment yield are difficult to define (Neil and Mazari 1993). Stephens (1984) notes that indiscreet cropland erosion types (e.g. sheet, rill and wind) are more difficult to identify on aerial photographs than mass-movements on steeper slopes. CaLM is also of the opinion that it would be extremely difficult to use API on forested land to identify existing erosion and, furthermore, the existence of erosion is a poor indicator of erosion hazard.

Areas of existing erosion could have been targeted by the Field Survey and more consideration given to the soils in such areas. The Soils Survey report (p.51) notes that from API work, the only example of erosion occurring within the study area was in Old Station Forest, on apparently poor quality country with ironbark timber and little or no herb or shrub layer. The Department of Planning notes that this area lies on Soil Mapping Unit D (sediments). The EIS could have provided an explanation why this area and not others on Soil Mapping Unit D experienced visible erosion.

Erosion is also identified as occurring in the lower part of Davis Creek Road just inside the Nulla-Five Day State Forest boundary. The EIS considers that the soils of this area are stable with a low erosion potential. This does not explain why erosion is occurring in this area. The DOP notes that such matters require further investigation and this can best be done at the harvesting plan scale of management.

Soil Nutrients

The EIS presents information on the physical properties of the soil. Very little use is made, in an interpretive way, of particle size analysis or the field descriptions, and no statistical analysis has been conducted on any of the data collected.

The EISs discussion of impacts on soil nutrients is based on principle. Site specific information is not presented despite soil nutrient information being obtained during the Soils Survey. This information has since been provided to the DOP and is presented here in Table

15. The EIS could have provided this information and offered some interpretation of the results obtained. The EIS (p.18) considers that the loss of nutrients by removal of trees in harvesting operations will be relatively small compared to the total nutrient levels in the forest soils. Impacts of harvesting on soil nutrients have been studied by Turner and Lambert (1986) and Stewart et al (1990). These studies found there to be little impact at least in the short term, with imapcts not being detectable for four or five rotations (upwards of 320 years).

The EIS (p.18) comments that post harvesting burning will potentially result in nutrient losses if heavy rain removes ash and top soil before revegetation takes place. The DOP notes that this risk will be reduced by implementing the SEMGL and that post-harvest burning also reduces the risk of wildfire which can cause even greater amounts of soil erosion and nutrient loss.

Soil Compaction

Soil compaction effects are discussed on pages 213 and 214 of the EIS. Soil compaction reduces biological activity which happens to be the dominant process in the natural recovery from compaction. It can also retard tree growth and seedling establishment (cf. Graecen and Sands 1980, Lacey 1993). The EIS (p.213) notes that soil compaction is most severe on log dumps which typically occupy about 1% of the total area harvested. The area likely to be affected by soil compaction is derived by comparison with the Karuah Research Area (Cornish 1991). This comparison may not be directly applicable due to the presence of different terrain in the K/WMA such as the presence of steep slopes in the Wauchope MA, however, should it give a general indication of the order of magnitude. The EIS considers compaction to be limited in extent, but that the rate of recovery depends upon soil type and degree of compaction.

The degree of compaction is best examined by taking soil cores and comparing the bulk density of compacted areas to that of undisturbed forest as undertaken for the Glen Innes Management Area EIS. While this has not been undertaken for the K/WMA the EIS states (p.214) that the natural regeneration on former log dumps and snig tracks 2-3 years after logging in the Study Area, indicating that the impacts are usually short term. Further information indicating the density of seedling establishment 2-3 years after logging, how this compared with undisturbed areas, and if growth rates on such seedlings appeared impeded would have been valuable. The DOP notes that the time it takes for areas to recover from compaction will depend on the soil type, vegetation, moisture conditions, depth of compacted layer and degree of compaction. Jakobsen (1983) has found compaction effects to exist in forest Kraznozem soils for at least 32 years. Rab (1992) found that in East Gippsland recovery from compaction may take between 10-100years depending on the above variables.

While the EIS did not propose any measures to counteract adverse soil compaction effects the DOP recognises that one of the few measures that could be implemented is the ripping of compacted areas, such as log dumps. The DOP acknowledges that the issue of ripping or not ripping compacted areas, such as log dumps, is addressed in the SEMGL and that these distinguish between temporary and permanent log dumps. The DOP considers that there is no need to rip permanent log dumps as these are to be used for future operations. The ripping of temporary log dumps may be necessary in many instances, however, requires site specific consideration particularly of factor such as erosion hazard. Liaison with CaLM by the

Table 15. Soil Chemical Analyses - Kempsey/Wauchope EIS

Surface soil analyses

Soil mapping Unit	Sample	% Clay	% Silt	% Sand	% Gravel	pH	P ppm	OM %	N %	C/N
A - Volcanics	1102	24	20	56	7	4.96	425	15.1	0.49	18.1
A - Volcanics	1301	40	15	45	9	4.84	59	4.4	0.13	19.5
A - Volcanics	2701	26	18	56	9	5.29	985	15.0	0.38	22.7
A - Volcanics	2501	23	23	54	5	5.84	745	9.85	0.31	18.3
B - Granitoids	0901	13	10	77	13	4.98	35	3.44	0.08	24.7
B - Granitoids	1001	14	9	77	12	6.90	105	4.61	0.11	24.1
B - Granitoids	1601	16	15	69	13	5.56	395	7.55	0.18	24.1
B - Granitoids	1803	8	13	79	23	5.47	140	4.68	0.14	19.2
B - Granitoids	2901	18	14	59	9	4.99	150	7.63	0.20	21.9
C - Metasediments	1404	12	16	53	19	4.60	140	8.52	0.32	15.3
C - Metasediments	1408	9	9	19	63	4.78	180	6.25	0.33	10.9
C - Metasediments	1416	10	18	35	37	5.03	150	11.5	0.32	20.7
C - Metasediments	1424	8	14	32	46	5.11	275	18.2	0.41	25.5
C - Metasediments	1425	12	23	52	13	5.57	325	12.3	0.30	23.6
C - Metasediments	2401	17	19	43	21	4.77	215	9.22	0.26	20.4
C - Metasediments	2802	4	8	59	29	4.28	440	51.0	0.73	40.2
C - Metasediments	2806	21	25	47	7	5.24	300	10.3	0.27	21.9
D - Sediments	0102	4	6	14	76	5.68	600	10.4	0.36	16.6
D - Sediments	0105	17	22	34	27	5.17	110	5.07	0.11	26.5
D - Sediments	0109	28	21	33	18	5.14	220	11.0	0.21	30.1
D - Sediments	0202	21	24	32	23	4.72	155	7.39	0.16	26.5
D - Sediments	0805	16	31	29	24	4.82	125	4.14	0.13	18.3
D - Sediments	0807	5	8	16	71	5.60	260	9.21	0.24	22.1
D - Sediments	1505	16	26	44	14	4.89	85	4.49	0.10	25.8
D - Sediments	2101	14	11	38	37	4.83	505	11.1	0.34	18.8
D - Sediments	2203	6	15	28	51	5.29	510	7.26	0.21	19.7
D - Sediments	2301	16	21	56	7	5.08	310	9.16	0.26	20.2
D - Sediments	3001	8	19	31	37	5.66	650	6.55	0.22	17.1
D - Sediments	3103	10	34	40	16	5.38	1100	5.42	0.15	20.8
E. alluvials	0702	19	30	48	3	4.84	150	11.4	0.29	22.6

SFNSW would be appropriate in this regard This is provided for in the DOP's proposed erosion hazard and sediment control strategy (see Section 3.8.9 of this report).

Biodiversity

As identified by CaLM soil conservation is a critical component of forest ecosystems and hence biological diversity. The successful implementation of soil conservation measures is therefore important to maintaining biodiversity.

Conclusion

The EIS addresses soil erosion, soil compaction and soil nutrient impacts. In relation to soil erosion, the EIS could have better examined soil erosion problem areas in relation to their soil characteristics. The information obtained on soil nutrients should have been presented and discussed in the EIS. Soil compaction effects could have been better examined at a site-specific level by obtaining bulk density information of soils in non-disturbed forest sites and comparing this to areas disturbed by forestry operations. Some attention could have been given to the biodiversity of soil biota.

3.8.8 Standard Erosion Mitigation Guidelines for Logging (SEMGL)

The following section discusses the derivation of the Standard Erosion Mitigation Guidelines for Logging (SEMGL). It considers the appropriateness of the SEMC followed by a critique of the USLE, a distinguishing feature between the SEMC and the SEMGL.

In 1977, in the absence of definitive research results, the Forestry Commission and the Soil Conservation Service (now CaLM) drew up a general set of soil erosion and mitigation conditions under the auspices of the then Catchment Areas Protection (CAP) Board. These general conditions were applied to all harvesting operations which occurred on protected land (Soil Conservation Act) and Crown-timber lands (Forestry Act). This set of general conditions was entitled The Standard Erosion Mitigation Conditions for Logging (SEMC). In 1989, with amendments to the Soil Conservation Act, the CAP Board was replaced by the Commissioner of the Soil Conservation Service (SCS) and the definition of protected lands extended to include designated *"environmentally sensitive"* areas (CaLM 1993). The SCS has since been incorporated into the NSW Department of Conservation and Land Management and the Director General of CaLM now holds the powers of Commissioner for the SCS for the purposes of the Soil Conservation Act, 1938. The SEMC have been modified several times, the last time being in 1990. Even with these revisions these conditions have only ever had limited regard to the site characteristics of each harvesting area.

One of the major criticisms of the SEMC was that the conditions were not site-specific. In Bailey v Forestry Commission of New South Wales [(1989) 67 (GRA 200)], Hemmings, J. commented that the *"premise that the imposition of the Standard Erosion Mitigation Conditions on licence would be appropriate under all circumstances"* was erroneous. In March 1993, the SEMC were substantially revised to make them more site specific and since then have been known as the Standard Erosion Mitigation Guidelines for Logging (SEMGL).

There now exists a Memorandum of Understanding (MOU) between CaLM and the Forestry Commission which institutes the replacement of the SEMC with the Standard Erosion Mitigation Guidelines for Logging (SEMGL; 5/3/93). The MOU describes an ongoing process and commits both organisations to develop mutually agreed tools and techniques to adequately assess the impact of forestry on the soil environment as well as arrive at erosion and sediment control designs and specifications which must apply at the operational level. It should be noted that the SEMGL are not a static definitive set of guidelines but that they too are likely to change as a result of future research. They are used at a site-specific level to achieve minimum impact to the soil environment by forestry operations.

Despite this MOU, the EIS considers that the SEMC are more appropriate than the SEMGL. The Soils Survey Report goes to some lengths to criticise the tables at the appendices of the SEMGL. No comments are made regarding the appropriateness of the tables of the SEMC (1984) or the absence of tables in the SEMC (1990). [Note: Tables were omitted from the SEMC (1990) due to the fact these were still under revision at the time of their publication.] Support for the SEMC is commonly justified in the Soils Survey Report by statements such as *"the appropriateness of the existing SEMC conditions"* without providing appropriate evidence. The limitations of the SEMC have recently been illustrated in the Oakes State Forest report (Atkinson et al 1992). Given that both parties agreed to the adoption of the SEMGL through an MOU, it is extremely inappropriate for the SFNSW, as the proponent of the K/WMA EIS, to use the EIS process and the documentation attached to the EIS as a vehicle to criticise the adoption of the SEMGL. While it is noted that the criticism emanates from the soils consultant, such a public criticism is in direct conflict with the Memorandum of Understanding which exists between the two agencies.

One of the major limitations of the SEMC was that they essentially ignored the physiographic limitations of a particular site. In contrast, many specifications of the SEMGL place a strong reliance on the correct determination of erosion hazard for a particular site. For the SEMGL, erosion hazard is determined by applying the Universal Soil Loss Equation (USLE). The use of the USLE to determine erosion hazard is another area of some contention. The Soils Survey Report strongly criticises the use of the USLE.

CaLM notes that the USLE has been adapted to the Australian environment by: developing new methods for estimating the rainfall erosivity factor (see Rosewell and Turner 1992); the use of a subfactor approach to estimate the crop and cover management factors for new crops; the validation of the adapted equation against 4,500 plot years of data, and; the adaptation of the soil erodibility nomograph for Australian soils. CaLM notes that the factors used in the USLE need to be evaluated for Australian conditions and the equation needs to be evaluated for use. CaLM notes that it is the SOILOSS application of the USLE that has been validated for use in NSW and not the USLE as described by Wischmeier and Smith (1978). Although many of the factor values used in New South Wales are taken directly from the USLE, the rainfall erosivity, soil erodibility and annual crop management factors have been locally developed. In this sense, the USLE as used in the SEMGL, is a revised version of that described by Wischmeier and Smith (1978).

The USLE is a tool for estimating the long-term average sheet and rill erosion from specific areas of uniform topography under specified cover and management conditions. It does not attempt to predict concentrated flow erosion, gully erosion, stream bank erosion or deposition and cannot, therefore, be used to predict catchment sediment yield. Additionally, the USLE does not apply for any area where deposition occurs or for erosion by concentrated flow, so

the USLE cannot estimate the net erosion (upland sheet and rill erosion and concentrated flow erosion minus deposition) or the sediment yield (net erosion plus gully and stream bank erosion minus deposition). Again although such matters are important when considering water quality issues, it is difficult to estimate with the available technology how much of the eroded soil will get into water courses. CaLM acknowledges that its position is that if soil loss occurs on disturbed areas such as snig tracks then there is a possibility that the eroded soil will get into a water course either in this cycle of the harvesting rotation or in some future one.

The EIS views the SEMGL as an impediment to economic production rather than as a conservation-based practical measure to minimise environmental impacts. CaLM considers that it is inappropriate to claim that the implementation of the SEMGL will lead to a decline in revenue by an average of $3.1 million per year, without presenting clear documentation and explanation of their economic indices (i.e. there must be a conversion of the biophysical values of the SEMGL into economic indices to successfully suggest such a claim). As noted by CaLM, the question should be asked whether the areas demarcated as being excluded because of SEMGLs (3.5% of old growth forest) would not be excluded due to another factor in the absence of the SEMGL (i.e. if the SEMC were implemented). If it were, then the apparent revenue loss was not applicable to the implementation of the Guidelines. The DOP concurs with this view and additionally considers that the claims in the EIS are greatly exaggerated.

Several public submissions considered that a cost-benefit analysis of the SEMGL should be conducted. The Department of Planning considers that the adoption of the SEMGL which provides for more detailed analysis at the harvesting plan level is essential to minimising the environmental impacts of forest logging. Nevertheless the application and consequences of these guidelines will be monitored by CaLM and SFNSW.

As outlined in this assessment report, CaLM has expressed concerns over numerous aspects of the EIS's consideration of soils in the K/WMA area. Notwithstanding its concerns regarding a number of issues relating to the EIS, CaLM notes that *"if there is a rigorous, systematic and very strong commitment to the application of the SEMGL and to the preparation of holistic and detailed harvest plans, followed by a strong monitoring program commensurate with a detailed staff training and technology transfer program, the major areas of concern can be alleviated".*

Conclusion

Despite claims in the EIS supporting the SEMC rather than the SEMGL, the DOP is of the opinion that the SEMGL are more appropriate as they take full account of the physical capability of the landscape and assess erosion hazard objectively through the application of the USLE. Although there is some debate over the appropriateness of the USLE, many of its factors have been and are currently being derived for Australian conditions. In light of this, the DOP considers that it is more appropriate to use the USLE which has been and is being tested rather than some other untried tool or subjective assessment to determine erosion hazard. Hence, the DOP considers that the SEMGL which adopt the USLE to determine erosion hazard, are much more appropriate to examine the biophysical constraints to operational forestry than the SEMC.

3.8.9 Harvesting Plans

CaLM notes *"the design and effective implementation of harvesting plans are the basis of sound erosion and sediment control in forestry operations"* and that the presentation and interpretation of data in the EIS should be aimed at providing basic information to allow management decisions to be effectively made during the formation and implementation of the harvesting plans. This includes the identification of soils and soil constraints and that this can best be achieved through the adoption of an erosion hazard and sediment control strategy. As noted earlier, an erosion hazard and sediment control strategy requires the collation of site specific biophysical information at the harvesting plan scale of operations. Specifically, an erosion hazard and sediment control strategy should determine and map the range of erosion hazards occurring in the area proposed for harvesting and new roading. Subsequent to this, it should make provision for: road location, design, construction, drainage and erosion control measures; snig track and log dump location, drainage and erosion control measures; upper slope limits for harvesting, snig tracks and roads; ground cover management techniques; and criteria to determine whether or not to rip temporary log dumps. Once this information has been collated, the SEMGL can be effectively employed. The DOP also considers that the SFNSW must consult with CaLM prior to the development of Harvesting Plans and the erosion hazard and sediment control strategy.

Conclusion

An erosion hazard and sediment control strategy should be prepared by the SFNSW and incorporated into harvesting plans prior to the commencement of forestry operations. The strategy should determine and map the range of erosion hazards occurring in an area prior to harvesting and new road construction. Subsequent to this it should make provision for the location and constraints of the proposed operations. Such a strategy should also allow for consultation with CaLM.

3.8.10 Training

The EIS (p.304) notes that field days and workshops will be held in association with CaLM for the SFNSW staff and industry workers to ensure they are fully familiar with the SEMGL and their application to the highest possible standard. This initiative is entirely necessary.

Conclusion

The EIS's provision of training SFNSW field staff and industry workers to successfully implement the SEMGL is fully endorsed.

3.8.11 Monitoring

In relation to soils monitoring, the EIS proposes the following:

- The SFNSW will supervise harvesting and road construction operations to ensure they comply with the Harvesting Plans and prescribed environmental protection measures. Penalties will be applied to contractors or operators who fail to meet specified standards (EIS p.304).

- Guidelines for assessing environmental impacts at a local level will be followed and regularly reviewed by the Commission (p.304).

- The Standard Erosion Mitigation Guidelines for Logging (SEMGL) will be applied to all harvesting and road construction operations carried out by the SFNSW. SFNSW will liaise with the CaLM personnel where appropriate in implementing these guidelines in the field (EIS p.305).

- The SFNSW will monitor the implementation and compliance with the sediment and erosion control strategy and its effectiveness in controlling erosion, taking into consideration the advice of CaLM with respect to the nature and scope of the monitoring program (EIS p.305).

The DOP fully endorses these initiatives but notes that they should form part of the Minister's determination and therefore should proceed as recommendations. This is provided for in Chapter 4 of this report.

Conclusion

The EIS's provision for monitoring compliance with and the effectiveness of the SEMGL and the DOP's erosion hazard and sediment control strategy is fully endorsed.

3.9 Hydrology and Water Quality

The assessment of hydrology and water quality considers the following topics:

. Background Information
. Impact Assessment
. Mitigative Measures

3.9.1 Background Information

The EIS identifies all the sub-catchments occurring in the K/WMA and includes important background information on these such as their total catchment area, that area contained in State Forests and the proportion of the catchment this represents. The location of the sub-catchments is shown on Map 5 of the EIS. This information provides the detail needed to assess the impacts of the proposal in a spatial context for each of the subcatchments (see Section 3.9.2).

Climate, geology, soils and vegetation aspects are considered in a broad context for both Kempsey and Wauchope in both the EIS and the Hydrology Report (Appendix J). The EIS (Volume 1) and Appendix J, however, would have benefitted by providing this detail at a subcatchment level. CaLM considers that the climate, geology, soils and vegetation descriptions need to be more detailed, providing data to identify and quantify key climatic and site attributes crucial to catchment hydrologic behaviour. These attributes are important as they can interact with the proposed operations to produce detrimental environmental impacts on the hydrologic environment in either the short or long term or at a local or more regional scale.

The main limitation of the description of the K/WMA's water quality and hydrological attributes is the absence of site-specific information. The Department of Water Resources considers that pH, temperature, Biological Oxygen Demand (BOD), Dissolved Oxygen (DO), salinity, suspended solids and conductivity are parameters for which baseline data should be obtained. As raised by the EPA, site-specific collection of data on sediment loading, particle size distribution and nutrient distribution may provide useful baseline information for the assessment of the effectiveness of the forestry management practices. The EPA considers that *"To make a useful assessment of water quality, monitoring must be event based covering a reasonable range of event conditions with a complete range of seasons. To allow for this approach, a minimum of 1 to 2 years would be required. Study design will still now allow for a number of variables, for example, a dry year or wildfire occurring, during the study period"*. The DOP considers that ideally, site specific information and long-term studies are needed if the impact of forestry activities is to be better assessed. This, however, is very difficult in light of the EIS time-frame, the costs of conducting such measurements and the large areas of land being considered.

The description of existing water quality considers total dissolved salts (TDS) and turbidity. Although consideration of these parameters is appropriate, the data presented is not referenced and as the EPA submission notes, values for total dissolved salts and turbidity are stated without indicating the spatial or temporal sampling regimes or methodologies. A greater range of parameters in the description of existing water quality should also be considered. Nevertheless, the information provided directs attention to the most likely water quality impacts of the proposal.

3.9.2 Impact Assessment

The EIS provides information on the catchment area of the subcatchments [Tables 3.3(a) and 3.3(b)] the percentage which lies in State Forest, and the total area to be affected by logging (Table 5.11). This information is used to calculate the percentage of the catchment to be affected by operations (Table 5.11) and is useful in identifying which catchments are more likely, in a spatial context, to be affected by the proposal. It should be noted that some of the information presented in Table 5.11 is incomplete. Table 16 in this report combines Tables 3.3(a) and (b) and 5.11 of the EIS to examine the percentage of each sub-catchment to be harvested in the next 10 years. From Table 16 it is apparent that the Tobins River, Wilson River, Dyke River, and Georges River will be most affected by the proposed operations. The Tobins River sub-catchment includes Doyles River (part) and Mount Seaview State Forests; the Wilson River sub-catchment includes Mount Boss (part), Kippara, Bril Bril, Ballengarra, Cairncross (part) and Bellangry State Forests; the Dyke River sub-catchment includes Styx River (part and Lower Creek State Forests; the Georges River sub-catchment includes Styx River (part) State Forest and Vacant Crown Land and leasehold. In relation to these four sub-catchments and the others presented in Table 16, it is important to note that the areas of forest actually subject to disturbance by harvesting will be less than what is presented in the *"total area to be harvested"* column, as the proposed harvesting areas include filter strips, rainforest and other areas which will not be subject to forestry operations.

The EIS could have given more consideration to the relationship between natural hydrological features (Section 3.6 of the EIS) and the proposed harvesting pattern (Table 5.1,

p.183). CaLM comments that increased runoff resulting from harvesting (Appendix J, p.5-10, 5-11) may have a significant impact on stream bank and bed erosion downstream. CaLM expresses concern that the EIS has not addressed this type of impact. The DOP notes that to successfully gauge this type of impact, monitoring would have to be conducted for every subcatchment. This is not a feasible proposition. CaLM also notes that it cannot reasonably determine what duration, recurrence intervals or intensity of rainfall are most relevant to catchment hydrologic behaviour or those which might be most relevant to the proposed forest operations. Changes in catchment hydrology are most affected by factors which lead to the generation of overland flow (Bren and Turner 1980). The DOP notes that the SEMGL are designed to minimise overland flow and their adoption will aid in minimising impacts to catchment hydrology.

Table 16 - Spatial Impact of the proposal on the sub-catchments of the K/WMA

Catchment Name	Total Area of Catchment (ha)	Total Area in State Forest within K/WMA (ha)	Total Area to be harvested (ha)	% of Catchment to be harvested
1 Tobins River	14,800	10,400	2,550	17
2 Fenwicks Creek	9,300	7,700	600	6
3 Warnes River	19,000	4,900	-	-
4 Hastings River	22,300	1,000	-	-
5 Ralfes Creek/Flynns Creek	10,000	3,100	700	7
6 Doyles River	3,000	900	100	3
7 Forbes River	36,200	12,200	2,150	6
8 Pine Scrub Creek	5,200	1,100	-	-
9 Ellenborough River	33,500	3,100	200	1
11 Pappinbarra River	27,200	10,600	2,500	9
12 Wilson River *	59,000	32,000	8,500	14
13 Mortons Creek	13,000	3,200	200	2
16 Cowarra Creek	4,000	1,400	200	5
25 Parrabel Creek *	34,800	5,800	1,955	6
30 Kunderang Brook	36,000	9,100	100	0.3
36 Green Gully Creek	37,500	0	200	1
Various	12,800	5,300		
	20,700	6,000		

17 Maria River	31,200	9,200	1,800	6
18 Reedy Creek	4,100	1,000	100	2.4
19 Dungay Creek	23,700	14,800	500	2
20 Christmas Creek	9,400	2,100	400	4
21 Collombatti Creek	9,800	2,700	600	6
22 Clybucca Creek	30,500	5,500	400	1
23 Warrell Creek	27,400	15,600	400	1
24 Mungay Creek	5,500	2,000	200	4
26 Hickeys Creek	12,400	3,300	300	2
27 Nulla Nulla Creek,Pee Dee Creek	26,500	15,000	1,000	4
28 Warbro-Mack	29,300	3,500	200	1
29 Stockyard Creek	14,900	7,100	-	-
31 Carolls & Felters Creeks & others	14,100	5,100	100	1
32 Five Day Creek	28,900	11,000	2,600	9
33 Lagoon-Smith Creeks	8,700	2,700	-	-
34 Dyke River	9,200	6,900	900	10
35 Georges River	3,000	600	400	13

Water Yield

The EIS provides a discussion on water yield, although the information presented is not quantified. The impacts on water yield are related to the Karuah Hydrology research. From the Karuah information (Cornish 1991), the EIS (p. 218) concludes that any changes within the Study Area will be short-term and reversible, lasting about 6 years. This duration is consistent with Langford et al (1982) who studied clearfelling effects on water yield and quality in mature Mountain Ash forest in Victoria. It is also supported by the information contained in Campbell and Doeg (1989). In light of the lack of site specific information, however, the DOP cannot be certain that the impacts will truly be short-term and reversible. The Department of Water Resources considers that modelling of yield and other hydrologic parameters is possible and should be seriously considered.

The EIS could also have given consideration to the effect of seasonality and intensity of rainfall events on water yield. The Department of Water Resources, in its submission, comments that the Hydrology Report needed to place more emphasis on the importance of rainfall events on the quantity and quality of water in existing State forests. In this regard more interpretive use could have been made of the monthly rainfall data which showed that the K/WMA had a distinctive wet summer season followed by a drier winter (Appendix J, p.3-1).

Water Quality

Much of the forested land in the K/WMA serves the dual purpose of providing a water supply for both in and off-stream uses, including provisions for domestic and agricultural supply, conservation and recreation. As Doeg and Koehn (1990) note, the best utilisation of the water resource requires that the effects of silvicultural practices on the quantity and quality of available water be ascertained. The needs and wants of the community are an essential step in defining the environmental values of a particular water body (ANZECC 1992). Once these are identified, the water quality required to attain or maintain these values can be determined and comparisons made in relation to the values likely to result from the proposed activity. The K/WMA EIS places a strong emphasis on drinking water quality. More consideration could have been given to the water quality needed to sustain other stream uses, e.g. recreation, agricultural irrigation, aquatic biota. Water quality criteria for various water uses is provided in the ANZECC guidelines (1992). Information such as this could have been utilised in the assessment of water quality impacts. The description of existing water quality and potential changes need to be more specific.

Turbidity

Of importance to small communities in northern NSW is the impact of turbidity on their water supply. Curtin et al (1991) note that high turbidity levels are not acceptable in potable water supplies and can cause problems in the important fisheries of lakes and rivers. The EIS notes that a number of landholders utilised streams in the K/WMA for their water supply. More information could have been given on the number of residences utilising the streams for drinking water and the proximity of these residences to the State Forest and Crown-timber land areas, particularly those areas proposed to be harvested.

The EIS provides an indication of current turbidity levels in the K/WMA noting that turbidity in the Hastings River at Koree Island, exceeds a threshold limit of 15 Nephelometric Turbidity Units (NTU) for around 160 days of the year. It should also be noted that the level of turbidity acceptable for domestic supplies varies depending on the standards or guidelines being used. The standards set by the World Health Organisation (Anon, 1971) set the highest desirable level of turbidity at 5 NTU. However, in 1980, acceptable levels for Australia were identified as being 25 NTU or less (Anon 1980). More recently there has been a move towards considering that the amount of allowable turbidity is site specific (ANZECC 1992). Hence, the levels of Koree Island are high compared with World Health Organisation Standards (Anon 1971) but may be permissible according to the Australian guidelines (Anon 1980). Without site-specific information the ANZECC (1992) guidelines cannot be utilised for comparison. It is also worth noting that the 15 NTU level measured at Koree Island, may not be directly related to forestry impacts, but may also be a result of other surrounding land uses (e.g. agriculture).

In light of the lack of site-specific information, the EIS considers turbidity effects by considering research that has been conducted in State Forest areas at Karuah (Cornish 1991) and Eden (Cornish and Binns 1987). The EIS considers that any exacerbated turbidity effects resulting from the proposal are likely to return to pre-logged levels within 2 to 3 years after logging. The study by Cornish and Binns (1987) indicates that this may be the case, however, without site specific information, this cannot be confirmed.

From Map 5 (Catchments) of the EIS, it is apparent that many of the streams in the K/WMA have their headwaters in State Forest and other Crown-timber lands, and hence the proposal has the potential to impact on the downstream reaches. It is important to note that the effective management of turbidity in stream water requires the correct identification of the major source areas (Gippel 1993). Table 2 of Appendix J provides the percentage of the catchment falling within State forests for each of the subcatchments. From a spatial perspective, it is apparent that State Forests could potentially pose a major sediment source in Tobins River and Fenwicks Creek.

As previously noted, there is a lack of site-specific information regarding turbidity. This is important as ANZECC (1992) considers that the amount of allowable turbidity is site-specific. The key to turbidity control is the prevention of entrainment of fine sediment from exposed soil surfaces (Gippel 1993). The impact of new roads is of particular concern in this regard (see Section 3.9.2). **The DOP notes that the provisions of the SEMGL, particularly Sections 2.3 (filter strips and protection strips), 2.1.3(iv) (roads crossing streams), and 2.2 (ground cover management) shall minimise any adverse turbidity effects likely to result from the proposal. The DOP's proposed erosion hazard and sediment control strategy (Section 3.8.9) provides for the adoption of the SEMGL.**

Runoff

Runoff coefficients were identified for each MA, Wauchope having the higher at 19%. The Hydrology Report also identified that the upper reaches of streams in Wauchope could have runoff coefficients of 30-40%. Peak co-efficients during high intensity rainfall events were also identified (EIS p.39). The Department of Water Resources expresses concerns that as harvesting is now occurring in high velocity upper mountain catchments, high stream flows move any and all loads quickly downstream where deposition can cause problems for other stream users. As raised by Public Works, the impact of any changes in runoff on flood behaviour should be examined in this regard.

The EIS stated that for the Wauchope Management Area, stream flow in the Hastings River catchment is measured at eight gauging stations. The EIS could have shown the location of these gauging stations so their position in relation to the State Forest and other Crown-timber land areas in the Wauchope MA, could have been identified. A similar situation applies to the 15 gauging stations in the Macleay River catchment which lies within the Kempsey Management Area.

Studies have shown that transport of sediment is storm dominated (e.g. Olive and Rieger 1987). The Department of Water Resources is concerned with the proposal to harvest logs during wet weather. The DOP notes that this concern can be overcome through the rigorous implementation of the SEMGL which makes provision for restricting snig track use. Under Section 2.1.3 (xii) of the SEMGL, snig tracks should not be used where there is runoff from the road/snig track surface; or where significant damage to the road/snig track surface (including rilling and rutting) is likely to occur.

Impacts of fire on hydrology are discussed on page 267 of the EIS. It identifies that fuel reduction burning could increase surface runoff and sediment movement but considered that the impact of wildfire would be far worse. In light of the limited research that is available, the impacts from control burning are relatively short term and minor when compared to the hydrological impact of wildfire. The EIS notes that the use of fuel reduction burning lowers

the risk of wildfires and minimises the resultant impacts on water quality and yields. **The DOP agrees that the impact of more frequent, lower intensity prescribed burning will have less of an impact on turbidity levels and sediment movement than wildfire.**

Sedimentation

The effects of sedimentation on streambank and instream hydrology and streambed morphology could have been discussed and areas of potential sedimentation, identified. Campbell and Doeg (1989) note that the deposition of sediment in streams resulting from timber harvesting activities has not yet been investigated in Australia. In light of this, the DOP notes that it would be extremely difficult to assess sedimentation without monitoring or long-term site-specific studies.

Streamwater Chemistry

The EIS considers the impact of the proposal on streamwater nutrients (p.219). This consideration is qualitative and general. The EIS could have provided measures or estimates of different streamwater chemistry parameters (e.g. calcium, phosphorous, potassium, magnesium, sodium) for the K/WMA. The discussion does, however, consider impact on phosphate and nitrate levels, albeit in general terms. Reference is made to the work of Cornish (1991) and Cornish and Binns (1987) who studied the specific conductivity and turbidity of streams at Karuah and Eden respectively. Specific conductivity is relevant as it is a measure of salinity. Numerous other streamwater parameters could have been given consideration in the discussion. The impacts of logging on nutrient removal have been found to be variable. Mackay and Robinson (1987) found that logging (prior to fire disturbance) had no detectable effect on the concentrations of Ca, K, Mg, Na, CI, NO_3 nor the pH of stream waters. In contrast, Hopmans et al (1987) found that yearly stream nutrient balances were highly correlated with runoff. The State Pollution Control Commission (1982) concluded that nutrient levels, salinity and temperature were unlikely to be influenced markedly in areas where logging is of low intensity and managed in an environmentally sensitive way. The EIS notes that by minimising runoff and associated erosion through the application of the SEMGL, nutrient 'leakages' into the aquatic environment due to logging, will be minimised. The DOP is of a similar opinion.

The EIS (p.267) considers that the impact of more frequent, low intensity prescribed burning would have less of an impact on stream water nutrient composition than less frequent high intensity wildfire. This is consistent with the findings of Humphreys and Craig (1981) [cit Boughton (1970) and Brown (1974)] who concluded that fires of low intensity offer a much lower risk of adverse effects on water supplies than wildfires of higher intensities.

Of some concern to the DOP is the storage of fuels and chemicals and the potential of these substances to pollute waterways. **The DOP considers that the storage and handling of fuel oils should comply with the requirements of AS1940 - *"The storage and handling of flammable and combustible liquids"* and that the storage and handling of chemicals should meet the requirements of the WorkCover Authority.**

Comparison with Karuah

The EIS considers the water quality of the K/WMA in light of the monitoring which has been conducted in the Karuah Catchment, south of the study area. The Hydrology Report provides

data on the geology, rainfall, soils, topography and vegetation which is necessary to assess the comparability of the K/WMA and Karuah. CaLM, however, has expressed some concern over this information. CaLM notes that although the data given on the geology, soils, topography and vegetation (especially that presented in Table 8 of the Hydrology Report) is important for assessing the potential relevance of the Karuah Study, it cannot be reasonably deduced what site attributes, if any, are relevant to any observed, inferred or predicted catchment behaviour or response. Additionally, CaLM comments that the resource information is presented with little or no analysis, interpretation and assessment of implications for the hydrologic environment. The DOP notes that Table 8 would have been more applicable if it compared the characteristics of the individual Karuah sub-catchments to those individual sub-catchments of the K/WMA. The information, as presented, does not clearly demonstrate that the subcatchments of Karuah are environmentally similar to the subcatchments of the K/WMA.

Water Temperature

The EIS considers that harvesting is not expected to result in significant increases in stream water temperature due to the retention of existing vegetation in filter strips along the sides of streamlines. Having regard to the information presented in Campbell and Doeg (1989), the DOP is of a similar view.

Aquatic Ecosystem

The impact of forestry operations on the aquatic biota was given limited treatment in the EIS (p.209). Requirements for the preparation of Environmental Planning and Assessment Documents in relation to freshwater habitat management, are provided in Burchmore (1991). The ANZECC (1992) water quality guidelines give particular consideration to the aquatic environment. The EIS provides a list of fish species thought to inhabit the area including the Eastern Freshwater Cod considered to be endangered (Michaelis 1985). The presence or absence of these species was not confirmed for the waterways identified, and the report from which the data was extracted should have been dated and referenced. The EIS could have included a field survey of aquatic fauna.

The EIS quotes Storrs (1982) who concluded that logging can have a marked effect on aquatic invertebrates but considered that these impacts were only temporary. Information on the methods to reduce the impact of logging and roading on benthic invertebrates and fish could be provided making special provision for monitoring during forestry operations. Information on stream crossings, such as number, size and method to allow fish passage, could also have been provided in the EIS. The DOP notes that under Section 29 of the Fisheries and Oyster Farms Act, it is an offence to block the free passage of fish.

The EIS concludes that provided the SEMGL are implemented effectively, logging will not result in significant long term impacts on aquatic fauna in the Study Area. It also concludes that any impacts that may occur will be limited in extent, short term and reversible. The DOP notes that from the information presented in the EIS, this claim cannot be substantiated. From an ecological perspective, the ameliorative actions proposed in the EIS (i.e. the reliance on the SEMGL) may not be sufficient, especially considering that no monitoring is proposed and no sampling of the aquatic fauna of the waterways, undertaken. The ecological effect of reduced water quality over a number of years, particularly in undisturbed sub-catchments,

requires more investigation. **The DOP considers that special provision for aquatic fauna needs to be made in relation to the monitoring of water quality in the K/WMA.**

3.9.3 Mitigative Measures

Licensing Arrangements

The EIS notes that the SFNSW will monitor compliance with conditions of its Pollution Control Licence (EIS p.305). Pollution Control Licences were first issued to the Forestry Commission shortly after the establishment of the EPA in 1992. The 1992 licences required compliance with the "Standard Erosion Mitigation Conditions for Logging in NSW" (SEMC), dated July 1990, published jointly by the Soil Conservation Service of NSW and the Forestry Commission. The SFNSW currently hold a pollution control licence issued by the EPA under the Pollution Control Act (1970) for each of its five forestry regions; this includes the Northern Region which covers the Wauchope-Kempsey Management Area. The licences relate to water pollution resulting from logging operations. At the time the 1992 licences were issued, the EPA made it clear that the licences were the first step in an on-going process and that the appropriateness of the conditions would be monitored and reviewed. The SEMC have subsequently been revised by the Department of Conservation and Land Management and changed into the Standard Erosion Mitigation Guidelines for Logging (SEMGL). The EPA is currently reviewing the applicability of these revised guidelines from a regulatory perspective. In the meantime, interim licences have been issued to the SFNSW on the same terms as the original licences. This has allowed the EPA time to formulate the basis on which any future licences may be issued to the SFNSW and, in particular, to consider the best means to apply the new SEMGL to protect water quality. A significant feature of the licensing approach currently being formulated by the EPA, is a requirement that water quality monitoring be carried out. Provisions for water quality monitoring has also formed part of the Minister's determination for Wingham and Glen Innes EISs. Provisions for water quality monitoring for the K/WMA are outlined below.

Monitoring

In light of the absence of site-specific hydrological and water quality information, **the DOP is of the opinion that water quality monitoring should be conducted in the K/WMA region.** It is important that the monitoring program takes account of intensive sampling of sediment movement during storm events. The program should be designed to test the impacts of logging operations on instream flora and fauna, not solely town water quality. The program should control for such variables as slope, soil erodibility, geology, harvesting intensity and burning intensity/fire regime, or take them into account during analysis. **Parameters for monitoring should include streamwater turbidity, runoff and water yield, streamwater chemistry and populations of key aquatic species.** Hughes et al (1986) provides details of how field assessment of impacted streams can best be examined. When designing the monitoring program, consideration will have to be given to the biophysical attributes of the control ('undisturbed') sites. Hughes et al (1986) comment that control sites, such as upstream/downstream or wilderness sites, have proven inadequate for assessing attainable ecological conditions where the control streams differ naturally from the impacted streams to a considerable degree or where different disturbances exist than those being studied. They conclude that relatively undisturbed reference sites with watersheds in areas having the same land-surface form, soil, potential, natural vegetation, and land use as

are predominant in large, relatively homogeneous regions are suggested as alternative control sites.

Conclusion

The EIS considers the impact of the proposal on hydrology and water quality, albeit in rather general terms. Consideration is given to turbidity, water yield, salinity and runoff. Impacts on the aquatic environment and streamwater nutrients could have been given more detailed consideration. In the absence of site specific information, however, the impact of the proposal on hydrology and water quality cannot be definitively ascertained. Such information is difficult to obtain within the allocated EIS timeframe as long-term studies are needed. In light of this, the DOP concludes that water quality monitoring should now commence in the region, taking into account water yield, turbidity, a range of streamwater nutrients and the aquatic environment. This can best be arranged by consultation with CaLM and the EPA. Special provision for the storage of chemicals and fuels is also required.

3.10 New Roads

The assessment of new roads considers the following topics:

- Description
- Assessment of Environmental Impacts
- Environmental Protection Measures

3.10.1 Description

The EIS proposes that there will be approximately 139km of access roads and tracks over the next ten years. Beyond the year 2002, an additional 101km of access roads and tracks will be constructed. Details of new roading for the next 10 years is provided in Appendix C and summarised in Chapter 7 of the EIS. The extent of the proposed roading is provided in Table 7.1 of the EIS. It is proposed that within the Wauchope MA, 20km of major roads and 69km of minor roads will be constructed over the next 10 years. An additional 63km (25km of major roads; 38km of minor roads) of roading is proposed between 2003-2020. Within the Kempsey MA, 40km of major roads and 10km of minor roads will be constructed within the next 10 years. An additional 38km of roading (28km of major roads; 10km of minor roads) is proposed between 2003-2020.

It should be noted that roading definitions are not consistent for the two Management Areas. For the Wauchope MA, major roads are defined as permanent, all weather roads with full or centre line survey. Minor roads are defined as permanent, natural surface with partial survey (temporary roads are not included). For the Kempsey MA, major roads are Class III or IV roads. Minor roads are short term logging roads. Definitions of major and minor roads should have been consistent for both Management Areas. CaLM notes that the terms 'major' and 'minor' roads were excluded from the SEMGL because of their vague meaning, particularly in terms of potential impact from construction of new roads and the upgrading of existing roads. Ideally, temporary roads need to be distinguished from permanent roads. A description of each road class would have benefitted the EIS. Details of road clearing width (according to road class) and formation width, however, was provided in Appendix C of the EIS. This information is directly relevant for assessing the scale of disturbance.

More support information on the method of road location, design and construction standards, and their possible environmental impact, could have been provided. Nevertheless, as noted by CaLM, these should be *"interpreted"* from the SEMGL after full erosion hazard assessments have been made and measures required for road stability, determined. Such information is provided for in the DOP's erosion hazard and sediment control Strategy (see section 3.8.9) which adopts the SEMGL and incorporates them into Harvesting Plans.

3.10.2 Assessment of Environmental Impacts

The EIS (p.249) identifies a wide range of environmental impacts resulting from new roading including: dust generation, increased soil erosion and sedimentation, hydrological changes, increased vehicle-fauna collisions, increased noise, increased access for introduced species, intrusion of vegetation edge effects, loss of fauna habitat, and fragmentation of habitat. The DOP also notes that other impacts include soil compaction and loss of flora habitat. The EIS notes that the nature and significance of these impacts is very much dependent on the type and extent of roads and the level of use they receive. The DOP also notes it is dependent upon soil type, landscape limitations and biological richness of an area. The majority of these impacts are considered in detail in Appendix C which considers each of the new roading proposals in turn.

Appendix C provides details of the roading required for the next ten years (1993-2002). The DOP has examined the roading details provided in Appendix C. For each of the new roading proposals (Maps R1-R11) Appendix C makes comment on landform, geology/soils/erosion hazard, hydrology, vegetation, fauna, visual, archaeological/heritage, conservation and gravel pit construction impacts while also providing reasons justifying why such roading was needed. The following comments are relevant for each of the impacts listed and highlights any areas of interest or concern to the DOP.

Vegetation

The EIS (p.250) identifies that major forest roads can cause permanent damage to a forest by the complete removal of the tree canopy. In terms of direct impact on the vegetation through clearing, the DOP is mainly concerned with roading impacts on rare species.

Rare or significant plant species and communities are afforded particular consideration in Appendix C. Appendix C claims that no rare or significant plant species or communities will be crossed by new roading. It should be noted, however, that pre-roading surveys for such vegetation have not yet been carried along the proposed routes, and hence such claims are only made in light of the flora in the general area of road construction. **The DOP considers that no new roading should occur through locations of rare plant species protected from logging by the EIS as amended by these recommendations. In addition, new roads should avoid the location of those rare or significant species not protected from logging.**

Microclimatic effects are also considered by the EIS. The EIS stresses that new road construction can alter the light and microclimatic conditions of the road edge, noting that rainforest, and in particular species such as coachwood, are especially susceptible. Rainforest will be crossed with roading associated with Maps R1, R3, R6 (as shown on the map), R8, R9, R10 and R11 of Appendix C. Of this, some cool temperate rainforest will be crossed by roading associated with Maps R4 and R9. Warm temperate rainforest will be crossed by roading associated with Map R1. Roading impacts associated with rainforest are given greater consideration in Section 3.2.7 of this report.

Weed species were also given consideration by the EIS. The EIS (p.250) also identifies that soil compaction and disturbance associated with new roads can favour weed species and that roads are a major site for weeds. Of particular interest to the DOP is the effect on new roading on lantana infestation. This is considered in greater detail in Section 3.1.8 of this report.

Fauna

Areas rich in arboreal fauna identified by Appendix C of the EIS include the roading proposals shown on Maps R1, R2, R3, R7, R8, R9, R10 and R11. The area of habitat destruction was provided for each of the roading proposals, with habitat fragmentation being identified as the main impact.

The EIS (p.250) identifies that while road construction results in the removal of relatively small amounts of habitat, it can cause isolation of fauna populations by the fragmentation of habitat. Andrews (1990) provides a review of fragmentation effects by roads. Impacts on habitat fragmentation could have been given greater consideration by examining the area serviced in relation to length of roading proposed for each of the new roading proposals shown on Maps R1-R11 of Appendix C of the EIS. This information is presented here in Table 17 which shows the degree of fragmentation likely to occur from the new roads. Areas not likely to be affected by fragmentation are those serviced by the roading shown on Maps R1, R3, R4, R6 and R11. Fauna safeguard measures are proposed by the EIS. These are discussed in Section 3.10.3.

Table 17 - Fragmentation of Habitat by Permanent New Roads

Road	Total Area Serviced (ha)	Total Length of Permanent Roads (km)	Area Serviced: Length of Road ratio (ha/km)
R1	2,381	19	125
R2	1,993	8	249
R3	1,330	10	133
R4	1,887	16	118
R5	4,141 (3,790)*	29	143 (131)*
R6	708	7	101
R7	1,886	2.7	699
R8	2,910	15	194
R9	5,590	22.5	248
R10	2,824	18.5	153
R11	4,070	33.2	123

* Conservation areas not included in the calculation of the area serviced.

Conservation Resources

The only new roads to cross any conservation area, are those proposed on Map R4. This roading affects Banda Banda Flora Reserve. Appendix C indicates that approximately 1.9km of roading will cross Banda Banda Flora Reserve. The impacts of this new roading are minimised by skirting just inside the Banda Banda Flora Reserve boundary. There is no topographic alternative. The DOP notes that Banda Banda Flora Reserve preserves significant stands of *Nothofagus* considered for World Heritage Values (see Section 3.7). The proposed roading does not affect these stands. Two minor pockets of *Nothofagus* may be affected by the proposal. Several areas of sub-tropical rainforest also appear to be affected by this roading. The DOP notes that these impacts can be minimised by the restrictions placed on roading through rainforest as detailed in Section 3.2.7. The proposed road also follows most of the alignment of the current Banda trail. It is considered that the proposed roading will do minimal damage to the reserve, and is therefore acceptable to the DOP.

The SFNSW also notes that there is an additional 0.9km of road proposed to cross Banda Banda Flora Reserve to service compartments east of Toorumbee Creek. This is not proposed for the first 10 year period and details of this roading have not been assessed in the EIS. Similarly, the EIS (p.319) states that 1.6km of major road will be constructed through Crown Road Conservation Area and 0.6km through Spur Road Conservation Area. This has not been assessed in Appendix C as they are not proposed for construction in the 0-10 year period. As the details of the Banda Banda Flora Reserve (0.9km), the Crown Road Conservation Area and Spur Road Conservation Area crossings have not been provided, **the DOP considers that these roads should not be allowed to proceed within the terms of the approval.**

Landform

Appendix C provides tables of the various road classes for each State Forest within the K/WMA including whether they are sidecut or ridge-top roads. A total of 139.2km of major and minor roads are proposed to be constructed in the forest lands of the K/WMA over the next 10 years. This comprises 82.1km of sidecut roads, 24.1km of major sidecut and 58.3km of minor sidecut roads. The threshold slope distinguishing ridgetop from sidecut construction should have been provided, although from the information presented it is clear that 'sidecut construction' encompasses slopes much lower than 30^{o} as well as those in excess of this grade.

CaLM, in its submission, raises some concern over the amount of new roading required on sideslopes, and notes that almost 60% of the proposed new roading in the two management areas will be constructed on sideslopes. It also expresses concern that no geologic or terrain analysis has been carried out which would allow CaLM to reasonably identify those locations where standard road construction techniques might be inadequate. New roading which crosses slopes over 30^{o} (e.g. roading associated with maps R1, R2, R3, R4) are of particular concern as the SEMGL state that "*roads should generally not be constructed in areas where the ground slope exceeds 30. Roads may be constructed where ground slopes exceed 30 only if engineering design and stabilisation techniques will ensure road or batter stability*". According to CaLM, the Doyles River State Forest has areas of known mass movement yet no areas have been identified nor has engineering design or stabilisation techniques been proposed. The DOP notes that all these issues can be resolved at the Harvesting Plan scale of operations through the implementation of an erosion hazard and sediment control strategy and the adoption of the SEMGL.

Soils

Road construction is an activity which can pose a major source area for soil erosion and sediment movement (cf. Atkinson et al 1992, Haydon et al 1991, Larse 1971). The EIS and Appendix C consider the impact of new roads in relation to soil erosion hazard. Of concern to the DOP is roading which crosses extreme erosion hazard areas. The EIS identifies that for new roading, erosion hazard becomes extreme for slopes of 25^{o} or less. The EIS has provided an indication that problem areas do exist. For example, erosion hazard associated with Maps R2, R3, R4 and R5 becomes extreme when slopes of 15^{o} or more are encountered. This information is beneficial, however a map of the proposed roads overlaying an erosion hazard map of the areas concerned, would better aid impact assessment. In a similar way, a slope map would also be appropriate to assess roading impacts. CaLM notes that the EIS has not identified the special soil conservation techniques to be used to identify unstable areas and to stabilise them. This concern, however, can be offset through the adoption and careful implementation of the SEMGL. The feasibility of roading and minimisation of impacts can best be addressed at the harvesting plan scale of management through the adoption of the DOP's proposed erosion hazard and sediment control strategy, incorporating the adoption of the SEMGL.

The EIS notes that given that future roads will be built to standards which are at least as high if not higher than the existing roads and in accordance with the new SEMGL, future road construction is unlikely to create significant soil erosion. The Department of Planning notes that this is dependent upon the engineering standards employed. The erosion hazard and sediment control strategy proposed by the Department (Section 3.8.9) adopts the SEMGL and makes provision for road location, design, construction, drainage and erosion control measures.

CaLM notes that Appendix C could have been improved by giving more consideration to the following:

- the effect of geology (dip, strike, cleavage etc), the potential for mass movement, and the impact on road construction,
- mapping at an appropriate scale to identify slope and terrain to determine potential erosion hazard and the method of road construction, and road location,
- providing more detailed soils information to help determine the effect of construction or soil stability,
- more information in relation to revegetation techniques or structural earthworks required to ensure road stability.

The DOP notes that this information is required to be considered at the Harvesting Plan level through the adoption of an erosion hazard and sediment control strategy to which the SEMGL apply (see Section 3.8.9).

Hydrology

Both the EIS and Appendix C give consideration to hydrological impacts. The EIS's (p.252) discussion on road construction impacts, notes that there is the potential for a deterioration in water quality during and as a result of road construction, but suggests that in the K/WMA forests, detrimental impacts will be low because of low soil erodibility. This may be so, but

it is more appropriate to give consideration to soil erosion hazard. The EPA notes that the discussion does not address the potential for increased or accelerated runoff from roads impacting on the stability of drainage lines. CaLM comments that the effects of the proposed roading program (p.248) must be effectively evaluated and discussed in terms of its impact on subcatchment hydrology (the 240km of additional roading must be interpreted as "*additional drainage channel*").

Roading creates the greatest potential for soil erosion and sedimentation in forest operations. Of concern to the DOP is the impact of stream crossings on turbidity levels (cf. Cornish 1980). This has been recognised by the EIS, with Appendix C giving particular attention to any roads likely to require stream crossings. Maps R1-R11 could have shown stream locations in relation to the proposed roading. According to Appendix C, bridgework may be required for the Georges Creek area (Map R9), a splash crossing may be required over Granite Creek (Map R9) and there may need to be upgrading of splash crossings along the Dyke River (Map R10). More specific engineering details could have been provided in Appendix C. Notwithstanding, engineering details and the impacts of such crossings can best be addressed and included in the erosion hazard and sediment control strategy at the harvesting plan scale of development (see Section 3.8.9).

CaLM notes that some attempt to predict the impact of the various forest operation activities (including new roading), on stream discharge, sediment transport capacity and channel stability would also seem warranted. An assessment of the current state of stream channel stability should be possible which might then highlight streams that could be sensitive to altered hydrologic outputs. Data are also available on the water quality aspects, in particular the potential production of fine and coarse sediments, of roading and other forest activities. In this regard the particle size analysis test results of the Soils Survey could have been utilised. A consideration, no matter how tentative, of sediment size characteristics is essential as such characteristics have important implications for; the ability of catchment vegetation and terrain to trap sediments; stream ecology; transport capacity; and, sedimentation and downstream water quality issues.

Visual

Little of the new roading appears to have any visual impact. In relation to the roading shown on Map R3, small sections of road may be visible from Hastings Forest Way and the No. 1 Tower picnic area. In relation to the roading shown on Map R7, some sections could be visible from Point Lookout. The DOP concurs with the initiative of classifying some of the portions of these roads, PMP 1.1.6 (visual resource protection), however, visual resource management should not take precedence over erosion mitigation (cf. Atkinson 1992).

Archaeology/Heritage

Appendix C identifies that two of the new roading proposals may affect Aboriginal sites. The roading shown on Map R5 may affect the Stockyard complex. A significant archaeological complex has also been found in relation to the roading shown on Map R6. Safeguard measures for archaeological sites are discussed in Section 3.10.3.

Gravel and Mineral Extraction

Gravel and mineral extraction impacts were considered in the EIS and Appendix C. The EIS (p.249) notes that existing gravel pits within the K/WMA State Forests will be used as a source of material for maintaining existing roads as well as new road construction. The DOP concurs with this initiative but notes that future gravel pits may need to be constructed in conjunction with the new roading proposals. This is recognised in Appendix C of the EIS.

As specified by the EIS (p.253), the SEMGL require the SFNSW to minimise the extent of gravel (borrow) pits and to regrade, topsoil and establish an effective vegetation cover. Although borrow pits are small, their use for gravel extraction results in the vegetation being totally destroyed. **In light of this the DOP considers that sites containing rare, vulnerable and endangered species should be avoided when considering where gravel (borrow) pits should be located. The DOP further considers that where possible, habitat (hollow-bearing) trees should be avoided wherever possible and that pre-construction surveys are required to locate any sites of archaeological significance.**

Justification

In Appendix C of the EIS, all new roading was justified in terms of estimated hardwood sawlog yield except roads associated with Map R10. Justification should also have been provided for the roading presented in Map R10. The EIS (p.249) correctly identifies that impacts of new roads are offset to a large extent by the benefits of increased access for control of wildfires and for public recreation use of the forests.

3.10.3 Environmental Protection Measures

The EIS (p.253-254) proposes a number of safeguard measures for new roads. These relate to the impacts on soils, flora (particularly rainforest), fauna and Aboriginal sites. These aspects are considered below.

In relation to soils, the EIS (p.253) proposes that where possible, all tracks will be located on ridges and spurs so as to minimise earthworks, and associated potential for erosion and sedimentation. The DOP concurs with this initiative. The EIS further notes that where it is necessary for roads to be constructed on steep side slopes in soils which are known to have a potential for a significant slipping or slumping, specialist geotechnical advice will be sought in the design of such roads. The DOP notes that many of the new roads do cross steep side slopes, and the feasibility of road construction on such slopes will have to be examined at the harvesting plan scale of development in relation to the costs and standards of the engineering techniques required to stabilise such roads. This can best be assessed through the DOP's proposed erosion hazard and sediment control strategy which makes provision for the adoption of the SEMGL, erosion hazard assessment and liaison with CaLM. Engineering details are also provided for in both the SEMGL and the erosion hazard and sediment control strategy.

In relation to flora, the EIS concentrates on the impacts of roading on rainforest. The EIS (p.254) notes that road construction will avoid rainforest patches as much as possible. For those new roads that do cross rainforest, a number of mitigative measures are proposed.

These aspects are considered in Section 3.2.7 of this report. Provisions for rare plant species have already been considered.

The NPWS recommends that snig tracks and minor roads be ripped after use to encourage regeneration of the vegetation and to minimise feral animal ingress. The DOP notes that ripping is likely to cause more damage to linear features such as minor roads than areas such as log dumps. A general recommendation to rip minor roads has no regard to the slope or erosion hazard of the area, and may well damage the roots of surrounding trees. For these reasons the DOP has opted not to place a recommendation on the ripping of minor roads. The EIS (p.254) notes that roads and tracks which are not considered necessary for ongoing management will be closed by installing cross-banks and allowing the establishment of natural regeneration. The DOP concurs with this initiative.

In relation to fauna, the EIS (p.254) proposes that new roads will endeavour to avoid impact on habitat important to endangered fauna species. The DOP agrees with this initiative.

The EIS (p.255) proposes that known Aboriginal sites will be avoided as far as practicable in road location and construction. It further notes that where this is not practical, the local Aboriginal Land Council and the NPWS will be consulted to determine appropriate action. The DOP concurs with this initiative and further notes that 'consent to destroy' will have to be obtained by the NPWS if new roading is to damage or destroy any Aboriginal relics. The EIS also proposes that sections of proposed road alignments likely to contain significant sites will be inspected by a suitably qualified person prior to construction. **The DOP considers that all proposed road alignments should be surveyed for Aboriginal sites.**

Conclusion

The EIS and Appendix C provide appropriate details of new road descriptions and locations. A wide range of environmental impacts are considered for each of the new roading proposals. A range of safeguard measures are also proposed. Public concern has been raised over the level of detail provided in the EIS. These concerns, however, can be overcome at the Harvesting Plan scale of operations to which the SEMGL apply. Recommendations are required in relation to Aboriginal sites, reserved locations of rare or significant plant species, the protection of flora reserves and conservation areas, and ground pit construction.

3.11 Socio Economic Considerations

Direct and indirect jobs and output, revenue and expenditure, balance of payments, community services, population, mill prospects and wood supply agreements feature in the consideration of existing socio economic environment, environmental interactions, alternatives, consequences of not proceeding and justification of the proposal in the EIS and in public submissions. These matters are therefore dealt with in some detail. Other matters dealt with in the EIS and raised in submissions are also considered.

Before examining these matters it is relevant to consider the overall context of the native hardwood industry.

3.11.1 The Native Hardwood Industry

As pointed out in a number of submissions and by the RAC (1992 Vol. 1), the native hardwood industry in Australia has undergone, and is expected to continue to undergo, significant structural changes as a result of:

* increasing competition from domestic and overseas (particularly North America and New Zealand) softwood plantations;

* the replacement of hardwood by softwood in building applications;

* the replacement of timber by non-wood substitutes in building applications;

* the replacement of solid timber by panels and other reconstituted timber products;

* the continuing transition from old growth to regrowth forests (RAC, 1992, Vol. 1);

* declaration of Conservation Reserves and reduction of cut in some areas to achieve sustainable yields.

These factors have combined to produce a decline in the size of the native hardwood sawmilling sector and an increase in the size of the softwood sawmilling sector. This trend towards softwood is expected to continue (RAC, 1992, Vol. 1; Clark 1991). Nevertheless, the timber industry is expected to remain dependent for some time on the native hardwood resource (RAC 1992, Vol. 1).

The hardwood sawlog industry is still dominated by small and medium sized operations, mostly geared to cut large (old growth) logs. These operations will need to adapt their drying and sawing technology to cope with smaller logs and regrowth. To compete with softwoods further structural change will be needed. Large scale plants with high volume production eventually may have to be established to process regrowth sawlogs, but the small sawmill will still have a place for specialised operations (RAC 1992, Vol. 1). The best prospects for native hardwood appear to be in applications requiring weather resistance and durability, appearance grades for furniture and feature veneer and niche markets within the structural timber markets. Clark (1991) identified that small green hardwood sawmills supplying the local market and which are isolated from softwoods because of transport distances are also likely to remain viable. Both Clark (1991) and the RAC (1992, Vol. 1) considered that there will continue to be mill closures as the industry restructures. Assurance of continued supplies will encourage investment in new plant and technology (RAC 1992, Vol. 1).

Conclusion

The native hardwood industry in Australia has been and is expected to continue to undergo significant structural changes resulting in mill closures and rationalisations. This needs to be borne in mind when considering the impacts of the Minister for Planning's determination as impacts on local and regional economies attributed to the State Forests proposal (as amended by the Ministers determination) may simply be changes in the timing of impacts that may have occurred anyway.

3.11.2 Balance of Trade

The EIS identifies NSW and Australia's Balance of Trade deficit in 1990/91 with respect to sawn timber and foreshadows the worsening of Australia's Balance of Trade if various alternatives are adopted or the proposal does not proceed. Submissions also picked up on the issue of Australia's trade deficit in timber (22,161,155,157,147b,98) with some concerned at the trade deficit and the impact of of adopting alternatives that would result in a reduction in quota's while others considered the reference to Australia's balance of trade deficit in wood products as inaccurate and inflationary.

An insight into these arguments can be gained by:

a) looking closer at Australia and NSW's Balance of Trade with respect to sawn timber to get a clearer understanding of the situation;

b) briefly examining some economic aspects of the desirability or otherwise of a Balance of Trade deficit.

In 1990/91 the share of hardwood as a proportion of total sawn timber demand in NSW was 31% with the share of softwood being 69%. At this time NSW was virtually self sufficient in hardwood sawn timber with its balance of trade deficit in sawn timber largely a result of softwood imports. The forecast demand for hardwood in NSW is expected to remain relatively constant, although with some increase, while the demand for softwood is expected to increase substantially.

At the national level Australia has a considerable deficit in timber and paper products however, the majority of this is due to pulp and paper products. Notwithstanding, Australia imports approximately 30% of its sawn timber requirement (Clark 1991) with in the order of 80% of these imports being softwoods (Clark 1991).

The prospect for Australia and NSW's Balance of Trade deficit is not dissimilar with both Australia and NSW having the potential to increase domestic production of softwoods substantially and thus dramatically improve their trade deficit through import substitution and export of softwood. This is likely to be offset to a small extent by a worsening of the trade deficit with respect to hardwood.

Given these prospects a slight deterioration in the Balance of Trade in hardwood sawn timber under various alternatives is considered to be a minor issue.

Furthermore, while improvement in the nation's Balance of Trade may be a policy objective of Government, from an economic perspective a trade deficit does not constitute a problem in itself. A balanced result or a surplus in any sector is desirable only if it coincides with an efficient allocation of resources in the economy. In general, this means that sectors of the economy that have a comparative advantage in production will have trade surpluses, while those that have a comparative disadvantage will have deficits (RAC 1992, Vol. 1).

The RAC (1992, Vol. 1, page 277) continued by stating that *"This should not be interpreted as suggesting that an improvement in Australia's trading position in*

forest products is undesirable - the qualification is that any improvement must be achieved by an industry operating on an economically efficient basis. Against this background, the future contribution of the Australian wood and wood products sector to the Australian economy will be determined by Australia's cost-competitiveness in international markets, by government trade policy, and by a range of other Australian market conditions".

Clearly then the use of Balance of Trade payments as a criteria for evaluating alternatives or justifying a proposal would necessitate consideration of efficiency and comparative advantage issues.

Conclusion

The issue of Australia and NSW's balance of trade deficit in timber products is not as simple as portrayed in the EIS as for both Australia and NSW the balance of trade deficit is largely a result of softwood imports not hardwood imports. While a decrease in the availability of hardwood may cause some worsening of the balance of trade both Australia and NSW have considerable potential to substantially improve the balance of trade in wood products through import replacement and export of softwood

3.11.3 Employment

Employment was a key socioeconomic issue addressed in the EIS and one of the major issues raised in submissions. Key matters were the importance of the timber industry to employment levels, the estimates of employment dependent on the K/WMA, employment consequences of alternatives, potential for increases in employment in the timber industry and others, the high unemployment in the region and towns, the unsustainable levels of employment based on old growth (particularly the old growth of the Kempsey Management Area) and inconsistencies in information. These issues are addressed below.

Importance of the Timber Industry

At the regional level an indication of the structure of the economy of Hastings Municipality and Kempsey Shire, and the importance of the timber industry to these economies can be gauged from an examination of ABS Census expanded employment by industry data.

In looking at the timber industry generally ABS figures on 'forestry and logging' ASIC A03 and 'wood, wood products and furniture' ASIC C253 are relevant. Although it should be noted that the latter industry subdivision includes broad sub-categories such as mattresses. While these two categories give a general indicator of the timber industry other employment is likely to occur in the transport and storage industry and public administration sector.

Employment by industry, including employment in the timber industry categories of 'forestry and logging' and 'wood, wood products and furniture', are shown below for the two local government areas in question and combined region, for the last three census's.

At a broad industry level both LGAs have experienced a similar pattern. Agriculture has experienced an absolute and relative decline in terms of employment, manufacturing, transport and storage and construction have experienced a relative decline (with absolute employment numbers having remained fairly constant albeit with some oscillation, with the exception of transport and storage in Kempsey Shire which has also declined in absolute terms), while wholesale and retail trade, finance, property and business services, community services and recreational and personal services have all increased in importance in both absolute and relative terms.

In both absolute and relative terms the LGAs in question have generally experienced a decline in the importance of forestry and logging and wood manufacturing (although in absolute terms the numbers employed in wood manufacturing have tended to be reasonably constant in recent years).

For the Hastings Municipality it is evident that employment in the timber industry has declined from approximately 889 in 1981 to 439 in 1991, i.e. 7.2% of the total employed workforce to 2.7% of the total employed workforce. While for the Kempsey Shire employment in the timber industry has declined from 341 in 1981 to 159 in 1991, i.e. 5.0% to 2.0% of the employed workforce (ABS Census data).

For the combined region, employment in the timber industry has declined from approximately 1,230 to 598, i.e. 6.4% to 2.5% (ABS Census Data).

The above figures relate to the timber industry generally and not specifically the timber industry based on the timber resource of the K/WMA.

The EIS identifies a direct workforce of 211 people reliant on the timber resource of the WMA. Assuming that all these people live within the municipal boundary (which the EIS identifies they do not) this represents 1.3% of the employed workforce.

The EIS further identifies that 183 people could be considered to be employed in the forestry industry in the KMA. Assuming that all these people live within the Shire this represents 2.4% of the employed workforce.

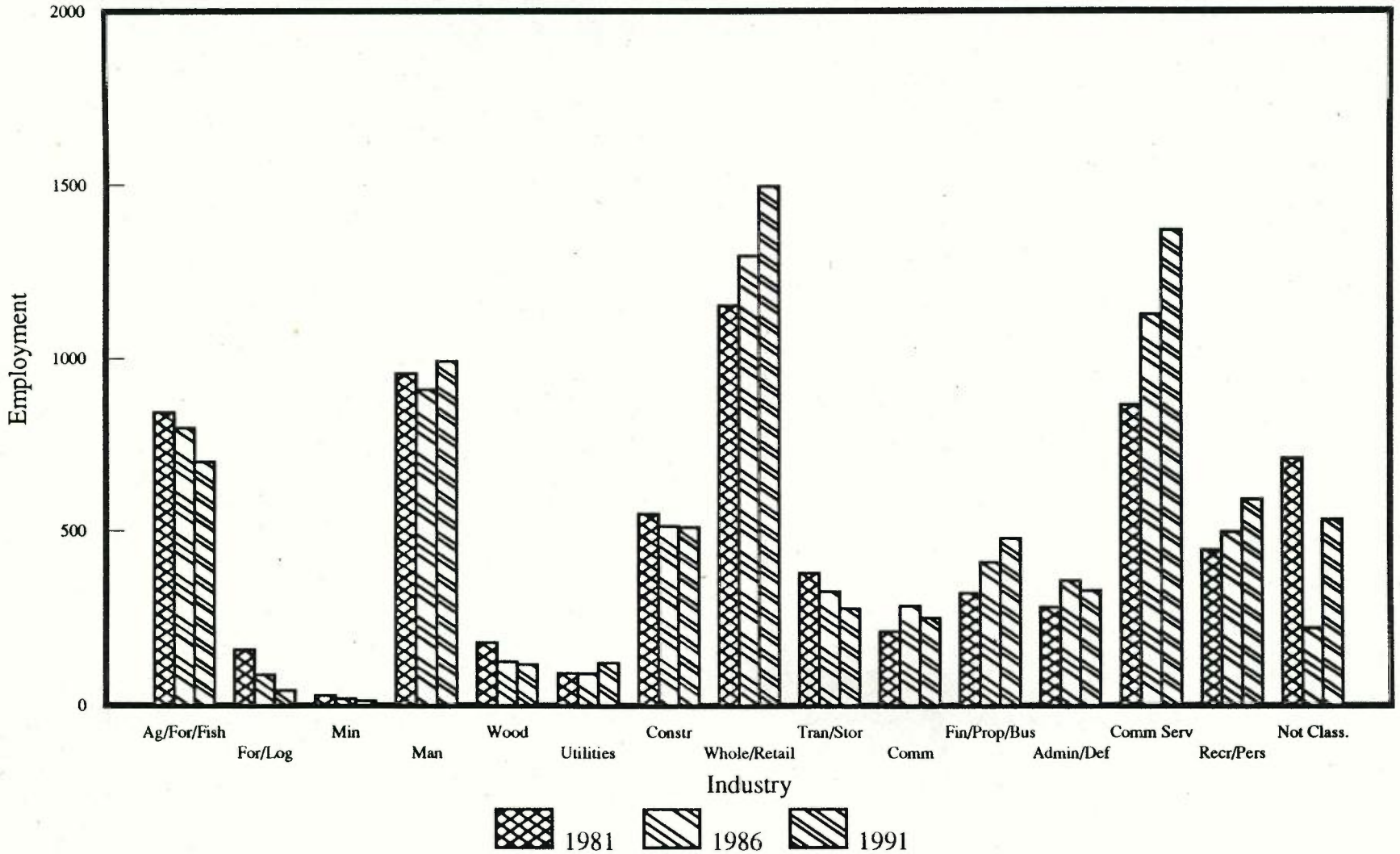
Overall the direct employment based on the K/WMA represents 1.7% of the employed population in the Hastings and Kempsey LGAs.

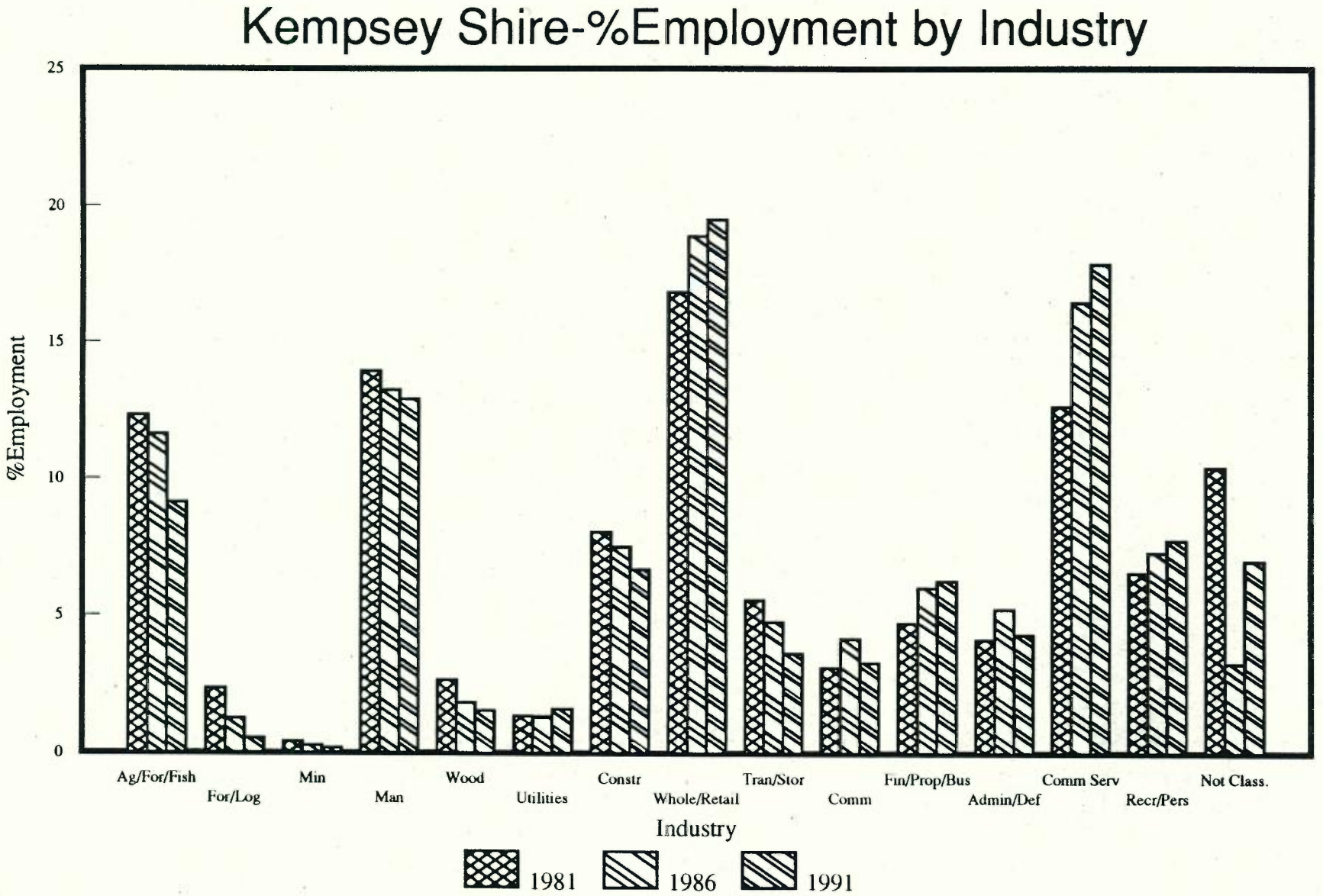
While employment generated by the forestry and timber industry in Kempsey Shire and Wauchope Municipality may not represent a significant proportion of the workforce to the region it may be more significant to specific towns. However, the EIS does not identify all mills/operations which receive timber from the K/WMA and for those which are identified (i.e. mills that receive some quota) place of residence of employees is not identified.

It is therefore difficult to determine if the timber industry is more important to specific towns or indeed which towns require examination.

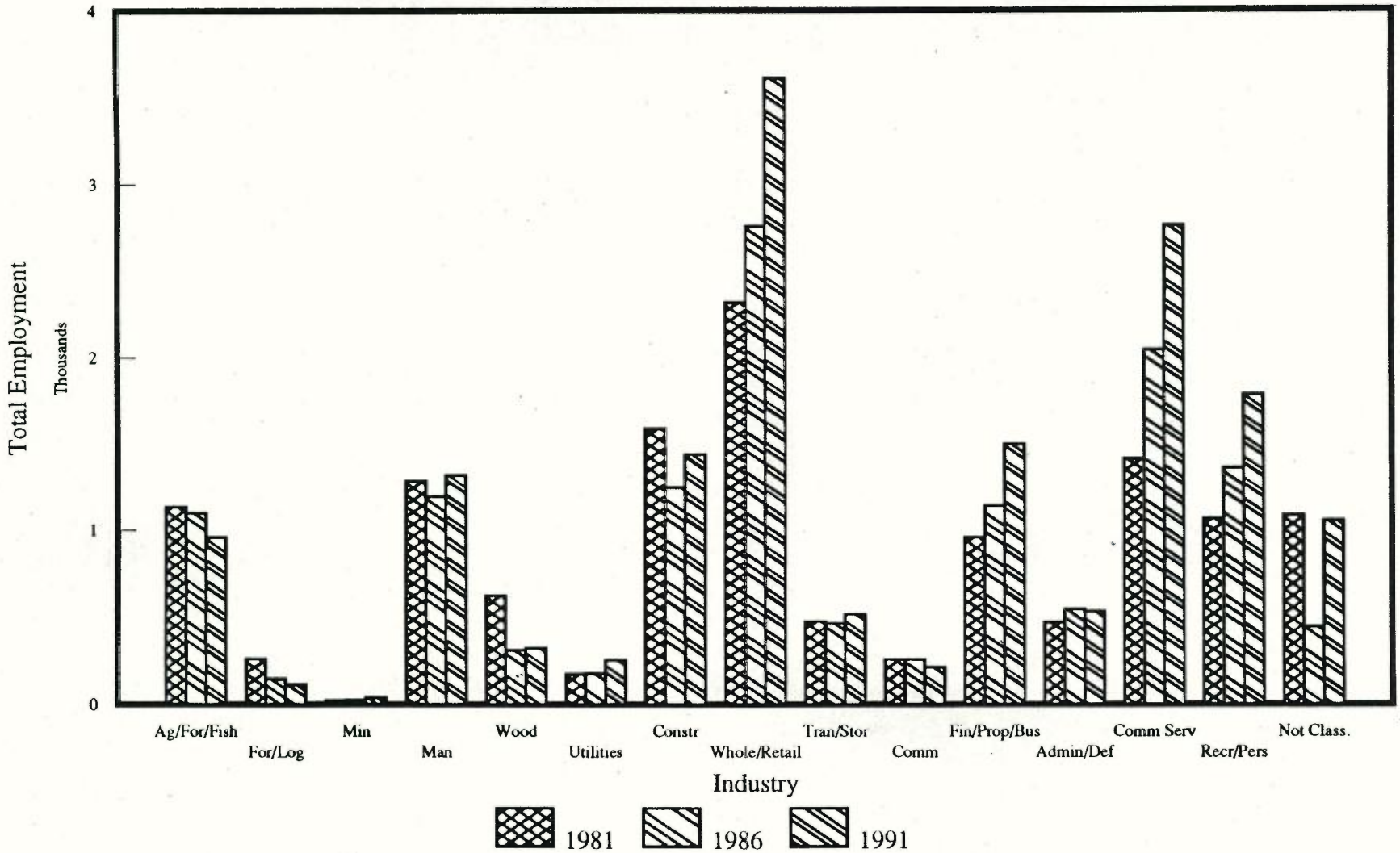
Nevertheless, based on the location of quota mills only and a broad verbal indication from these mills on location of residence the following can be deduced.

Kempsey Shire-Employment by Industry

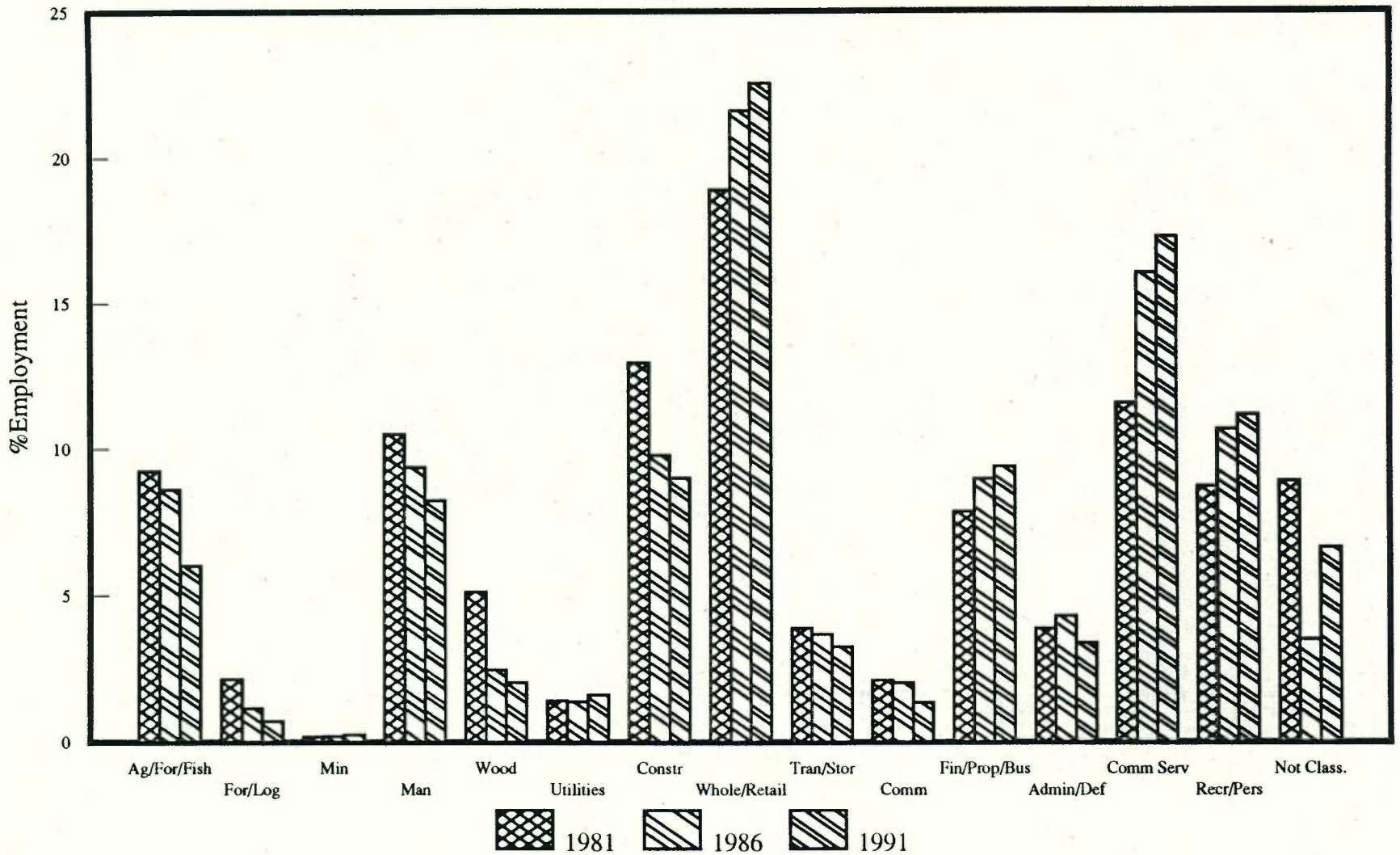



Kempsey Shire-%Employment by Industry
%Employment
25
20
15
10
5
0
Ag/For/Fish
For/Log
Min
Man
Wood
Utilities
Constr
Whole/Retail
Tran/Stor
Comm
Fin/Prop/Bus
Admin/Def
Comm Serv
Recr/Pers
Not Class.
Industry
1981
1986
1991

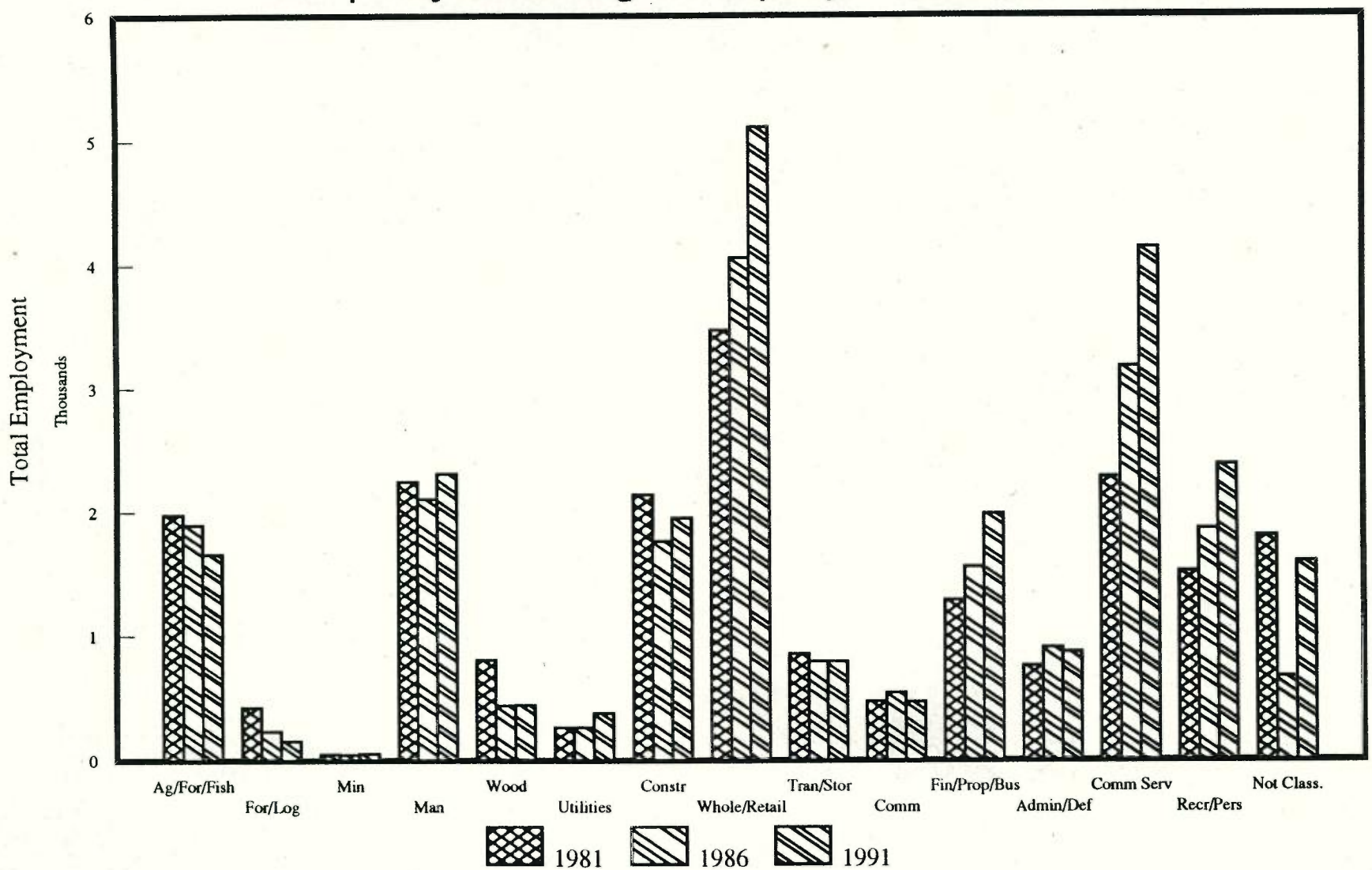
Hastings-Employment by Industry



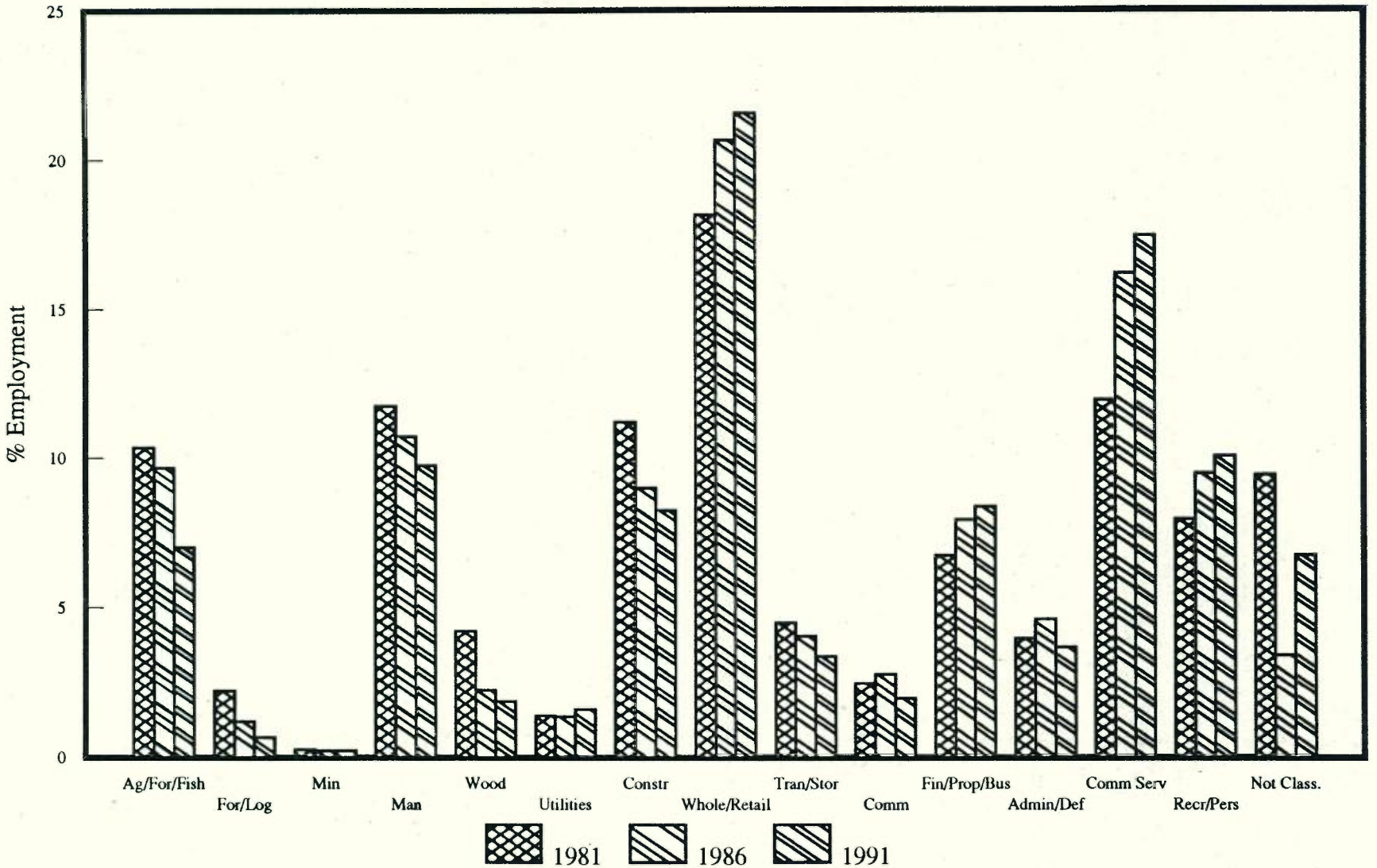
Hastings-%Employment by Industry



Kempsey/Hastings-Employment by Industry



Kempsey/Hastings-%Employment by Industry



* In the Kempsey Management Area the two main mills which receive quota are located in the town of Kempsey. The majority of employees of these mills reside in Kempsey although a small number also reportedly reside in Wauchope (4 or 5 people).

* In the Wauchope Management Area mills receiving quota are more geographically dispersed, i.e. located at Herons Creek, Beechwood and Bellangry and place of residence of employees also seems to be more geographically dispersed with places of residence reported to include Herons Creek, Kendal, Laurieton, Port Macquarie, Beechwood, Bellangry, Wauchope and Telegraph Point.

Given that:

a) Kempsey is the main administration or population centre within the Kempsey Shire and the two mills that receive quota from the KMA are located here; and

b) Wauchope is the main rural centre in Hastings Municipality and the EIS identifies that forestry activities are focussed around here and to a lesser extent at Beechwood,

the Department considered that the importance of the timber industry to these towns also required some consideration. This is not to say that some other smaller mainly dormitory settlements, may not also be adversely affected by quota reductions in the timber industry, in particular, Herons Creek and Bellangry.

Without detailed information from industry or State Forests on the place of residence of timber workers it is difficult to ascertain the importance of the timber industry (and in particular that proportion of the industry reliant on the resource of the K/WMA) to the towns of Kempsey and Wauchope. This is particularly so because the Australian Bureau of Statistics (ABS) does not provide expanded employment by industry data at the Census Collector District level.

Conclusion

The importance of the timber industry to the Hastings Municipality and Kempsey Shire has decreased considerably since 1981. At the time of the 1991 census the forestry and timber industry directly contributed approximately 2.7% of the employed workforce in the Hastings Municipality and 2% of the employed workforce in the Kempsey Shire. The forest and timber industry based on the K/WMA directly contributed approximately 1.7% of the employed workforce in the Hastings and Kempsey LGA's with the industry appearing to be more important to the Kempsey Shire (approximately 2.4% of the employed workforce compared to 1.3% for the Hastings LGA). While this may not represent a significant proportion of the workforce to the region it may be more significant to specific towns within the region. It has not been possible to ascertain whether this is the case without information on the place of residence of workers.

Estimates of Employment Dependent on the Timber Industry

The EIS identifies that the Wauchope Management Area (WMA) accounts for a total direct workforce of 211 people comprising 153 forestry and mill workers, contractors, managerial

and technical support staff, 40 employed in processing timber from the WMA at Herons Creek, Grafton and other locations outside the WMA and 18 people employed by the State Forests of NSW to manager the WMA.

The overall estimate of forestry industry employment in the Kempsey Management Area (KMA) is given as 183 people comprising 163 employed by timber companies and licencees and 20 people who work from the Kempsey District Forestry Office. The EIS alludes to the problem with using this figure as mills in other MAs are supplied with logs from KMA while some companies located in Kempsey draw timber from other MAs.

Together the K/WMA is identified as currently contributing 394 jobs directly and $18.9m/yr of output.

Submission 150, 157 identified that employment levels are considerably greater than identified in the EIS while other submissions were concerned that these employment levels were inflated (147b). This latter concern related to the fact that Timber Industry statistics had been relied upon and that there had been no independent assessment of these statistics and that statistics kept by the State Forests of NSW had not been assessed.

While the Department of Planning is not in a position to undertake a comprehensive independent survey of employment levels in the timber industry (based on the timber resource of the K/WMA) it did request further clarification of what the employment figures related to and a break down of these statistics.

The State Forests of NSW has identified that the consultants carried out their own review of employment and output figures and confirmed that according to the consultant the employment (and output) figures were calculated on a pro rata basis i.e people employed (and output figures) for each sawmill and operator were related to the proportion of the timber resource derived from the K/WMA. Mills located outside the K/WMA which received some resource from the K/WMA were included in the estimates while it was recognised that some mills within the K/WMA did not obtain any wood resource from State Forests in the K/WMA. Some of the complications in estimating direct employment are recognised by State Forests of NSW with its conclusion being that the employment figures in the EIS represent best estimates based on available information.

To provide some verification of the consultant's figures State Forests of NSW has provided the following information.

Table 18 - Employment in the Forest and Timber Industry

Sector	Wauchope District 1991	Wauchope District 1993	Kempsey District 1991	Kempsey District 1993
Sawmills	144.5	202.0	91.0	106.0
Extraction (Mill employees)	13.5	9.0	10.0	8.0
Contract Logging	25.0	60.0	31.0	10.0
Miscellaneous Operations	12.0	3.0	61.0	31.0
State Forests of NSW	14.0	40.0	14.0	16.5
Private Forestry	0.0	0.0	0.0	0.0
Totals	209.0	314.0	207.0	171.5

It should be noted that these figures are compiled on a District basis and do not take into account the processing of timber obtained from the Management Areas outside the District. The 1993 Wauchope figures also includes the former Kendall District An assessment by State Forests of the proportional dependence on resources in both management areas is provided below.

Table 19 - Proportional Employment Dependent on the K/WMA

Industry Sector	Wauchope MA	Kempsey MA
Sawmilling	117	83.0
Logging Contracts	40	27.0[1]
Pole Operators	10	-
Sleeper Operators	-	17.0[2]
Mining Timber	3	-
Miscellaneous	4	14.0
FC/SF	19	16.5
Other (SEPL hauliers etc.)	5	-
Totals	198	157.5

Note: 1. Two major contractors who are normally working in the District have been included in this table but have not been included in 1993 Employment Statistics.
2. Note decline in sleeper cutters from 45 to 17 since 1991.

For Wauchope the 1991 figures are used as the base figures to calculate proportional dependence as they relate to the Wauchope Management Area only and are not biased by borrow/payback arrangements. For the Kempsey Management area 1993 figures are used as base figures. With respect to the 1993 Kempsey figures the Department of Planning notes that the Kempsey District has experienced a significant downturn in sleeper operations and logging contractors are currently working in other Districts.

These figures do not take into account further processing by Boral at Herons Creek, Wingham or Maxwells Creek although significant inputs to these plants originate from Allen Taylor and Co. mills at Bellangry, Kempsey and Herons Creek. The District Forester, Wauchope points out that the figures are conservative with many part-time employees not included in the estimates.

From this information it can be seen that proportional employment directly reliant on the resource of the K/WMA is slightly lower than identified in the EIS although there are a number of reasons why this may be the case. One such reason not identified in State Forests' submission is that KMA is undergoing a program of quota reductions.

Given the complexities of current timber flows and log movements and the dynamic employment/output situation, the Department of Planning recognises the difficulties in estimating the level of employment directly dependent on the resource of K/WMA. Notwithstanding, the information provided by the State Forests of NSW would tend to confirm that the level of direct proportional employment identified in the EIS as being dependent on the resource of the K/WMA would seem to be a reasonable approximation.

As identified by the State Forests of NSW the extent of reliance can be much higher if the resource is critical in achieving a threshold level for maintaining viability of operations. This is particularly relevant when consider the impacts of a decline in quota (refer to later discussion of estimates of employment impacts of alternatives).

Conclusion

It is difficult to verify the employment figures given in the EIS as the methodology used is not explicit and disaggregated employment figures for each establishment reliant on timber from the K/WMA (including data on total throughput and throughput from the K/WMA) are not provided. Nevertheless the State Forests of NSW have rectified this to some extent by providing copies of its data on employment in the region. This tends to support the general magnitude of employment provided in the EIS

Employment Consequences of Alternatives

The EIS uses two means of determining the employment consequences of adopting the preferred options. The first is based on the assumption that the loss of jobs is comparable to the proportional loss of quota. The second method was based on information from Boral Timbers on the relationship between sawlog volume throughput and the number of employees. Both methods gave a similar result. The approach used to determine the employment consequences of alternatives is not stated in the EIS.

Without detailed knowledge of the likely response of individual mills the use of a proportional approach is probably the best method to estimate employment impacts. Nevertheless, all other things being equal, this method may overestimate job loss as the marginal employment loss of a mill, as a result of quota reductions, is likely to be less than the average employment ratio of mills.

Notwithstanding, when the impact of Wood Supply Agreement (WSA) is taken into account together with the labour ratios of different mills and likelihood of closure of mills, the overestimate may be offset (refer to WSA/Mill Closure section).

WSA/Mill Closures

A key issue identified in the EIS and raised in a number of submissions is the existence of wood supply agreements. While these were identified in the EIS there was little detailed consideration of the consequences of these. In particular consideration of WSA are relevant

to impacts on mills, mill closures, employment and output/income losses and distribution of social impacts. For instance, submission 134 identifies that Beechwood mill is likely to close as a result of the proposal as it would bear the brunt of quota reductions in the WMA. A similar situation is identified for Kempsey Timber (submission 150) as a result of quota reductions in the KMA.

The existence of a wood supply agreement may also mean that employment losses are higher than stated in the EIS as mills such as Kempsey Timber reportedly have a higher employment level per volume of throughput than other mills which hold WSA.

While mill closures may be a very real consequence of the SFNSW proposal and the Minister for Planning's determination it is impossible to determine the threshold of mill viability and so assess the likelihood of mill closure without access to confidential financial data. Furthermore, mill rationalisation may occur regardless of any quota reduction.

If mills did close for one reason or another, initially all jobs would be lost. Additional jobs would, however, most likely be generated at the mill(s) that received the remaining available wood. Nevertheless, the magnitude of the net job loss would be greater than estimated in the EIS since the number of new jobs generated where the remaining wood is directed (marginal employment coefficient) would in all likelihood be less than the number of jobs remaining if mills in the Kempsey Shire and Hastings Municipality continued to operate with reduced quota.

At the extreme, if the mills which receive the remaining wood (should say Kempsey Timbers and/or Beechwood Timbers close) have the capacity to expand throughput levels without significant increases in employment, net direct job losses would, for each option examined in the EIS, approximate the number of jobs in the mills that close.

Even if the number of net job losses were reduced by the generation of new employment opportunities at mills taking up the remaining quota, the distributional effects may be substantial if these mills are located outside the local area or region.

Conclusion

It is extremely difficult to estimate the direct employment loss that would result from the adoption of the different logging scenario's considered in the EIS. Complicating factors include the need to consider individual mill responses to quota reductions (which necessitates consideration of distribution of reduction in quota and other wood products, mill thresholds and mill closures, redistribution of quota if mills close). Without undertaking such detailed consideration a proportional estimate is considered to be the next best method thus the information provided in the EIS could be considered to give a reasonable estimate.

Potential for Employment

Submissions identified three areas which might provide potential for employment and thus offset to some extent employment losses due to reductions in quota. These were value adding, plantations and tourism.

The Study prepared by NSW Forest Products Association 1993 titled *"Market Opportunities on the West Coast of the USA for Flooring Milled from NSW Hardwoods - Preliminary Report"* highlights the potential employment gains from value adding by referring to the sawmilling, seasoning and manufacturing facilities of Dixon Lumber Co. in the USA which processes 45,000m^3 per annum and which employs 350 people. Clearly, encouragement of value adding by SFNSW may help to offset some employment losses from quota reductions.

While some submissions supported the allocation of quota to mills, such as Kempsey Timbers, that have demonstrated a commitment to value adding in the local area it must be recognised that Boral also has demonstrated a commitment to value adding with 60% of its total hardwood production being further processed (Boral Timber Division 1992) albeit not necessarily in the local area from which wood is obtained. Thus generation of jobs through value adding may not occur in the same LGA as the standing timber resource.

Two other issues are relevant to the matter of wood allocation. These are WSA and the Minister for Planning's powers under the Environmental Planning and Assessment Act and Timber Industry (Interim Protection) Act. WSA are discussed earlier in this report. With regard to the Minister for Planning's powers, the DOP considers that it is not within the Minister's power to make conditions regarding the allocation of wood to various mills.

Establishment of plantations would no doubt provide employment opportunities. In this respect the DOP notes the SFNSW commitment to expanding its plantations. In 1993/94 the State's hardwood plantations will be expanded through a Government contribution of $1M (in addition to the SFNSW expenditure) doubling State Forests' current plantation budget of $1M (SFNSW 1993).

Nevertheless, the occurrence of such a program may not occur in the regions that experience employment loss and therefore plantations may not provide alternative employment for those who lose their jobs in the Kempsey and Wauchope areas.

Section 3.18 of this report briefly considers tourism potential of the K/WMA and concludes that in the short term it is not likely to be great.

Unsustainability

Page 195 of the Environmental Impact Statement identifies the State Forests' program of yield reductions for the Kempsey Management Area. These yield reductions are aimed at bringing the Kempsey Management Area onto sustained yield management and comprise a 23% quota reduction in 1993 and a further 25% quota reduction in 1997 (based on the quota in 1993-1996), for Allen Taylor and Co. (Boral). It should be noted that based on 1993 figures Allen Taylor and Co. (Boral) receive 94% of the quota sawlogs from the Kempsey Management Area. The above yield reduction program is already in place and does not include the approximately 10% quota reduction proposed in the EIS.

This demonstrates that the levels of employment identified in the EIS as being dependent on the K/WMA are clearly unsustainable even in the short term without growth in employment through value adding.

With the proposal being for the remainder of the first cutting cycle and no consideration given in the EIS to wood volumes in the second cutting cycle there is also some doubt over the sustainability of employment into the second cutting cycle.

Conclusion

The levels of employment identified in the EIS as being dependent on wood from the KMA are clearly unsustainable due to a program of massive quota reductions to bring the management area onto sustainable yield.

Unemployment

"Unemployment in the North Coast region in higher than average State levels and has been for many years. The major problem for employment in the North Coast is the lack of suitable job opportunities. The industries on which the region has traditionally relied, primarily agriculture and its supporting infrastructure, no longer provide a reliable and expanding source of employment. Forestry, and other traditional industry in the region, has been experiencing difficulties for a number of years and new opportunities need to be identified. Other factors inhibiting employment growth are inadequate transport services, labour market skills which do not match employment opportunities and skills which remain untapped." (Department of Planning 1993b, page 55).

High local unemployment has been identified in a number of submissions as being of concern.

Previously it has been brought to the Department's attention that many people working in the timber industry have had only low level educational opportunities and as a consequence may not easily fit into current programs for retraining nor easily acquire other work.

Conclusion

Employment losses are of considerable concern particularly in times of high unemployment in areas where unemployment levels have been high for many years and in an industry where only a small proportion of employees may be suited for retraining and other work.

Minor Contradictory Information

When the proposal and the alternatives are considered together with the section on justification of the proposal, the employment consequences of different alternatives is somewhat confused. Alternative 1 which is continuation of the existing Plan of Management is identified on page 315 as leading to an additional 9.5 direct jobs (20 jobs on a regional basis) compared to the Proposed Activity. In contrast when the EIS examines the economic impacts of the proposal compared to continuation of the existing situation (i.e. the Plan of Management) (page 221) it identifies that the quota reduction under the proposal will lead to a loss of 39 direct jobs (85 in total).

The employment (and output) information in the Executive Summary regarding justification of the proposal differs to that in the body of the EIS. The Executive Summary identifies that benefits of the proposal will include *"employment of 851 people in the local area"* while the body of the EIS identifies that the *"beneficial impacts will include employment of 766 people in the local area"*.

The reference to the *"local area"* in both instances should refer to *"the region"* as these figures obviously included both the estimated direct and indirect employment. Secondly, the first reference to 851 people would appear to be an error as this is the number of direct and indirect jobs identified under the existing situation. The reference to 766 jobs corresponds to a loss of 39 direct jobs (85 in total) from adopting the proposal. This would therefore tend to confirm that the comment on page 315 that continuation of the existing operation would result in an additional 9.5 direct jobs, is also an error.

The employment consequences of the alternative of cessation of old growth logging is difficult to comprehend. Under this option the EIS identifies that 126 (86 plus 40) direct jobs will be lost. This is from a total of 394. Therefore the loss of approximately 59% of the total wood volume including 75% of the quota sawlog volume would lead to a loss of 32% of the direct employment.

The employment impacts identified in the EIS if the proposal did not proceed are the immediate loss of an estimated 857 jobs in the region including 394 people directly employed in forestry and a further 457 indirectly dependent on the forestry industry. Based on the multipliers and employment information used in the EIS this is considered to be an over-estimate. Refer to section on multipliers and their interpretation.

Conclusion

There are a number of minor conflicting and erroneous references to employment and output particularly between the summary and body of the EIS. This detracts from the readability of the EIS.

3.11.4 Output

Total Output from K/WMA

According to submissions 159 and 161 the Forestry Industry in Australia turns over approximately $10B per year while annual turnover in the Forest Industry in NSW is in the order of $2.45B.

The EIS identifies that according to financial data obtained from the major licensees within the KMA a total of $7.2m of timber and timber products was produced in 1991. The EIS further identifies that revenue generated from the forest and timber production using forest resources located in the WMA totalled $8.2m in the 1990/1991 financial year (according to information supplied by the nine major licensees operating in the area). Additionally, the remaining 134 licensees in the WMA are estimated to have generated in the order of $3.5-$4m of revenue per annum, i.e. a total of $11.7m to $12.2m. A similar approach seems to have been used for KMA with operators and licensees providing the information (although it is noted that small licensees have not been included for the KMA) (EPA and State Forests submissions). According to the State Forests information on small licences was not available for the Kempsey District.

The concern the DOP has with the approach used is that the figures on revenue have been used as equivalent to the direct output value. From examination of the 143 licence types it is evident that revenue generated by a contractor, operator or timber licensee would actually be a cost to a sawmill licensee and be incorporated in to the value of the mill's output (so that costs are recovered). Adding together revenue figures from different levels of licensees including sawmills would therefore lead to double counting and would not be representative of the value of output (refer to comments in section on multipliers). Beyond this simple statement it is difficult to determine whether double counting actually occurred or the degree of double counting. However, it is clear that the EIS would benefit from a clearer explanation of the methodology used in estimating output value.

For the WMA a value of production figure for forestry and timber of $8.2m is used for comparison with other sectors. However, when total output of both the WMA and KMA is examined on page 157, a figure of $11.7m is used for the WMA. It is not clear why two different figures have been used.

A further point is that for the WMA and KMA there is some ambiguity as to whether the revenue figures used represent the proportion of licensee revenue generated from the K/WMA Crown timber lands or includes revenue generated from private resource and/or resource outside the MAs.

Nevertheless, on balance the indication is that apportioning of revenue figures has occurred. State Forests submission confirms that this is the case.

It is also unclear whether *"revenue"* figures include the harvesting that has been undertaken to supply Wingham Management Area in the past two years.

Overall the EIS identifies the existing value of output for both the WMA and KMA as $18.9m.

While a number of submissions considered that the output value was an underestimate, e.g. submissions 10, 131 and 159, little evidence was provided to this effect.

Notwithstanding some of the above concerns, based on the wood volumes identified in the EIS and the mill door values of wood products, the Department of Planning considers the estimates of total output of the industry (based on the K/WMA) to be reasonable.

Conclusion

While the Department has some concerns with the method of output calculation based on the wood volumes identified in the EIS and the mill door value of wood products described, the estimates of output used in the EIS are considered to be reasonable.

Impact of Quota Reductions

The direct output impact of adopting various alternatives (as identified in the EIS) can be summarised as follows.

Table 20 - OUtput Impact of Adopting Alternatives

Alternative 1	Proposal	Alternative 2	Alternative 3	Alternative 4
$0M	$2M	$3.1M	$10.4M	$15M

Note: Figures in Chapter 13 of the EIS, on which these are based, are compared to the proposal and thus are of a smaller magnitude for Alternatives 2, 3 and 4.

While the EIS identifies that these estimates are based on the timber production estimates provided in the EIS no more detail is provided on the methodology used to estimate output loss (in particular wood values) for alternatives. Nevertheless the apparent use of proportional estimates are considered to give a reasonable estimate.

Conclusion

The apparent use of proportional estimates to gauge output consequences of adopting various alternatives are considered to be reasonable.

Importance of Timber Industry Output

The Department of Planning recognises that the output values given in the EIS do not include the output from other forest uses such as beekeeping and grazing. Submission 131 identifies that the output value from honey and beeswax may be in the vicinity of $1,025,000. The Department recognises that there is some potential to increase output value through value adding and acknowledges that the output figures used in the EIS are mill door figures and therefore do not take account of the value added or final value to the market.

Nevertheless, some indication of the importance of the timber industry to the Hastings Shire and Kempsey Municipality can be gained from examining the following tables which provide information on the value of production by sector, over time. The gaps in information are because the ABS did not publish figures for various years. The asterisk indicates that these figures were used in the EIS.

Table 21 - Value of Production by Sector in Kempsey LGA

	1983/84	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92
Forestry and Timber (Crown Only)						$7.2*	$7.9*	$7.2*	
Ag (excluding Forestry	$16.3	$16.6		$17.2	$19.7	$15.0*	$26.6*	$23.4*	$20.1

Manufacturing (W&S)	$13.8	$13.4			$15.0	$17.0	$17.0		
Turnover					$80.2	$96.8*	$96.8		
Building & Construction									
Res		$11.0	$ 8.4	$ 8.2		$17.4	$19.9	$18.7	$18.7
Non-Res		$11.3	$ 1.8	$ 3.7		$ 4.0	$3.0	$ 7.9	$ 4.4
Total		$22.3	$10.2	$11.9		$21.4*	$22.9*	$26.6*	$23.1
Tourism Spending						$47.0*	$51.7*	$53.7*	
LGA Revenue	$ 7.7 (1984)	$ 9.1 (1984)		$10.0 (1986)	$11.0 (1987)	$11.0 (1988)	$12.3* (1989)		

* From EIS

Table 22 - Value of Production by Sector in Hastings LGA

	1983/84	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92
Forestry and Timber						$ 9.0*	$ 9.4*	$ 8.2*	
Ag (excluding forestry	$19.1	$18.5		$20.2	$23.0	$25.3*	$27.4*	$27.2*	$25.3
Manufacturing (W&S)	$12.2	$12.5			$18.8	$ 22.2			
(Turnover)					$95.2	$140.1	$140.1		
Building and Construction									
Res		$34.8	$32.5	$26.2		$84.5	$68.9	$65.4	$74.8
Non-Res		$15.1	$15.4	$ 8.3		$13.6	$28.9	$12.2	$30.8
Total		$49.9	$47.9	$34.5		$98.1*	$97.8*	$77.6*	$105.6
Tourism						$177.0*	$199.0*	$186.0*	
LGA Revenue	$12.3 (1983)	$14.6 (1984)		$15.5 (1986)	$17.1 (1987)	$20.3* (1988)	$ 20.2 (1989)	$ 20.6*	

* From EIS

The above tables show that in 1990/91 the value of output of the forest and timber industry to Kempsey Shire and Hastings Municipality were respectively 6.5% and 2.6% of the value of production of these LGA's (excluding the manufacturing and retail sectors for which no data is currently available, the retail sector being the largest sector in these areas). Another observation from the above tables are that fluctuations in the value of output of some sectors of the economy have been greater than the total value of the output of the forest and timber industry e.g. for Kempsey look at the fluctuations in the manufacturing turnover and for Hastings Municipality refer to manufacturing turnover, residential and non-residential construction and tourism.

Conclusion

Some indication of the importance of the output to the regional economy can be gained from comparing the value of timber output (based on the information in the EIS) to information on the production of the regional economy. This shows that the value of output of the forest and timber industry to the Kempsey Shire and Hastings Municipality were respectively 6.5% and 2.6% (excluding consideration of the manufacturing and retail sectors). The fluctuations in the output of some sectors of the economy have been greater than the total value of the output of the forest and timber industry.

Minor Inconsistencies

When the proposal and alternatives are considered in the EIS together with the section on justification of the proposal, the output consequences of different alternatives are somewhat confused.

Alternative 1 which is a continuation of the existing Plan of Management is identified as resulting in an estimated contribution to the local economy of $19.2m per year ($28.8m regionally) [page 315]. This is more than the existing contribution (i.e. $18.9m) identified in Chapter 3 (page 157) and conflicts with the comment in the EIS (page 20) that this alternative would maintain the current value of production.

Justification of the proposal varies between the summary and the body of the EIS. A beneficial impact of $27m per year to the regional economy is identified on page 340 while a beneficial impact of $29.5m per year to the regional economy is identified in the summary (page 24). This latter figure is clearly an error and refers to continuation of the existing Plan of Management.

Conclusion

There are a number of minor inconsistencies between the summary and body of the EIS. This detracts from the readability of the EIS.

3.11.5 Indirect Output and Employment Effects

As well as identifying the direct output and employment effects of forestry and timber processing activities in the region the EIS also identified the direct and indirect output and employment effects by applying a multiplier, a multiplier being a measure of the stimulus provided by a particular sector to the wider economy and being dependent on linkages to other sectors (Centre for Farm Planning and Land Management 1989, page 129).

The EIS adopted an output multiplier of 1.56 and an employment multiplier of 2.16. These figures apparently originated from the "Latrobe Study" and is referenced to Gibbs 1990. However, no such reference is listed in the EIS. An income multiplier for the Grafton region (Kable 1981) was also applied to the K/WMA. While it important to recognise that there are both direct and indirect impacts of forestry activities on the regional economy great care is needed in interpreting multipliers. In this regard the following points are made:

* There are a number of methods that can be used to calculate multipliers for a region, for example input/output analysis, economic base theory and Keynesian methodology (Carter and Milanese 1983). Of these the input/output analysis is probably the most accurate although it can also be time consuming and costly (Kable 1981, pages 5,6). None of these methodologies have been used to calculate the appropriate forestry and timber multipliers for the Kempsey/Wauchope region.

* The multipliers applied to the Kempsey/Wauchope region have been taken from studies of other regions, i.e., Latrobe Valley in Victoria and Grafton in NSW. Studies of the Latrobe Valley examined by the Department have used input/output analysis (although the multipliers are not the same as the ones used in the EIS, see below) while the multipliers suggested by Kable (1981) for the Grafton area are calculated using a Keynesian methodology. The Keynesian approach (and economic base approach) is best suited to measurement of total changes in the level of economic activity occasioned by an event, rather than an examination either of absolute levels of activity, or of the effects of the change on the individual sectors of the economy (Jensen *et al* 1979, page 14).

* Multipliers are sensitive to the industry structure of a particular region and the way that boundaries are defined. For instance, the greater the size of a region the less leakages for the region (i.e. the less likelihood that goods and services will originate from outside the region) because of greater diversity of economic activity (Centre for Farm Planning and Land Management 1989, page 205). Consequently, multipliers calculated for the Latrobe Valley, the Grafton region or elsewhere will only be indicative of the magnitude of output, income and employment impact in the Kempsey/Wauchope region if these regions have a similar industry and regional structure (Centre for Farm Planning and Land Management 1989, page 209). Information to determine whether this is the case has not been given.

* There are a number of types of multiplier that can be generated, for instance, output, income and employment multipliers. In addition, by convention, income and employment multipliers can be converted to four types of " ratio" multipliers ie type IA, IB, IIA or IIB which expresses the multiplier in relation to the initial stimulus (Centre for Farm Planning and Land Management 1989, page 207: Carter and Milanese 1983, page 31). These type multipliers are as follows:

$$\text{Type 1A Multiplier} = \frac{\text{Initial + First Round Effects}}{\text{Initial Effects}}$$

$$\text{Type 1B Multiplier} = \frac{\text{Initial + Production Induced Effects}}{\text{Initial Effects}}$$

$$\text{Type 11A Multiplier} = \frac{\text{Initial + Production Induced + Consumption Induced Effects}}{\text{Initial Effects}}$$

$$\text{Type 11B Multiplier} = \frac{\text{Flow-on Effects}}{\text{Initial Effects}}$$

(Centre for Farm Planning and Land Management 1989, p.207)

It is evident that each type multiplier has a different meaning. It is therefore important that the type of multiplier used in the EIS is identified so that it can be correctly interpreted. This has not occurred in the K/WMA EIS.

* The Centre for Farm Planning and Land Management (1989), identify output multipliers and type IIA employment multipliers for forestry activities in the Latrobe Valley as 1.78 and 1.15 respectively. This is considerably different to the Latrobe Valley multipliers used in the EIS, i.e. employment multiplier of 2.16 and an output multiplier of 1.56.

* The magnitude of multipliers will change over time as industries within a regional economy undergo structural change. Consequently, while multipliers are useful for the period of compilation there are difficulties in extrapolating to other time frames (Hourigan and Kennedy 1985, page 2). This point is illustrated by the conclusions of Jensen et al 1990, page 52 who conclude that *"a model which represents regional economic structure at one time period is inevitably 'invalidated' by the passage of time"*. This is a particularly important point given the structural change that the native hardwood industry is undergoing and is expected to continue to undergo in the future and that the EIS has borrowed multipliers from earlier time periods.

* The use of multipliers to determine the significance of an industry to a region and the effect of a certain course of action does not take account of complementary or substitution effects (Jensen & West 1986, page 76). For example, a decrease in the logging of old growth forests may lead to an increase in tourism based on old growth values, thus offsetting the identified output and employment impacts to the regional economy. Alternatively, it may lead to *"'regional trade-offs', compensatory changes that can take place as adjustments are made to output from (neighbouring) regions in response to a decrease in output from one particular region. In some cases this adjustment in adjacent regions might fully compensate for reduction in output: in others it may stimulate production in quite different regions (e.g. interstate): and yet in other cases it might not be possible to replace foregone production from domestic sources, so that imports would be required. In those instances there would be a net loss in local and national economic activity, despite probable increases in distribution and merchant sectors"* (Hourigan and Kennedy 1985, page 4).

* Mules (1991 page 29) identifies that value added multipliers are a superior concept for measuring economic impact than the more conventional gross output multiplier (which has been used in the Kempsey/Wauchope Management Area EIS) because the latter are

known to be subject to multiple counting and may be misinterpreted. Double counting arises when the output of one group of firms is an input into another group within the same sector. Value added for the sector would be free of double counting as only the extra value added of each firm's production is counted. Misinterpretation may occur if gross output is mistakenly thought of as being equivalent to the economic concept of Gross Domestic Product. *"To do so is incorrect as gross output effects will always greatly exceed their corresponding net impact as measured without double counting"* (Mules 1991 page 30).

* As identified above, the type 11A multiplier can be disaggregated into initial effects, production induced impacts (impacts generated by expenditure of firms and organisations) and consumption induced impacts (impacts generated by expenditure of workers) (Economic and Planning Impact Consultants 1989).

While input/output methods and the multipliers they generate can show the importance of an industry to a region, care needs to be taken in inferring the impacts of a decline in an industry (Economic and Planning Impact Consultants 1989). This is largely because of the assumptions embodied in input/output analysis. These assumptions are outlined below.

"(i) It is assumed that when demand levels change, there is a corresponding change in production and input use. Thus, additional supplies are made available from production not stocks.

(ii) Any change in production implies the maintenance of exactly the same production system. Thus, there are no economies/diseconomies of scale and a 10 per cent change in production produces a uniform 10 per cent change in the use of all inputs i.e., production functions are assumed to be linear and homogeneous of degree one, technological change is absent and there is no factor substitution.

(iii) The household income - household consumption expenditure effects are similarly assumed to be proportionate, while any changes to the level of employment are presumed to be accommodated by employees moving in and out of the region.

(iv) Normally, there is no allowance for any price effects, so that all changes are 'real' and changes in the economy under analysis will not generate any price effects (i.e., a set of 'price-taker' assumptions)." (FCNSW 1990, page 17).

While these assumptions are of little significance when the method is used in a descriptive context they become critical when the methods are used to estimate the quantitative effects of a change in the industry. In short, the deficiency relates to the use of a fundamentally static method to predict the outcome of an essentially 'dynamic' set of adjustments (FCNSW 1990).

"The implication of this is that the use of input-output methods to predict the effects of a change will normally over-estimate the economic impacts if applied

in a simplistic way" (FCNSW 1990, page 18). In the EIS the multipliers have been applied in a simplistic way to estimate the indirect employment impacts of quota reductions and therefore, for the direct employment figures used, indirect employment effects of quota reductions calculated in the EIS are considered to be over-estimates.

This overestimate has resulted because of the assumption implicit in the approach, that any changes in the level of employment will be accommodated by employees moving in and out of the region. If it is assumed that some of the workers remain in the region, which is highly likely, then the impacts of a decline in the industry will not be as severe, since the consumption induced flow-ons of the decline will be reduced through the continued consumption expenditure of those that stay (Economic and Planning Impact Consultants 1989). As identified in the input-output analysis undertaken by Sevil (1991) for the Glen Innes area, the consumption induced component of the wood and forest employment multipliers is a substantial component of the total Type IIA multiplier.

The decision to move or stay will be affected by a number of factors including the prospects of gaining employment in the local region compared to other regions, the likely loss or gain from homeowners selling and the extent of "attachment" to the local region (Economic and Planning Impact Consultants 1989, page 13).

* The EIS identifies that if the proposal did not proceed the employment impacts would be the immediate loss of an estimated loss of 857 jobs in the region. However, this is an exaggeration and relies on the unlikely assumption that all people who become directly unemployed leave the region. Even if the extreme situation did occur, multiplier effects of a given expenditure accrue over time and so it may take several years for the full multiplier effects to work through the economy (Armstrong and Taylor 1993, page 25). The converse would be true of a reduction in local expenditures. This time component of multiplier effects has not been recognised in the EIS.

Conclusion

The EIS has not used any of the techniques available to estimate the multiplier for the Kempsey/Hastings region. Instead multipliers have been borrowed from the Latrobe Valley in Victoria and Grafton in NSW. Having regard to the region and time specificity of multipliers the validity of this method is technically questionable. This has been exacerbated by incorrect referencing of the source of the Latrobe multiplier, the non identification of the type of multiplier being used and the simplistic interpretation of the multiplier leading to an overestimate of the indirect impacts.

3.11.6 Alternatives and Evaluation Methodology

The EIS evaluated the preferred option together with 4 alternatives i.e.:

* Alternative 1 - implementation of the current plan of management

* Alternative 2 - amendment of the forest management activities to incorporate additional conservation measures prescribed in the determination of the Wingham EIS.

* Alternative 3 - phasing out logging of old growth forests within a 5 year period without decreasing the annual sawlog quotas.

* Alternative 4 - immediate cessation of sawlogs.

While some submissions supported the preparation and expansion of plantations as an alternative and others considered that the choice of alternatives heavily weighs potential outcomes towards reduction in timber supply it is important to recognise that the requirement to consider alternatives refers to feasibility: this meaning that they must be feasible to the proponent (in this case State Forests of NSW) as alternatives available to it (Department of Environment and Planning 1985).

Furthermore, plantations planted now or in the near future would take many years to yield quota sawlogs and therefore would not represent an alternative in the short term. Notwithstanding, the Department of Planning notes the NSW Government's commitment to developing additional timber resources for NSW through expansion of the States eucalypt plantations (State Forests of NSW 1993).

Without detail of what submission 161 was referring to when it suggested that the alternative of retaining the status quo should have been considered as a mid ground option it is difficult to comment on this. However, it is not immediately evident to the Department of Planning what options, which provide for greater levels of sustainable yield, are realistically available.

An integral part of the evaluation of alternatives and economic justification of the preferred option was the direct and indirect impact on employment and output, although other factors such as revenue and expenditure, balance of trade were also examined. This economic technique is based on regional impact analysis (input/output analysis). Detailed comments on the application and interpretation of this technique in the EIS are provided elsewhere in this report. The following provides an overview of the purpose of this technique and the difficulties with using this approach by itself to evaluate alternatives or justify a proposal on economic grounds.

Firstly, it is important to draw distinction between impact and evaluation studies. Regional impact analysis is concerned with measuring the economic impact of certain industries on the economy in terms of a number of criteria such as in this case employment and output, with the implication sometimes being drawn that an expanded or new industry, or growth is a desirable development or "benefit" to the economy (Jensen and West 1986, page 75). However, this is quite misleading since both benefits and costs need to be considered in order to evaluate a course of action. Indeed Jensen and West (1986) identify that a cost benefit evaluation study which showed costs exceeding benefits could be seen as a stimulus to the local economy in the input/ output table.

James and Boer (1988, page 86) provide the following insight into the problem of using input/output analysis by itself to evaluate alternatives or justify a proposal. *"Results of input output calculations conducted in EIA's are often poorly interpreted. Almost invariably, it is assumed that jobs and income predicted to flow from a new development project represent an economic benefit to the community. Equally, it*

seems to be assumed that if the project does not go ahead, or if an existing project is closed down, the jobs and income calculated by the input output model will be an economic loss. There is a basic misconception in this assessment".

The NSW Guidelines for Economic Appraisal (NSW Treasury 1990) similarly cautions that extreme care should be used in the interpretation of regional impact analysis primarily because impacts are not equivalent to benefits (or costs) and indeed particularly inefficient use of funds may show a greater "impact" due to its inefficiency.

While it is not uncommon to observe regional impact statements used as justification for a course of action they do not in themselves provide evaluative guidance (Jensen and West 1986). What they do show is regional structure as well as distributional impacts in terms of say income, employment or output. Even these distributional impacts are limited to the general region and industry groupings and do not identify impacts on community or disadvantaged groups etc.

Having regard to this it is of some concern that aspects of regional impact analysis, by itself, forms an integral part of both the evaluation of alternatives and economic justification of the preferred option with little regard to economic efficiency.

Economics is concerned with more than distributional issues. It is the science of resource allocation and as such the aim of economic analysis in general is to make wise use of available resource (James and Boer 1988 page 9). Thus it is important to determine the ways in which society can maximise community welfare by using scarce resources.

The NSW Guidelines for Economic Appraisal (NSW Treasury 1990) proposes two techniques for economic appraisal, cost benefit analysis (CBA) and cost effectiveness analysis (CEA). Both techniques have the underlying objective of identifying alternatives which maximise community welfare and thus improve economic efficiency and require as many as possible of the benefits and costs to be quantified. The Guidelines also clearly identify that while regional impact analysis may prove a useful adjunct to CBA (consideration of costs and benefits) it is not an alternative to CBA (NSW Treasury 1990).

It is clear from the Manual for Environmental Impact Assessment (Department of Environment and Planning 1985) that justification of the proposal requires weighing up the overall environmental penalties and benefits (costs and benefits) to identify the net benefits which appear to justify proceeding with the development. Where it recognised that this consideration of costs and benefits may take a written form, it is clear that the cost benefit framework is appropriate.

While consideration of costs and benefits addresses the issue of efficiency, ideally decision makers also need to know the identity of the groups which may both gain and lose as a result of their decisions, and the nature and size of those gains and losses (Department of Finance 1992). A number of techniques may be used as an adjunct to the consideration of costs and benefits in order to take into account these equity or distributional issues. These include distributional incidence charts or matrices, planning balance sheets and regional impact statements.

Conclusion

An integral part of the evaluation of alternatives and justification of the proposal is based on aspects of regional impact analysis. While such an approach is of use in identifying the the structure of a regional economy, the employment, income and output impacts in a region and the distribution of these impacts among industries, it is not an evaluation methodology. Having regard to the legislative framework, Treasury Guidelines on economic appraisal, the literature on regional impact analysis and the purpose of economics it is considered that such an analysis should be considered as an adjunct to the consideration of the economic costs and benefits of the proposal and alternatives and not as an alternative to it.

3.11.7 Consideration of Costs and Benefits

To demonstrate the type of outcome that may result when streams of economic costs and benefits are assessed over time the Department of Planning has undertaken a partial cost benefit analysis of the alternatives considered in the EIS, with the exception of alternative 3. Consideration of this alternative was omitted as it was difficult to forecast timber flows. The methodology applied by the Research Branch of the Resource Assessment Commission (Streeting and Hamilton 1991) in its economic analysis of the south eastern forests has been used.

It should be noted that the analysis undertaken by the Department of Planning is not included in this report as a definitive cost benefit analysis for the purposes of identifying the most appropriate alternative but is indicative only, as specific data for the K/WMA was not readily available. Consequently, for the purposes of this indicative analysis, data from the EIS on wood yields and employment were used and information from the "Economic Analysis of the South Eastern Forests" (Streeting and Hamilton 1991) on the shadow price of sawlogs, shadow wage rate, sawmill processing costs and harvesting, management and transport costs were used. The analysis includes information on loss of quota sawlogs to the end of the first cutting cycle.

While the Department of Planning recognises avoidance of road pavement damage from logging trucks may be considerable (as identified in a number of submissions) it has not been possible to quantify this in the indicative analysis undertaken.

Loss of capital from production is not included in the analysis as it is a sunk cost (NSW Treasury 1990). Notwithstanding this, some capital equipment such as prime movers and bulldozers could be productively employed elsewhere in the forestry industry or in other industries (Streeting and Hamilton 1991).

Table 23 below lists the major economic benefits and costs from the cessation of logging in Crown-timber lands (adapted from Streeting and Hamilton 1991). The table is divided into two parts. The items above the line are quantified in the analysis while the items below the line could not be readily quantified.

Using the cost benefit framework, as applied by Streeting and Hamilton (1991), the principal costs of adopting alternatives of: increasing conservation areas and adopting the SEMGL;

amendment of the forest management activities to incorporate additional conservation measures prescribed in the determination of the Wingham EIS; phasing out logging of old growth forests within a 5 year period; immediate cessation of old growth logging; instead of continuing operations under the 1988 Plans of Management, would be the value of sawlogs foregone and the economic and social costs of additional direct unemployment in the region. The principal benefits would be those associated with the preservation of old growth and the savings from sawmill operations and management, harvesting and transportation of logs.

Preservation values of forests encompass a diverse set of values including natural values such as their role in maintaining biodiversity, the value of the forest to scientific research and the effect of the forest on areas outside its boundaries through factors such as maintenance of water quality, prevention of soil erosion, wind control, and the provision of wildlife corridors. More human oriented values include wilderness value and aesthetic and spiritual values (Streeting and Hamilton 1991, page 11).

Table 23 - Major Economic Benefits and Costs of Reduction in Logging

Benefits	Costs
Capital and labour cost savings	Value of sawlogs foregone
- forest management[a] - log harvesting - log transport - sawmilling	Economic cost of unemployment
Avoidance of damage to natural environment	Social cost of unemployment
Maintenance of recreation and tourism opportunities	Loss of some opportunities for recreation and tourism
Reduced activity by logging trucks - avoidance of road pavement damage - reduction in air and noise pollution	
Maintenance of forest suitable for non-timber commercial uses (e.g. bee-keeping)	

a Includes management costs associated directly with harvesting. The ongoing cost of managing the forest for commercial timber production is assumed to be equal to the cost of managing the forest for preservation. (Streeting and Hamilton 1991, p.61).

The general purpose of cost benefit analysis is to identify options that yield the highest net benefits (total benefits less costs) to the entire community. Generally, only options with positive net present values (NPVs) should be undertaken with the preferred option being that with the highest net present value.

To do this unpriced values (both use values and non use values) need to be assessed. While many methods to do this exist e.g contingent valuation, surrogate market technique, dose-response approach (Department of Finance 1991), transferring values estimated at other sites (EPA submission 141) (Henshall Hansen Associates and Read Sturgess and Associates 1992) insufficient time and resources has meant that these approaches have not been used within this report.

An alternative approach acknowledges that it may be difficult to obtain reliable estimates of projected community values for the natural environment e.g. preservation values. Under these circumstances the cost benefit framework can still be applied by assessing 'threshold' or 'switching values' (James 1992).

The 'threshold' or 'switching value' is estimated by undertaking the analysis without considering the unquantified component e.g. preservation value of old growth. This approach enables the economic loss of withdrawing forest areas from logging to be estimated. This 'cost' is the price the community would have to pay if it preferred areas to be placed in reserves rather than continued to be used for wood production purposes (James 1992). Such an approach structures the decision making process and should increase the rationality of the final decision (Henshall Hansen Associates and Read Sturgess and Associates 1992) although it is recognised that by necessity a final value judgement needs to be made by the decision maker (Henshall Hansen Associates and Read Sturgess and Associates 1992).

This threshold value approach is demonstrated in the analysis undertaken by the Department of Planning. Preservation values were excluded because they are difficult to determine and some would argue can not or should not be measured in dollars. These values represent a major benefit of reduced logging. In addition, the social costs of unemployment were excluded (these represent a cost of reduced logging). The results of the analysis, excluding these two major variables, are given in Table 24.

Table 24 - Results of Cost/Benefit Analysis Carried out by the Department of Planning

Discount Rate	Proposal	Alternative 2	Alternative 4 Cessation of Growth Logging
4%	- $2.5M	- $3.4M	- $13.5M
7%	- $2.1M	- $2.9M	- $10.9M
10%	- $1.8M	- $2.5M	- $9.2M

* Amounts are net present values

The above switching values for the three options examined are negative and since royalty values may underestimate the economic value of timber (Read Sturgess and Associates 1992) and the social costs of unemployment have been excluded these figures represent the

minimum logging benefits foregone by conserving areas of old growth. As such, they are the **minimum** costs to the community of placing the areas in conservation reserves. These costs will be higher still if the social costs of unemployment (e.g. a social adjustment package) is taken into consideration (or other products apart from sawlogs are included although sawlogs are the main wood product affected). In theory, if the community was willing to pay these amounts then the net present values of the analysis would be positive and therefore the conservation options should be adopted. In practice, some people consider that the community should actually make these payments to enable conservation options to be adopted.

The switching value can be interpreted in several ways to give it some perspective:

* as a one off lump sum payment;
* as a continuing annual payment;
* as a lump sum payment by a proportion of the adult population of a region;
* as a continuing payment by each adult in the same region;
* having regard to the Krutilla and Fisher argument that the preservation values would increase over time in comparison to the value of ordinary goods and services (RAC 1992 Vol. 1).

With the exception of the Krutilla and Fisher method the switching values are given below for a 7% discount rate (NSW Treasury 1990). As there may be some debate over the region which may have an interest in the issue of preservation of old growth in the K/WMA and might express a willingness to pay to have it preserved, three regions have been used. These are the Hastings Municipality/Kempsey Shire (denoted by 3 in Table 25), Northern and Mid-North Coast Region (denoted by 2 in Table 25) and NSW (denoted by 1 in Table 25). The adult population (18 years and over) of these respective regions is 55,175, 300,917 and 4,215,581 (ABS, 1992).

Table 25 - Interpretation of the Switching Value

Method of Payment		Proposal	Alternative 2	Cessation of Old Growth Logging
One off lump sum		$ 2.1M	$ 2.9M	$10.9M
Continuing annual payment		$147,000	$203,000	$763,000
One off lump sum	(1)	$38.06	$52.56	$197.55
per adult in the	(2)	$ 6.97	$ 9.64	$ 36.22
regions	(3)	$ 0.46	$ 0.64	$ 2.41
Continuing annual	(1)	$ 2.66	$ 3.68	$ 13.83
payment per adult	(2)	$ 0.48	$ 0.68	$ 2.53
in the regions	(3)	$ 0.04	$ 0.05	$ 0.18

One important point to note is that these results do not include any consideration of mill closure. This issue is considered later in this report.

The threshold model demonstrates that the costs to the wider community (Northern and Mid-North Coast Region and NSW) of preserving various areas of old growth in the K/WMA would be modest with the economic costs increasing the greater the area of forest conserved. Costs would not be so modest if it were assumed that interest in the preservation of old growth in the K/WMA is limited to the region of Hastings Municipality and Kempsey Shire.

Caution needs to be used in this interpretation of the results as by applying this same approach to all management areas on the north coast (and indeed other environmental dilemmas where some expression of willingness to pay is required) would ignore the cumulative consequences to the budget of the household or individual.

Nevertheless, evidence from the RAC inquiry suggests that the community places high values on old growth forests.

A further relevant factor to consider is the distribution of economic costs and benefits (Commonwealth Department of Finance 1991). Economic and social costs of unemployment are borne by individuals in the local community, while value of sawlogs foregone is borne by the local mill and the State Forests of NSW. Benefits in sawmill, log harvesting and mill savings accrue to the mill, forest management savings accrue to the State Forests of NSW, savings in reduced road pavement damage accrue to Council and the local community and the benefits from preservation of old growth accrues to the entire wider community.

Sensitivity Testing

Sensitivity testing is necessary to consider the impact of changes to key variables. This compliments the sensitivity analysis embodied in using different discount rates in Table 4.6. It is apparent from this table that the results of the economic analysis are not strongly influenced by reasonable variations in the discount rate.

Sensitivity testing was considered warranted for the five major variables in the economic analysis. This testing included the following:

* lower and higher estimates of the shadow price of sawlogs (i.e., rising and falling by a flat rate of 1% per annum from the base case of $\$56.50/m^3$);

* lower and higher estimates of average sawmill variable processing costs (i.e., 20% higher and 20% lower than the base case of $\$9.67/m^3$);

* lower and higher estimates of the level of unemployment (i.e., 75% remain unemployed for three years and 25% remain unemployed for three years as opposed to the base case of 50%);

* lower and higher economic costs of unemployment (ie \$300/wk and \$500/wk rather than the base case of \$400/wk);

* lower and higher harvesting, management and transportation costs (i.e., \$25 and \$35/m^3 rather than the base case of \$30/m^3).

Table 26 summarises the results of the sensitivity analysis under the set of assumptions most favourable to logging and the set of assumptions most favourable to the preservation of various areas of the old growth (i.e., high sawmill processing cost savings, a high management, harvesting and transportation cost saving, a falling sawlog shadow price over time, a lower long term unemployment and a low economic cost of unemployment).

Table 26 - Results of the Sensitivity Testing (NPV)

	Proposal	Alternative 2	**Cessation of Old Growth Logging**
Least favourable to logging	- \$0.7M	- \$1.0M	-\$ 3.7M
most favourable to logging	- \$3.7M	- \$5.1M	- \$19.1M

It is evident from the sensitivity testing that considerable variation in net present values arise from varying the five major variables in the economic analysis. This variation is more evident for options involving greater areas of conservation.

Again it needs to be emphasised that the calculated net benefits need to be weighed against the preservation value of the old growth conserved and the social costs of unemployment that would flow from the cessation of logging. In a more comprehensive analysis of the options canvassed in the EIS the unquantified preservation value of old growth for the various options could be qualitatively dealt with in more detail and the social costs of unemployment e.g., an appropriate social and business adjustment package, could be examined and factored into the analysis. The latter addition would have the effect of increasing the amount that the community would need to be willing to pay (or actually pay) to justify adoption of the conservation options.

While the above indicative analysis does not, in itself, enable conclusions to be drawn on whether old growth should be logged or not, or what level of conservation is appropriate, it does offer a framework within which the allocations of forest resources between conservation and logging can be assessed and alternatives can be compared, taking into account both the costs and benefits to the community over time. The analysis also gives an indication of the magnitude of (minimum) net economic benefits foregone by conserving various areas of old growth forest and the minimum price the community could be expected to pay to justify the preservation of forest areas under consideration.

Conclusion

Using a cost benefit framework the Department of Planning has undertaken an indicative analysis using the threshold value model. This approach recognises that it is difficult to value natural attributes and instead identifies the economic cost of adopting

options of increasing conservation. Having regard to only quota sawlogs the analysis shows that the minimum costs to the wider community of conserving various areas of old growth in the K/WMA would be modest with the minimum costs considerably more if only the regional community is considered. The minimum costs identified in the indicative analysis would also be higher if other wood products are included and if the social impacts of adopting the alternatives were able to be valued. Nevertheless, evidence from the RAC inquiry suggests that the community places high values on old growth forests. In terms of the distribution of impacts, in particular employment loss, these would be largely concentrated in the Kempsey and Hastings LGA's.

3.11.8 State Forests of NSW Expenditure and Revenue

The EIS provides the estimated expenditure associated with forest management to the end of the current cutting cycles together with estimated revenue for each alterative examined, although these figures have not been discounted to Net Present Value. With regard to revenue the reason given was that the revenue stream is highly unpredictable with the future price of timber products dependent on a number of factors including:

- Government policy on forest management (both in Australia and overseas);
- exchange rate fluctuations;
- an increasing proportion of timber processing and value adding.

With regard to costs the EIS identifies that the cost stream would be affected by factors such as the cost of environmental protection and management, new scientific knowledge in relation to biological values of forestry, advances in technology and other factors.

While the DOP recognises that future expenditure and revenue streams will be affected by factors such as those outlined the above, the accuracy and relevance of valuing expenditure and revenue at current day values is still limited by these factors and also by the additional factor of not having any regard to the discounting effect of time. As such the Department considers that if it is to be assumed that all other factors remain constant (as is implicit in valuing the future stream of expenditure and revenue using current dollar prices) then it would be more appropriate to examine an even distribution of expenditure and revenue over time and thus at least have regard to the discounting effect of time.

As the EIS did not provide disaggragated expenditure information (between Kempsey and Wauchope management areas) for the preferred option, this additional information was requested from State Forests to facilitate the analysis of the preferred option. The results of the Department of Planning's discounted cash flow analysis for the options examined in the EIS, using a 7% discount rate, are given in Table 27.

Table 27 - Discounted Cash Flow Analysis of Alternatives

Alternative 1	Proposal	Alternative 2	Alternative 3	Alternative 4
$6.16m	$4.76m	$3.95m	-	-$1.92m

For all options analysed the DOP has assumed that expenditure and revenue are distributed evenly over the remainder of the cutting cycle. This is considered to be a reasonable assumption given that the major revenue item, i.e. quota sawlogs, will generally be harvested on an even flow sustained yield basis and most cost items relate to ongoing management activities (with the exception of road construction). Although it is recognised that quota reduction will be phased in over time.

No analysis was undertaken for Alternative 3 (i.e. cessation of old growth logging in 5 years) as it was not considered to be reasonable to spread the identified expenses evenly over time. This was because there would be different costs associated with logging of old growth in the first 5 years of the proposal and logging of regrowth from that time on. It is not possible to distinguish these costs from the data provided in the EIS.

The analysis shows that, on the basis of the figures provided by State Forests and the assumptions outlined above, logging of K/WMA in accordance with alternative 1, alternative 2 and the proposal is financially viable, with alternative 1 yielding the highest financial return.

The Department of Planning considered it worthwhile to compare the revenue and expenditure figures used in the EIS to those obtained from discounting the future stream of revenues and expenditure. Table 28 provides this information. The most noticeable effect is that the NPV of revenues, expenditures and profit levels are substantially less than those used in the EIS. While there is considerable difference in absolute figures, the proportional losses of revenue for each option remain the same (because of the Department of Planning's assumption of an even distribution of revenue and expenditure over the remainder of the cutting cycle).

Table 28 - Comparison of Revenue and Expenditure Figures

	Alternative 1		Proposal		Alternative 2		Altn. 3		Alternative 4	
	EIS	DOP	EIS	DOP	EIS	DOP	EIS	DOP	EIS	DOP
	$m		$m		$m		$m		$m	
Revenue	$59 vs	$27.8	$55.8 vs	$26.3	$53.4 vs	$25.1	$34.6	-	$23.4	$10.8
Expenditure	$45.3	$21.6	$45.1	$21.5	$44.4	$21.2	$34.2*	-	$27.6	$12.8
Profit	$13.7	$ 6.2	$10.7	$ 4.8	$ 9.0	$ 3.9	$ 0.4	-	-$4.2	-$2.0

It is evident from the above consideration that it is important that the discounting effect of time be included in consideration of revenues and expenditures as a considerably different result is obtained. This is especially important when loss of revenue is included as a consideration in deciding the preferred option, as it is in Chapter 13 of the EIS.

Some Minor Inconsistencies in Revenue and Expenditure Data

Revenue and expenditure data is found within the EIS in a number of locations e.g. page 220, 308, 311, 312, 313, 316, 322, 325, 326, 329 and in a number of different forms e.g in disaggregated table form, aggregated table form and graphic form. Unfortunately there are a

number of minor inconsistencies between data which are representing the same thing. For example:

* the revenue figure for alternative 1 used in the above table i.e. $59M (refer to page 316 of the EIS) is given elsewhere in the EIS as $58.9M (refer to page 313) and $60.9M (refer to page 220).

* the expenditure figure for alternative 1 used in the above table i.e. $45.3M (refer to page 316 of the EIS) is given as $45.5M on pages 308, 312, 313 of the EIS.

* the revenue figure for the proposal used in the above table i.e. $55.8M (refer to page 220) is given as $55.9M on pages 308, 311 and 313 of the EIS.

* the expenditure figure for alternative 2 used in the above table i.e. $44.4M is given on pages 308 and 312 as $44.5M.

* the expenditure figure for alternative 3 used in the above table i.e. $34.2M is given as $34.7M on pages 308, 312, 313.

While most of these inconsistencies are only of a minor nature they can affect the interpretation of the data. For instance, with regard to the inconsistencies with the data for alternative 1, identified above, page 223 of the EIS identifies an 8.5% decrease in revenue as a consequence of adopting the proposal while interpretation of the information on page 311 of the EIS results in a 5% decrease in revenue as a result of adopting the proposal.

Conclusion

The Department of Planning considers that when providing information on revenue and expenditure it is appropriate to consider the distribution of these over time and discount the flows back to present value terms rather than value it in current day terms as provided in the EIS. Based on the information provided in the EIS and assuming an even distribution of revenue and expenditure over time it was evident that the proposal and alternatives 1 and 2 provide a positive financial return to State Forests while alternative 4 is not financially viable. It was not possible to analyse alternative 3. Comparing the results of the analysis to the undiscounted figures given in the EIS it is evident that the absolute level of profit from adopting the alternatives are considerably less than provided in the EIS. There are also a number of minor inconsistencies in the revenue and expenditure data which complicates consideration of this matter.

3.11.9 Implications of Intergenerational Equity and the Precautionary Principles - An Economic Perspective

The economic goal of maximising human welfare is generally complemented by discussion of appropriate distribution of wealth. A relatively new aspect of the equity debate is the distribution of wealth over time (Hohl and Tisdell 1992). Conceptually intergenerational equity can be achieved in a number of ways including maintaining natural capital and adopting the precautionary principle (Young 1993).

Community welfare in the broadest sense is derived from a combination of natural and man made capital. Man made capital, however, may not be a satisfactory substitute for natural capital and any degradation of natural capital may be irreversible.

Peerce et al (1990) advocate *"constancy of the natural capital stock* as a condition of sustainable development, while Young (1993) identifies that all natural resources do not need to be preserved as some play no significant role in major ecological and life support systems. Krutilla and Fisher (1975) identified that the value of environmental goods and services (natural capital) can be expected to increase exponentially over time compared to goods and services from man made capital (James 1993, p.2).

James (1993 p.2-3) identifies the following *"recommendations that flow from a recognition of the value of natural capital: maintaining and enhancing existing stocks of ecological and natural resources; maintaining sustainable flows of products and services from existing stock; replacing exhaustible resources with renewable resources to counter resource depletion; and undertaking environmental shadow projects to replace or replicate the characteristics or functions of natural resources that have been used or destroyed".*

In the case of logging of the K/WMA some of these are already in place such as moving to sustainable flows of wood products, while in a broader sense there is a substitution of softwoods for hardwoods in many applications. It is important, however, that the value of capital stocks is recognised in the Minister's determination by trying as far as possible to maintain and enhance these existing stocks of ecological and natural resources, whose depletion could have significant irreversible or adverse consequences for future generations.

The precautionary principle refers to how to act responsibly in the face of uncertainty and lack of full scientific knowledge. It does not mean that developments with uncertain ecological impacts should not be undertaken but that all options should be explored when considering a significant, potentially irreversible action with unpredictable consequences (Young 1993). Logging of old growth in the K/WMA could be considered to be such an action. Hufschmidt (1979) identifies a number of ways to incorporate this principle into economic analysis including lowering the discount rate when dealing with benefits that accrue to future generations; assigning shadow prices to reflect interests of later generations. Hufschmidt points out, however, the difficulties with doing this and identifies the alternative of introducing safe minimum standards. The adoption of safe minimum standards is most appropriate to the conservation of renewable resources with critical zones; including flora, fauna, with the rationale being that uncertainty and extra market values surround the future use of irreplaceable resources. These resources should thus be preserved as long as the social costs of doing so are reasonable. Refer to the Department of Planning's consideration of Social Impacts as well the foregoing discussion of Economic Impacts.

While the Department of Planning recognises that there are considerable inaccuracies and uncertainties in the setting of safe minimum standards or conditions (see Hohl and Tisdell 1992) the prescriptions imposed by the Department (in particular refer to the flora and fauna sections of this report) are based on the best available information, attempt to deal with uncertainty of impacts of logging operations and are likely to improve the probability of survival of species.

Conclusion

The Department of Planning recognises the value of natural capital stock and the uncertainty and lack of full scientific knowledge on the impacts of logging on the environment. Consequently, it considers that it is appropriate to adopt a precautionary approach. This includes the adoption of numerous prescriptions to protect critical flora, fauna and habitat as well as limiting the length of approval (refer to other sections of this report).

3.11.10 Social Impact Assessment

Introduction

While the EIS did provide some information on the existing social environment in Hastings Municipality and Kempsey Shire (eg age distribution, population growth and projections, employment, incomes, community services) and the social impacts of the proposal (in terms of employment, mill closure, community services, uncertainty and conflict) and the consequences of not proceeding (eg employment, mills, decline of populations/towns, community services, community conflict and dislocation) in many respects this analysis would have benefitted from a more rigorous approach. This is especially the case with the consideration of alternatives which did not consider social consequences apart from employment.

The RAC (1992a) provides an outline of social impact assessment methodology which combines the two schools of thought on how this should be done. i.e. the social systems approach which involves technical analysis of social change based on data collection and modelling and the sociopolitical process approach which emphasises interaction with the community rather than on technical analysis (Hollick 1993, page 191-192).

To add to the information provided in the EIS the Department of Planning has undertaken some further work to help in the consideration of social impacts. While this draws on the methodology outlined by the RAC it has not been possible to complete a full social impact assessment.

Socio-demographic Profile of Hastings Municipality, Kempsey Shire and the Towns of Kempsey and Wauchope

Demographic Context

At the time of the 1991 Census the NSW population was more than 5.7 million. Of these marginally more than 50% were male. Pre-school children numbered around 7.5%, all children under 15 years of age around 22.1% and a further 61.6% between the age of 15 and 59. 16.3% of the population were over 60 years of age.

The Study Area

The regions examined in the EIS included the Kempsey Shire and the Hastings Municipality. In addition to these the Department of Planning has examined the town of Kempsey and the town of Wauchope. Table 29 provides some initial population statistics for these regions.

Kempsey Shire, Hastings Municipality and the towns of Kempsey and Wauchope all have a slightly higher proportion of females than males and have a a higher proportion of people younger than 15 than does NSW. All these areas also have a higher proportion of over 60 year olds than NSW with Hastings Municipality having by far the highest proportion, i.e. 26.8%.

All areas have a proportionally lower potential workforce than NSW with less than 56% of the population between the ages of 15 and 59. Hastings Municipality has the lowest figure at 51.9%.

Table 29 - Population Characteristics

	NSW	Kempsey Shire	Hastings Munic.	Wauchope Town	Kempsey Town
Total Population	5,731,906	25,343	50,058	4,305	10,118
Male (%)	50.36	49.7	48.7	48.1	47.5
Females (%)	49.64	50.3	51.3	51.9	52.5
Younger than 5 (%)	7.5	8.4	6.8	7.2	8.4
Younger than 15 (%)	22.1	25.1	21.3	22.2	24.9
15-59 Years (%)	61.6	55.6	51.9	55.5	55.0
Over 60 (%)	16.3	19.2	26.8	22.5	20.2

Population Growth

"The North Coast region is the fastest growing region in the State with more than double the State average growth rate. The region is expected to increase its share of the State's population from 6.5% in 1986 to between 9 and 11% by 2021, largely as a result of migration". (Department of Planning 1993, page 11).

Growth rates have varied between shires and towns on the North Coast. From Table 30 it is evident that between 1976 and 1991 both the Hastings Municipality and Kempsey Shire have experienced considerably greater average annual population growth than NSW. Nevertheless, the average annual population growth rate of the towns of Wauchope and Kempsey has been considerably different. Kempsey's population has been essentially static since 1976, albeit with a small decline between 1986 and 1991 while Wauchope's average annual population growth rate has generally been well below that of NSW with the exception of a period between 1981 and 1986 when it was more than double that of the States average.

Table 30 - Population Growth

	1976	1981	1986	1991	Average Annual Growth 1976-81	1981-86	1986-91
Kempsey Town	8,881	9,037	9,335	9,049	0.35	0.65	-0.62
Wauchope Town	3,525	3,645	4,181	4,297	0.67	2.78	0.55
Kempsey Shire	17,041	19,582	22,900	25,343	2.82	3.18	2.05
Hastings Municipality	25,323	35,507	41,804	50,058	6.99	3.32	3.67
NSW	4,777,103	5,126,217	5,401,881	5,731,906	1.42	1.05	1.19

Marital Status

From Table 31 it is evident that with the exception of the town of Kempsey the residents of the areas examined are more likely to be married than the residents of NSW.

Table 31 - Selected Marital Status

	NSW	Kempsey Shire	Hastings Munic.	Wauchope Town	Kempsey Town
Presently Married	55.7	58.5	63.9	58.9	52.1
Never Married	29.4	24.8	19.3	23.8	27.6
Other	14.9	16.7	16.9	17.2	20.3
Total Number	4,468,129	18,992	39,371	3,312	7,622

Family Type

Table 32 presents details of the family type for NSW and the four areas being examined. While all the areas examined, with the exception of Hastings Municipality having a higher proportion of single parent families with children the figure for the town of Kempsey is significantly higher than the other areas i.e. 21.1% of family types. Furthermore, while all the areas examined have a higher proportion of couples without children than NSW, Hastings Municipality has a very high proportion i.e. 44.5%. All areas have a lower proportion of couples with children than NSW..

Table 32 - Selected Family Types

	NSW	Kempsey Shire	Hastings Munic.	Wauchope Town	Kempsey Town
Single Parent with Children	13.1	15.5	10.9	13.7	21.1
Couple with no Children	31.4	35.7	44.5	36.2	32.6
Couple with Children	53.4	48.8	44.6	48.8	44.3
Total Number	1,461,118	6,560	13,272	1,181	2,610

Education

In NSW 12.8% of the population (over 15 years of age) had left school under the age of 15 (Table 33). In all areas examined the percentage was higher than this with the town of Wauchope having by far the largest percentage of the population under 15 leaving school i.e. 21.2%. In contrast to the other areas examined Wauchope town had a lower proportion of the population (than NSW) leaving school between the age of 15 and 18. All areas had a lower proportion of the population (than NSW) continuing with schooling until over the age of 19. This is particularly the case with the towns of Kempsey and Wauchope which both had 1.5% of the population (over 15 years of age) leaving school at age 19 or over compared with the NSW average of 5.5%.

Table 33 - Age Left School

	NSW	Kempsey Shire	Hastings Munic.	Wauchope Town	Kempsey Town
Under 15	12.8	17.1	17.9	21.2	17.2
15-18	67.8	68.4	66.9	64.8	67.8
19 or Over	5.5	1.7	2.0	1.5	1.5
Still at School	4.7	5.0	4.4	5.8	5.3
Other	9.3	7.8	8.7	6.7	8.4
Total Number	4,468,838	18,989	39,318	3,342	7,600

Higher education qualifications are considerably less common in all the regions examined than they are in NSW as a whole. Of all the areas examined the towns of Kempsey and Wauchope have the lowest proportion of the population with higher education qualifications (Table 34).

Table 34 - Educational Qualifications

	NSW	Kempsey Shire	Hastings Munic.	Wauchope Town	Kempsey Town
Degree	7.9	3.2	4.4	2.5	2.6
Diploma	5.2	4.4	5.0	3.8	3.6
Trade	14.5	13.9	15.6	12.7	11.9
Not qualified/Other	72.3	78.4	75.2	81.1	81.9
Total Number	4,468,864	19,005	39,411	3,338	7,617

Income

40.2% of persons in the State (aged 15 or more) reported an income of less than $12,000 pa. The equivalent figure for all the regions examined was considerably higher than the State average. Similarly all regions also had a higher proportion of the population (aged 15 or more) earning less than $30,000 pa compared to the NSW average. The proportion of the population earning less than $30,000 was highest in the town of Wauchope and Kempsey i.e. 86.1% and 86.7% respectively, compared to 73.9% for NSW. Hastings Municipality has the highest proportion of the population (aged 15 or more) which earns over $30,000 (see Table 35).

Table 35 - Income Levels (persons aged 15 or more)

	NSW	Kempsey Shire	Hastings Munic.	Wauchope Town	Kempsey Town
No Income/Less than $12,000	40.2	53.2	51.9	52.8	53.3
$12,000 to $30,000	33.7	32.3	31.5	33.3	33.4
Greater than $30,000	16.4	6.8	8.5	6.0	6.4
Not Stated	9.6	7.8	8.1	7.8	7.0
Total Number	4,468,736	18,996	39,370	3,340	7,604

Ethnicity

Kempsey Shire, Hastings Municipality, and the towns of Wauchope and Kempsey show high homogeneity with between 88% and 94% of the population being Australian born compared to 74.79% for NSW as a whole. Of the areas examined the Hastings Municipality has the lowest proportion of Australian born residents and the highest proportion of other english speaking residents (see Table 36).

Table 36 - Ethnicity

	NSW	Kempsey Shire	Hastings Munic.	Wauchope Town	Kempsey Town
Australia	74.79	92.0	88.0	93.6	93.5
Other English Speaking	7.88	4.5	7.5	3.5	3.3
Other	14.91	2.4	2.9	1.7	1.9
Total Number	5,731,906	25,304	50,044	4,305	10,118

Note: Does not add up due to Data Location in ABS Census.

Aborigines and Torres Strait Islanders

The NSW Aboriginal and Torres Strait Islanders population numbers 69,914 or 1.2% of the total population. All the areas examined except Hastings Municipality have a higher proportion of Aborigines and Torres Strait Islanders than NSW. Kempsey Shire and the town of Kempsey both have significantly higher proportions i.e. 5.2% and 8.1% (see Table 37).

Table 37 - Aboriginal and Torres Strait Islanders

	NSW	Kempsey Shire	Hastings Munic.	Wauchope Town	Kempsey Town
Aborigines and Torres Strait Islanders (% of population)	1.2	5.2	0.9	2.1	8.1
Total Number	5,732,006	25,349	50,058	4,297	10,131

Housing

In NSW around 68.9% of people either own their own home or are purchasing it. The figures for the areas examined are not dissimilar with the exception of the town of Kempsey which is considerably lower, i.e. Hastings Municipality 69.7%, Kempsey Shire 70%, town of Wauchope 71.3% and town of Kempsey 62.2%.

An indicator of the existence of transient populations and perhaps economically disadvantaged groups is the proportion of the population in non-permanent accommodation. From the 1991 Census, data is available on the proportion of the population living in caravans and improvised housing. This gives at least a first approximation to the issue in question. The data is provided in Table 38.

The figure for NSW indicates that 1.2% of the population live in less than permanent accommodation. For all the areas examined the proportion of the population living in less than permanent accommodation is greater than the NSW average. The highest degree of transience is in the Hastings Municipality followed by the Kempsey Shire and the Town of Kempsey.

Table 38 - Proportion of Total Population in Caravans & Improvised Housing

	NSW	Kempsey Shire	Hastings Munic.	Wauchope Town	Kempsey Town
% of Population	1.2	3.7	4.5	1.7	2.5
Total Number	5,539,328	24,635	47,970	4,167	9,685

Labour Force

General labour force statistics are provided in Table 39. As can be seen the proportion employed, in all areas examined, is considerably lower than the NSW average with the town of Kempsey having the lowest proportion of the population employed.

In the town of Wauchope the proportion of the population that is unemployed is lower than the State average while for the remainder of the areas examined the proportion unemployed is higher than the State average. All the regions examined with the exception of the Kempsey Shire have a higher proportion of the population (over 15 years of age) not in the labour force than the NSW average of 47.3%. The unemployment rate for all the areas examined, however, was higher than the State average.

Table 39 - Labour Force Status (persons aged 15 years or more)

	NSW	Kempsey Shire	Hastings Munic.	Wauchope Town	Kempsey Town
Employed	55.34	41.3	41.5	44.4	40.3
Unemployed	7.00	12.0	7.7	6.6	11.3
Not in the Labour Force	47.30	46.8	50.9	49.0	48.4
Total	4,348,898	18,595	36,573	3,277	7,503
Unemployed Rate	11.23	15.8	15.6	13.0	21.8

Occupation of the Workforce

Data on occupation of the workforce is provided in Table 40. Managers and professionals, upper white collar workers, comprise about 31.6% of the NSW workforce. A lower proportion is found in all the areas examined with by far the lowest proportions being in the towns of Wauchope and Kempsey.

Clerical and sales persons, that is lower white collar workers, comprise 29.4% of the NSW workforce. The proportion is slightly lower in the Kempsey Shire, Hastings Municipality and the town of Wauchope, but higher in the town of Kempsey.

Semi-skilled and unskilled workers, machine operators and labourers comprise 19.1% of the NSW workforce. The proportion of this group in the Hastings Municipality is not dissimilar (i.e. 19.4%) while that for the remainder of the areas examined is considerably higher, with the town of Wauchope having the highest proportion of semi-skilled and unskilled workers (i.e. 27.1%).

All areas examined have a higher proportion of tradesmen than NSW.

Table 40 - Occupations

	NSW	Kempsey Shire	Hastings Munic.	Wauchope Town	Kempsey Town
Managers, Professionals	31.6	28.7	30.5	20.8	21.9
Clerical and Sales	29.4	26.6	29.2	27.9	31.8
Tradesmen	13.5	15.2	15.0	15.0	16.1
Plant & Machinery Operators	6.9	9.2	5.5	9.0	9.6
Labourers	12.2	14.6	12.9	18.1	15.4
Other (including not stated)	6.4	6.6	5.8	6.5	5.4
Total Number	2,405,901	7,743	15,851	1,444	3,028

Industrial Base of the Workforce

Earlier in this report the Department examined the importance of forestry and logging and wood manufacturing to Kempsey Shire and Hastings Municipality as well as the importance of that part of the industry reliant on the K/WMA. This showed that in 1991 the proportion of the workforce employed in forestry and logging and wood manufacturing was higher in the Hastings Municipality (2.7% of the workforce) than the Kempsey Shire (2% of the employed workforce) but that it appeared that the proportion of the workforce reliant on the K/WMA was greater in the Kempsey Shire (2.4% of the employed workforce) than the Hastings Municipality (1.3% of the employed workforce).

It was not possible to determine the importance of the K/WMA to employment in individual towns as there was no information provided in the EIS on the place of residence of employees.

A closer look at the changes in the structural base of these two towns can be obtained from examination of the employment by industry information provided in the following pages. This shows that for the town of Wauchope the importance of agriculture, forestry and fishing,

manufacturing, transport and storage, and communications to employment has declined in both absolute and relative importance. While other sectors such as mining, wholesale and retail, finance, property and business, and recreation or personal services have increased in importance in both absolute and relative terms. Other sectors such as utilities, construction, administration and defence and community services have either remained constant or oscillated in importance.

In the town of Kempsey the importance of agriculture, forestry and fishing, mining, construction, transport and storage to employment has declined in both absolute and relative terms. While other sectors such as utilities and community services have increased in absolute and relative terms.

Manufacturing has declined in absolute numbers employed but remained fairly constant in relative terms; absolute employment levels in wholesale and retail trade oscillated but relative levels have increased; employment levels in communications and financial property and business, administration and defence have oscillated in both absolute and relative terms; employment levels in recreation and personal services have tended to oscillate but increased in relative terms.

While some of the more traditional employment in both towns has declined, this has been offset to some extent by expansion in other sectors.

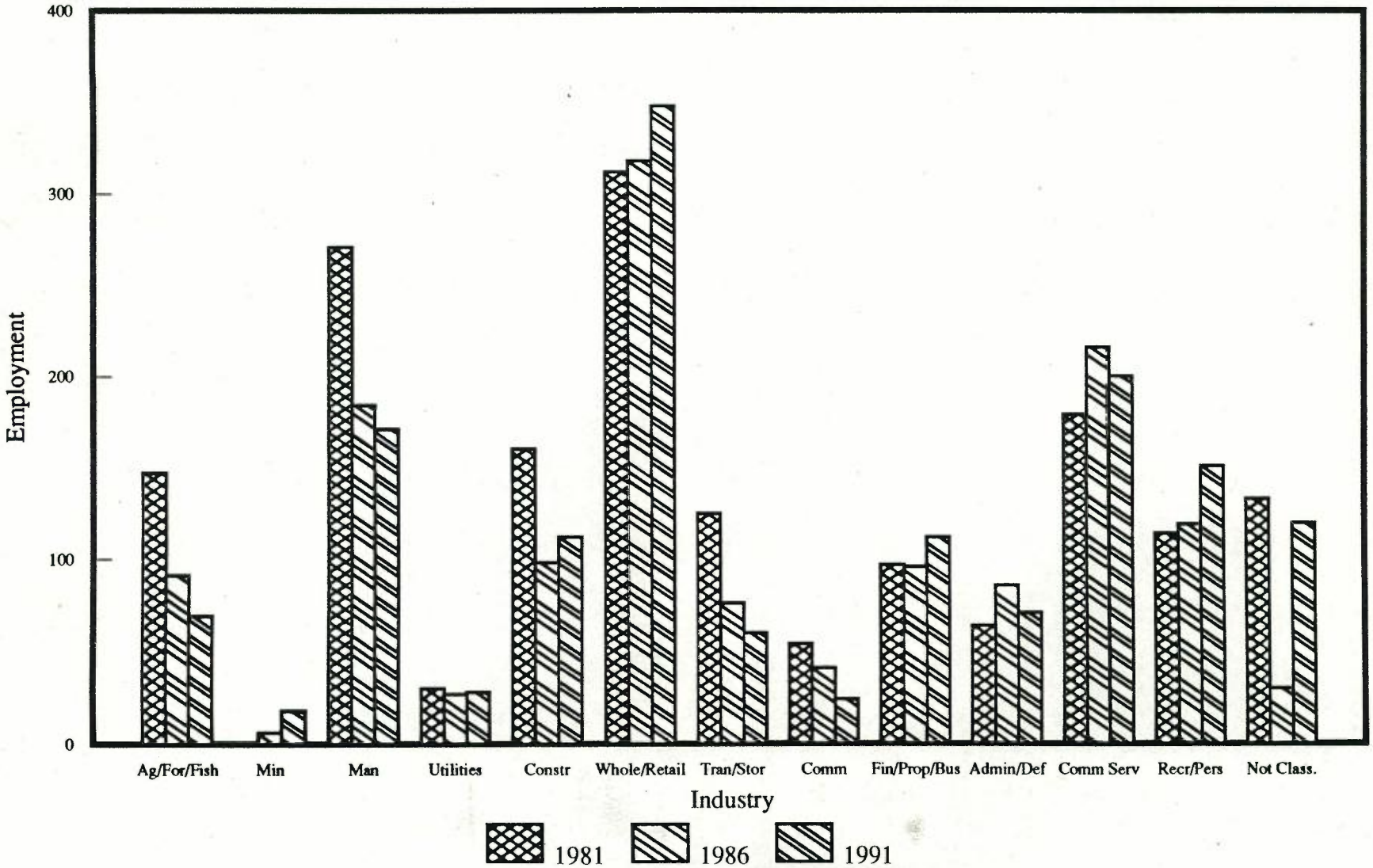
Conclusion

This section of the report has provided a socio-demographic analysis of the four regions examined in comparison to NSW. The aim has been to present a social profile of the regions and in doing so identify groups and areas which might be differentially affected by the decision for the K/WMA.

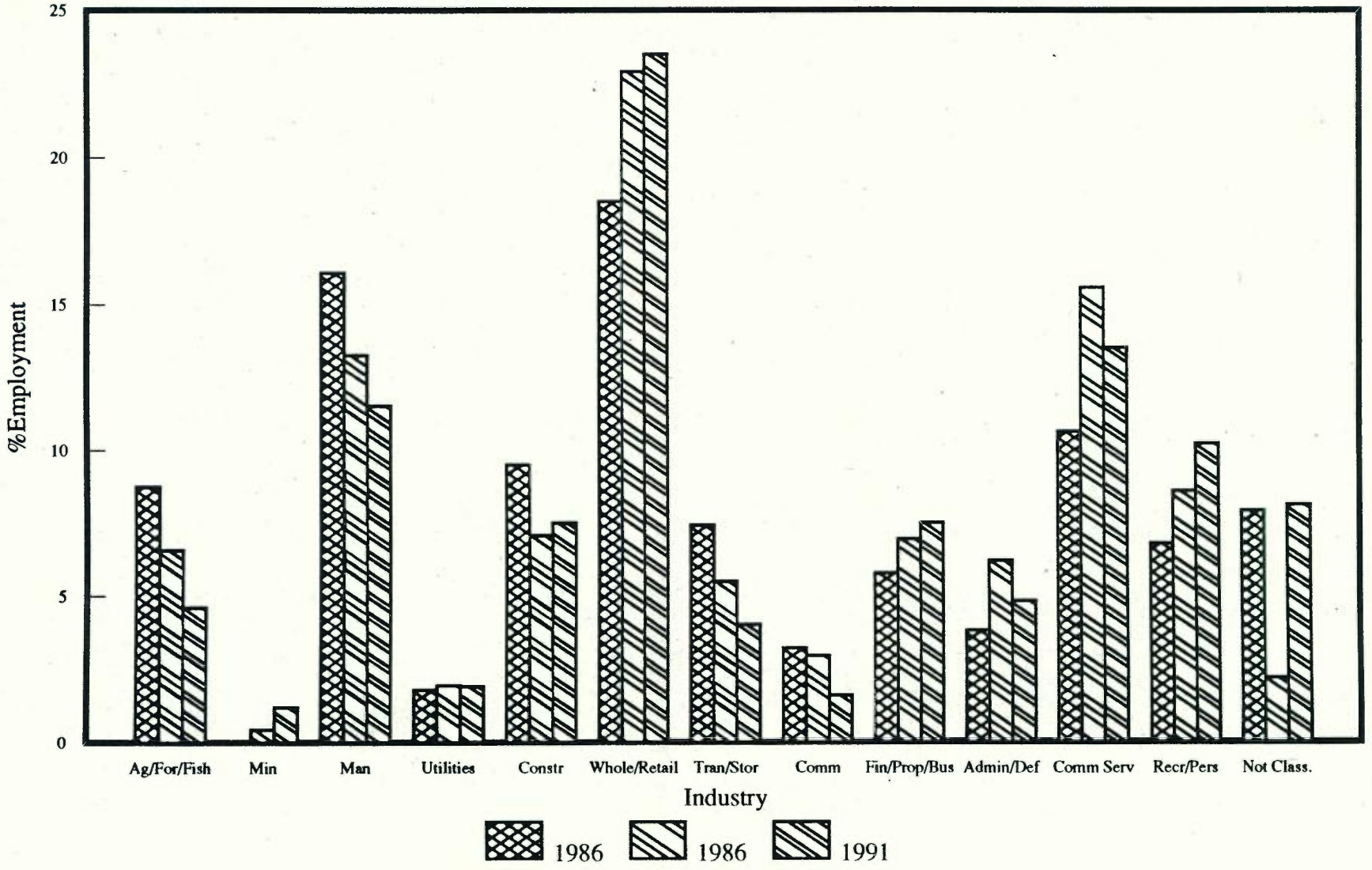
In general the analysis shows that the town of Kempsey would appear to be most susceptible to quota reduction from the K/WMA as the Shire of Kempsey (of which Kempsey is the major service centre) has the greatest proportion of the employed population working in forestry, logging and wood manufacturing that is based on the K/WMA. Furthermore, the town of Kempsey has experienced little population growth in the last 15 years with a small decline between 1988-91. It has the highest proportion of single parent families, the highest proportion of unqualified and low income earners, the lowest proportion of home ownership, and the highest unemployment rate. Furthermore, the town of Kempsey will experience the greater quota reduction due to the current program to bring the management area on to an even flow sustainable yield.

The town of Wauchope also has experienced much less population growth than the Municipality and also would appear to have greater reliance on the forestry, logging and wood manufacturing than the Municipality. These towns therefore warrant some further consideration in terms of the impact of the proposal (as amended by the Minister) on their prosperity.

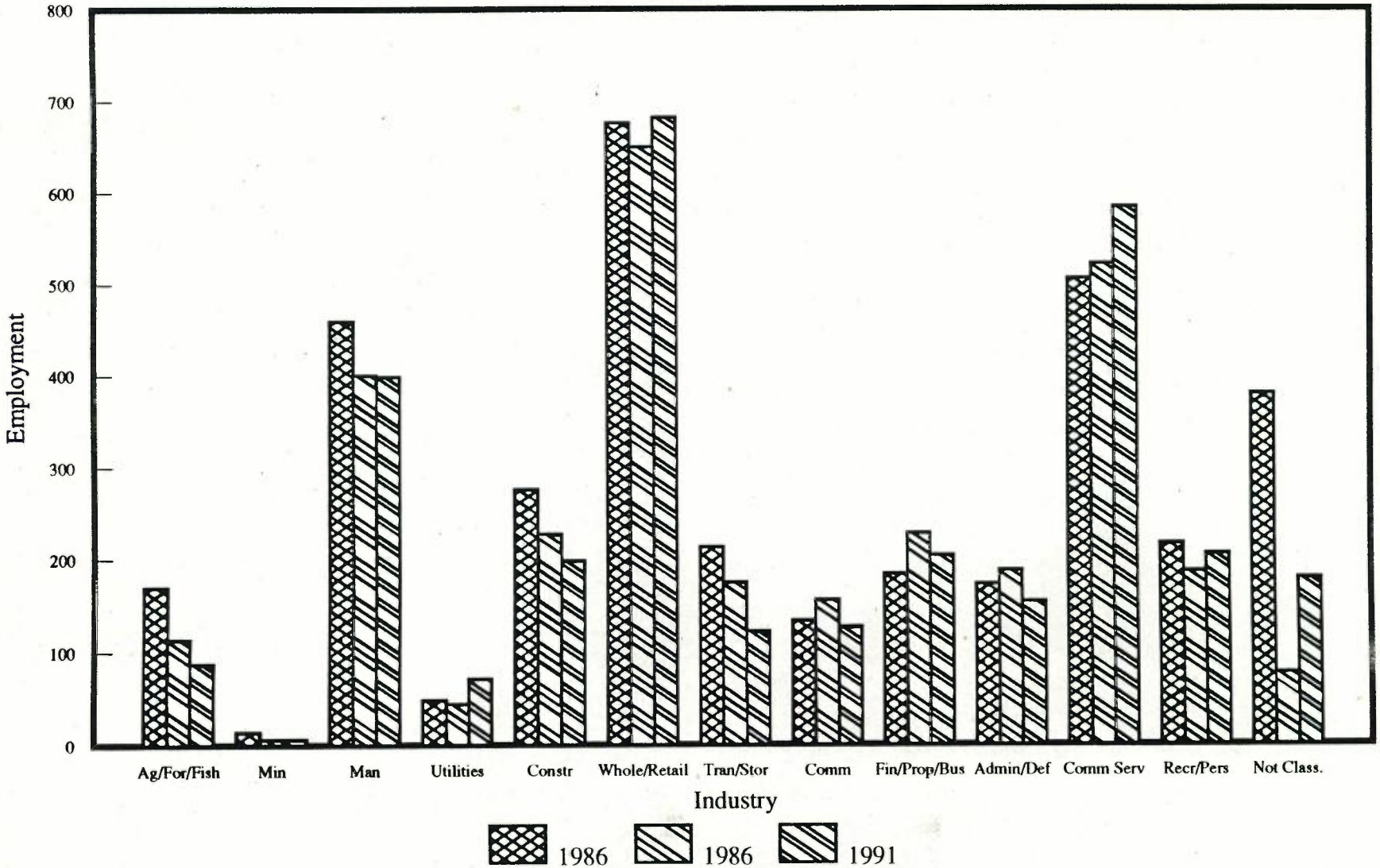
Town of Wauchope-Employment by Industry



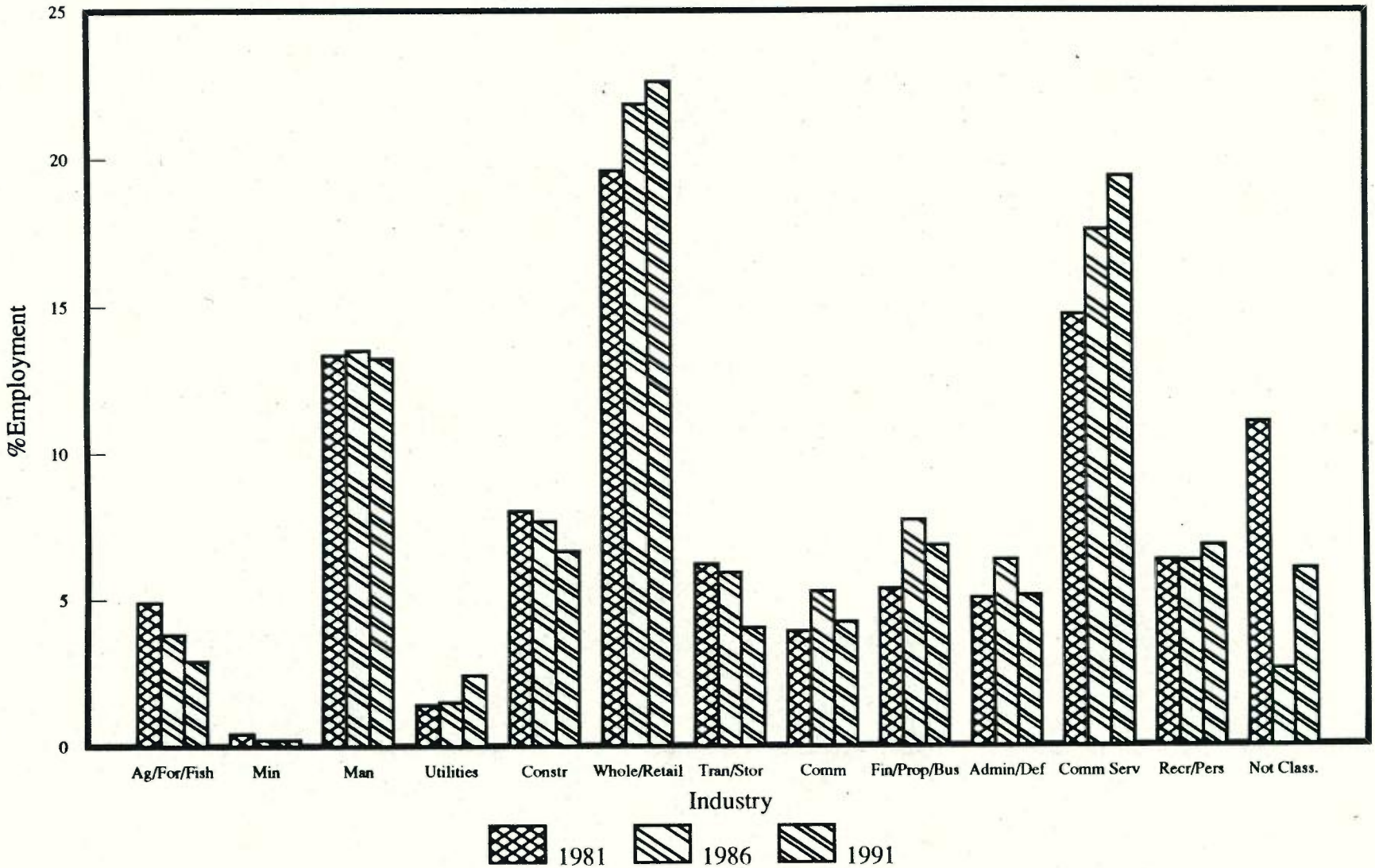
Town of Wauchope-%Employment by Industry



Town of Kempsey-Employment by Industry



Town of Kempsey-%Employment by Industry



Settlement Prosperity

One issue raised in public submissions was that towns were once again under threat, in particular Wauchope (e.g.7)) although concern was also expressed over the effect of quota reductions on businesses in Kempsey (12). Submission 13 took a more pessimistic view considering that the the economy will fail and the social fabric of the north coast will be destroyed unless we ensure a continuity of supply and guarantee a sustainable forest industry. Many of the submissions raising the issue of employment also point to concerns over impacts of loss of employment on towns.

This raises the issue of settlement prosperity and the impact of the proposal and the Minister of Planning's determination on towns. A common indicator of settlement prosperity is population expansion or decline (Sorensen 1990). Sorensen 1990 identifies a circular and cumulative virtuous cycle of growth and vicious cycle of decline. Essentially places which are able to attract population immigration create increased demand for goods and services and thus more jobs. This growth leads to increasing local multiplier effects, scale economies and an increase in the rate of innovation and capital availability (Sorensen 1990). The converse occurs if population declines. Sorensen (1990) identifies places with static population which he considers is due to a mutual balance of virtuous and vicious cycles.

The trigger mechanism for expansion or decline of towns can be place specific mechanisms such as closure of a towns principle employer, large scale infrastructure investment, opening and closure of mines, proclamation of National Parks (although Sorensen recognises that the impact of this is ambiguous), changes in the prices received for farm produce and changes in the value of the currency. Environmental attractiveness and tourism development can also play a part (Sorensen 1990). Other less place specific mechanisms may also be important such as increasing mobility of the consumer, an increasingly wealthy society demanding a wider range of goods and services in good quality surroundings, sustainability of yields etc (Sorensen 1990).

To gain an appreciation of the susceptibility of Kempsey and Wauchope to decisions which may involve employment loss the Department of Planning has examined population trends for these towns having regard to trends for the North Coast, Hastings statistical subdivision, Kempsey Shire and Hastings municipality. The potential population losses to the Kempsey Shire, Hastings Municipality and towns of Kempsey and Wauchope as a result of adopting various alternatives raised in the EIS, are also examined.

The North Coast is the fastest growing non-metropolitan region in the State. As identified in the "North Coast Region: Prelude to a Strategy Discussion Paper" (Department of Planning 1991) it increased its proportion of the State's population from 5.3% to 6.2% during 1981-1989. It also attracted the highest share of the State's population growth (14.7%) outside the Sydney metropolitan area during this period (Department of Planning 1991).

Data on population growth in the Hastings Statistical Subdivision of the North Coast (which includes Kempsey Shire and Hastings Municipality) can be seen from examination of Table 41.

Table 41 - Census Count Annual Growth Rate

	1971-76	1976-81	1981-86	1986-91
Hastings SSD	3.4%	3.8%	3.2%	2.9%

It is evident from this information that the Hastings statistical subdivision has experienced tremendous population growth over a prolonged period.

At a more disaggregate level the Kempsey Shire and Hastings Municipality have also experienced average annual population growth well in excess of the NSW average (refer to Table 30).

The actual towns of Kempsey and Wauchope have not experienced this dramatic growth. Nevertheless it is interesting to note that Wauchope has continued to grow through the late 1970s and 1980s with average annual growth in excess of the State average between 1981 and 1986. This being a time which submissions identify as when the town was being heavily impacted by the 1982 Rainforest decision. In latter times Wauchope's population growth has slowed considerably, however, it has continued to be positive. Kempsey on the other hand has experienced essentially stagnant population over the last 20 years albeit with a small decline between 1986 and 1991.

Assuming that the direct employment losses identified in the EIS for each option are generally reasonable, the worst case scenario in terms of population loss for the towns of Kempsey and Wauchope can be examined by making a number of simplifying assumptions.

The following table summarises overall direct job losses as identified in the EIS and distributes these between Hastings Municipality and Kempsey Shire on the assumption that job losses occur in the same proportion as the existing ratio of jobs between Wauchope Management Area and Kempsey Management Area, i.e. 211:183.

Potential maximum loss of population is based on the assumption that each person who loses their job leaves the region and takes their family. The family size is assumed to be equal to the average private dwelling occupancy rate in 1991 for Kempsey Shire and Hastings Municipality, i.e. 2.73 and 2.58 respectively.

Table 42 - Direct Population Loss

	Proposal	Alternative 2	Does not occur for 5 years Alternative 3	Alternative 4
Direct Job Loss	39	51	75	125
Distribution of Job Loss				
Kempsey Shire	18	24	35	58
Hastings Municipality	21	27	40	67
Distribution of Population Loss				
Kempsey Shire	49	66	96	158
Hastings Municipality	54	70	103	173

When comparing these maximum potential population losses to population increases in the Kempsey Shire and Hastings Municipality (refer to Table 30) it is evident that these population losses would be minor.

If it is assumed that all the people from the Kempsey Shire who will lose their job reside in the town of Kempsey and in the Hastings Municipality reside in the town of Wauchope and that population loss occurs over a 5 year period, it can be seen that:

* in the town of Kempsey the adoption of any alternative would result in a population loss that is less than the intercensal fluctuations in population that the town has experienced over the last 15 years;

* in the town of Wauchope the adoption of any alternative, apart from cessation of old growth logging (Alternative 4) would result in a population loss that is less than the intercensal population growth over the last 15 years.

Notwithstanding, options that minimise the likelihood of population loss obviously compare favourably to those that may cause greater population loss.

A further point worth noting is that within the North Coast the Port Macquarie area (including Wauchope, Camden Haven, Laurieton, Kendall, Herons Creek) has been identified as a major urban area which is expected to double its 1986 population by 2016 (Department of Planning 1991). Given this projection there is every likelihood that the town of Wauchope will benefit to some extent from increasing population pressure in the area. The North Coast Draft Urban Planning Strategy (Department of Planning 1993d, page 19) identifies that Wauchope is likely to grow slowly due to high market demand at nearby Port Macquarie but should retain and enhance its function as an industrial and manufacturing centre.

The town of Kempsey and environs services a large hinterland area and contains a core industrial base which can be expanded. Kempsey also has potential to accommodate greater population (Department of Planning 1993d).

Conclusion

The North Coast Region, Hastings Statistical Subdivision, Kempsey Shire and Hastings Municipality have all experienced considerable population growth over a prolonged period. While the towns of Kempsey and Wauchope have not experienced this dramatic prolonged growth it would appear that the potential population losses for these towns from adopting almost any of the alternatives identified in the EIS would be less than the intercensal fluctuations in population that these towns have experienced over the last 15 or 20 years. The exception to this is the impact of ceasing old growth logging, on the town of Wauchope. Furthermore, it would appear that Kempsey has potential to accommodate greater population while Wauchope is likely to benefit from increasing population pressure in the Port Macquarie area.

Businesses and Community Services

Given the above conclusions regarding settlement prosperity it is evident that the main businesses that will be impacted by the proposal, as amended by the Minister for Plannings determination, are mills. In this respect both Kempsey Timbers and Beechwood Timbers have identified that they will be forced to close as a result of the SFNSW proposal. Other smaller operations will also be impacted as the quantity of exquota sawlogs available will reduce commensurate with the reduction in quota sawlogs. The EIS has not given any detailed consideration to the issue of mill closure, however, the Department of Planning acknowledges the difficulty of considering minimum operating levels for mills and the likely commercial response of mills to timber losses.

There was little evidence put forward in the EIS of loss of community services as a result quota reduction leading to population threshold falling below viable levels. Indeed this was not an issue raised in public submissions. Given, the size of major service towns (Kempsey and Wauchope), that the potential population losses from adopting most of the alternatives would be less than the intercensal fluctuations in population that these towns have experienced over the last 15 or 30 years, and the prospects for population growth in the region it is considered unlikely that community services and facilities will fall below threshold levels as a result of the proposal (as amended by the Minister for Planning).

While some smaller, mainly dormitory settlements could be adversely affected/susceptible to quota reductions in the timber industry, e.g. Herons Creek and Bellangry, given the close proximity of these smaller towns/settlements to more major towns such as Port Macquarie, Wauchope, Kempsey etc. the impact in terms of loss of access to community facilities is somewhat diminished.

A further aspect to consider when gauging the likely impacts of the various alternatives on community services and facilities is that demand for various facilities and services is often not simply a function of total population numbers but a function of other variables such as population structure and trends, for example, the demand for senior schools is affected by

retention rates of students. The National Health Strategy (1992) identified that health service use is a function of socioeconomic status, family composition, language spoken at home and sex.

Conclusion

The main businesses that will be affected by the proposal, as amended by the Minister for Planning, are mills. The EIS has not given any detailed consideration to the issue of mill closure, however, the Department of Planning acknowledges the difficulty in considering minimum operating levels for mills and the likely commercial response of mills to timber losses. Some mills may close as a result of the proposal (as amended by the Minister for Planning).

Having regard to: submissions; consideration of population trends and potential population loss as a result of adopting the alternatives identified in the EIS; and that there are other variables that impact demand for community services and facilities; there is little evidence that community services or facilities will fall below threshold levels as a result of the SFNSW's proposal (as amended by the Minister for Planning).

Groups and Individuals

As identified by the RAC (1992a) many individuals, groups and communities have developed a particular way of life around the wood and wood products' industry which will be significantly altered if there are changes in the industry.

The restructuring and rationalisation of the industry has already resulted in loss of jobs and disruption to lifestyle and will continue to do so. In addition the changes that result from the SFNSW proposal as amended by the Minister for Planning will also have impacts. The RAC 1992 VI (p.295) identified that *"redundancies and prolonged unemployment can generate a range of personal and social problems, among them an increased risk of domestic violence, drug and alcohol dependency, crime and indebtedness, loss of self esteem, community dislocation and family difficulties"*.

Of the individuals who become unemployed those who are most at risk are those who are most strongly tied to local social networks and least likely to be employed elsewhere such as male timber workers with low levels of education and little work experience other than in the timber industry. The situation is likely to be exacerbated for older workers.

Conclusion

The main social impacts as a result of the SFNSW proposal and the Minister's determination are likely to be those on families and individuals who are affected by job loss, in particular aging males with low education levels and little work experience apart from in the timber industry.

3.11.11 SFNSW Program of Yield Reductions

As briefly mentioned earlier in this report, page 195 of the EIS clearly identifies a program of yield reductions that is in place for the Kempsey Management Area for Allen Taylor & Co. (Boral) as follows:

- 1992 35,720m^3 gross
- 1993-96 27,480m^3 gross
- 1997 20,600m^3 gross

These apparently resulted from a yield review and were initially set in train in the 1988 Management Plan for the Kempsey Management Area. Even without consideration of the quota reduction that will result from the SFNSW conservation strategy (as amended by the Minister for Planning) and adoption of the SEMGL, the quota of Allen Taylor & Co. (Boral) will require further adjustment (after 1997) to bring the Management Area on to even flow sustained yield.

The social and economic impacts considered in the EIS and earlier in this environmental impact assessment report are superimposed on those that will occur as a result of the above program of quota reductions. Specific consideration of the social and economic impacts of these programmed quota reductions was not provided in the EIS, however, some insight into this can be made.

From an economic perspective what is important when considering the consequences of a proposal or alternative is to compare it to the *"without"* case i.e. what would have occurred without the proposal or alternative.

With respect to the consideration of wood yield in the EIS, this has occurred as the wood yields for adopting alternative 1 (continuation of the existing Management Plan) against which the proposal and other alternatives are compared includes the latest estimates of remaining yield.

With respect to employment and output, however, an important feature of comparing the proposal and alternatives to the base case is to recognise that the base case includes a decline in employment and output over time as a result of the programmed quota reductions. These losses in output and employment are the result of unsustainable quota levels and, all other things being equal, would occur at some point in time if these were not currently programmed.

Nevertheless, the reductions in quota to sustainable levels may trigger commercial decisions with respect to mill rationalisation resulting in perhaps additional losses in employment together with relocation of some employment and output.

As the programmed quota reductions only apply to the Allen Taylor & Co. (Boral) mill, the worst case scenario for the town of Kempsey, all other things being equal, would be that the quota levels fall below threshold levels for the mill and the mill closes, redistributing its remaining quota to other Boral operations. This would cause an initial loss of direct employment to the Kempsey area of in the order of 31 mill employees plus some bush operators and drivers. Although as the remainder of the quota would be allocated to another Boral mill, this loss of employment would be offset to some extent, albeit in another area.

Output value would also be lost to the Kempsey area but, similarly would be offset to some extent by output gain, where remaining wood is reallocated.

Whether the programmed quota reductions will result in the closure of the Allen Taylor & Co. (Boral) mill and impacts in the Kempsey area will, in the end, depend on commercial decisions made by Boral with respect to rationalisation of its holdings. The quota reductions could potentially result in impacts in another region depending on decisions made by Boral regarding allocation of its quotas. Similarly, closure of the mill could realistically occur any way, regardless of quota reductions, due to commercial decisions by Boral.

Thus impacts in the Kempsey region from the programmed quota reductions could range from none to the full loss of employment and output. The Department notes that there is also likely to be impacts to other smaller operations as it is evident from the EIS that associated with quota reductions is a commensurate loss of exquota sawlogs.

From a community perspective social impacts to the Kempsey area could range from none to those associated with the loss of in the order of 31 jobs to no impact (the impact being borne in another region). From earlier consideration in this report it is evident that the loss of 31 jobs would not impact on the prosperity of Kempsey or the viability of community facilities and services, but like alternatives assessed in the EIS would mainly impact on individuals and their families.

Conclusion

The social and economic impacts considered in the EIS and in this report are superimposed on those that will occur as a result of programmed quota reductions. The impacts that will result from these programmed quota reductions are the result of unsustainable quota levels and must occur at some point in time. The final impact of these will largely depend on commercial decisions made by Boral with respect to allocation of timber and mill viability.

3.11.12 Socioeconomic Impact Mitigation Measures

As identified by the RAC 1992 VI (p.299), in general, Australian society does not make special provisions, beyond the social security system and charitable organisations, to compensate individuals or businesses for the impacts of structural change.

The matter of compensation or structural adjustment packages has been raised in submissions but raises issues which are beyond those which can be dealt with in the Minister for Planning's determination.

One method to mitigate to some extent the impact of quota reductions that will result from the SFNSW proposal (as amended by the Minister for Planning) is to permit the quota reductions to be phased in over time. This allows both businesses and employees to make plans for their future. A period of 5 years is considered to be an appropriate timeframe within which to phase in quota reductions and with respect to the KMA will permit some coordination of quota reduction with the current program of quota reductions.

Conclusion

The matter of compensation raises issues that are beyond those that can be dealt with in the Minister's determination. Social and economic impact could be mitigated to some extent by permitting quota reductions to be phased in over a period of five years. This will allow both businesses and individuals to make plans for their future and in the case of KMA permit some coordination of quota reductions with the current program of quota reductions.

3.12 Length of Any Approval and Resource Security

As identified previously, the native hardwood sawmilling industry is likely to continue to undergo considerable structural change. Uncertainty about future wood allocations from native forests as a result of allocation of productive forests to Conservation Reserves has been perceived as discouraging investment in value adding processing equipment and new cutting and drying technology to deal with small sawlogs from regrowth forests. The RAC Timber Inquiry (1992, Vol. 1) took the view that resource security should be determined on a regional or State wide basis, not on a project by project basis and that agreements between State Forest managers and industry should be developed through long term contracts with clear provisions for financial compensation.

The Minister for Planning is not in a position to ensure such long term contracts or financial compensation. However, the Minister's determination could seek to ensure that resource security is not prevented by issuing long term approval to the logging. The following matters should be considered when determining the length of any approval given:

* Closely linked to the notion of sustainable development is precautionary principle. The RAC Inquiry (1992) concluded that the logging of old growth potentially violates the precautionary principle of ecologically sustainable development and considered that there are two options available to governments for dealing with areas of old growth;

  . rapid cessation of all logging operations;
  . preparation of comprehensive management plans that identify and rank old growth forests in term of their full range of values.

  Under this latter option it may be decided that after adequate protection of examples of old growth forests some old growth may be available for logging. It should be noted that the NPWS and SFNSW are currently working to perfect the methods for carrying out such an old growth study.

* The old growth resource is the primary source of sawlogs until 2008 for the Kempsey Management Area and until 2020 for the Wauchope Management Area. As fundamental studies and inventory of the old growth in NSW have not been undertaken to date it is not considered that long term approval of logging of old growth should be given at this stage.

* The longest approvals that have been issued for resource developments under the EP&A Act have been 21 years for coal mining. For sand and gravel extraction at Penrith Lakes approvals have been given in a number of stages, each stage being no more than approximately ten years.

* Community attitudes towards forests have changed significantly in the last two decades and it is expected that they will continue to change. Two eminent economists, Krutilla and Fisher, explained this phenomena in the 1970's. They observed that due to technological progress and the existence of substitutes, the average cost and therefore the relative value of ordinary goods and services has fallen dramatically. In contrast, the supply of natural environments is fixed or diminishing. Combined with growing community demand (from increased population) the relative value of the natural environment has been increasing and will continue to increase over time (RAC 1992, Vol. 1).

* The RAC Timber Inquiry (1992, Vol. 1) identified that if a high level of substitutability of softwoods for sawn hardwood timber is assumed then Australia's softwood plantations technically may have the potential to meet all domestic consumption requirements for sawn timber from around the year 2010. Clark (1991) identified that for economic reasons many softwood plantations will be harvested five to ten years earlier than previously considered. If this occurs softwood sawn timber will be able to meet most of Australia's sawn timber needs by the year 2000.

* Given the complex and dynamic nature of ecosystems and forestry operations it is considered that ten years would be the maximum period that the information presented in the EIS could be considered to be reliable and accurate.

Conclusion

Having regard to the above matters the Department of Planning considers that ten years would be an appropriate period for any approval issued to the State Forests of NSW for the logging in the K/WMA.

3.13 Harvesting

Harvesting operations are considered in chapter 5 of the EIS. The proposed strategy prescriptions, procedures pattern and rates of harvesting as described pose no obvious problems and are endorsed by the Department. Impacts of harvesting on flora, fauna, soils and hydrology are considered separately within those respective sections.

In terms of area harvested, operations will be relatively evenly spread between old growth, recut and regrowth as the following table illustrates:

Table 43 - Proportion of Each Type of Operation by Area, Combined MAs.

	1993-1997	1998-2002	2003+
Old growth	41%	34%	33%
Recut	20%	32%	29%
Regrowth	39%	34%	38%

An important component of the harvesting strategy is integrated harvesting which, it is claimed, will maximise economic utilisation (EIS p. 180). Two submissions (10, 119) asserted that, while integrated harvesting may be desirable, it involves additional problems that are not discussed in the EIS. Indeed, these problems may be so great in some instances that they outweigh the advantages of integrated harvesting. Unfortunately, these problems

("insurance and workers compensation, supply of all products at required levels, need for close supervision to ensure correct segregation) are not explained in sufficient detail in either submission to permit a thorough evaluation. Thus, while acknowledging that there may be some problems and extra costs (especially for sawmillers and logging contractors), the Department considers that integrated harvesting should be preferred to separate operations as it is mostly likely to achieve the intended purpose of best use of all merchantable products without any additional impact on the forest.

An assessment of changes in stand structure resulting from harvesting is reported in the EIS (pp 200-202). This survey was fairly modest in scope, including only two types of operation (old growth and recut logging), five compartments (three from Kempsey MA and two from Wauchope MA) and three forest types. The forest types selected for the survey, 47, 62 and 163, represent moist hardwood, dry hardwood and New England hardwood forest associations respectively. These types are important economically and together account for slightly more than 50% of the total area of State forest in the study area.

The conclusion drawn from the survey is that logging alters stand structure, the extent of alteration varying with forest type and previous stand condition (old growth or disturbed). In each case however, the number of retained stems (merchantable and unmerchantable) is relatively large, ranging from 47% of the initial total (old growth logging in Compartment 212) to 96% (recut of Compartment 32). Also notable from examination of EIS Table 5.7 is the stocking of regeneration which, in all samples, is judged to be more than adequate in view of the number of older trees retained.

While the Department acknowledges the value of including a representative stand table such as EIS Table 5.7, it is really only the first step in assessing the impact of logging. Changes in stand attributes need to be recorded over time in order for a comprehensive picture of long term impacts to be developed. Submission 6 alleges the failure of the EIS to address cumulative impacts of logging while submission 140 claims that the EIS does not adequately sample the range of variation in logged forests with respect to age class structure. The Department considers that EIS Table 5.7 indicates the probable range of logging outcomes (despite the admittedly small sample size) and that further efforts should be directed to establishing a research project specifically to monitor long-term, cumulative impacts of forestry operations on the forest types typically found in the Kempsey and Wauchope MAs.

Submission 147c expresses concern at the apparent rapid increase in the rate of pulpwood harvesting (EIS figures 3.6 and 3.7). It is noted that pulpwood harvesting only commenced in Wauchope MA in 1987-88 when 2,347m3 gross was removed; by 1990/91, this had increased to about 20,000m3 gross. In Kempsey MA, on the other hand, the annual cut has remained steady at 5,000m3 gross or less since operations began in 1988-89. The EIS (Table 5.3) gives the total volume of pulpwood to be removed during the remainder of the first cutting cycles as 477,000m3 gross, 314,000 m3 gross (66%) of which is from thinning operations in regrowth. A further 48,000m3 gross (10%) is to come from head and butt salvage, leaving a balance of 115,000m3 gross (24%) which it is proposed to obtain from the silvcultural treatment of stands (other than regrowth) within Wauchope MA. The Department is of the view that the impact of harvesting pulpwood in conjunction with the

thinning of regrowth stands and from heads and butts as a component of integrated sawlog operations is likely to be negligible and that there is no need to place any additional restrictions on the removal of pulpwood in these circumstances. With respect to the 115,000m3 gross to be obtained from silvicultural operations, SFNSW has indicated that no harvesting will occur during the 1993-2002 period and that, even when operations do commence, very little will occur in old growth stands (see section 3.3.5 of this report) and that the average volume removed annually will be relatively modest. Thus, having considered the detailed information provided in the EIS and subsequently by SFNSW, the Department concludes that additional restrictions on pulpwood produced in the course of silvicultural treatment should not be applied in Wauchope MA even though additional restrictions on the removal of pulpwood from old growth forests have applied in earlier EIS determinations (eg. Glen Innes MA).

Submission 152 claimed that *"thinning can reasonably be expected to reduce biodiversity by simplifying habitat diversity and converting the complex structure of natural forests to the uniform structure of plantations"* and that the EIS had failed to consider such impacts in the 25,000ha of regrowth forest proposed for thinning. This overlooks the fact that, in some instances, logging of stands may actually increase habitat diversity, especially if the stands are very uniform to begin with (as even-age regrowth stands often are). For example, in the southeastern USA, creation of a forest reserve from a multi-use forest benefited a species of woodpecker but disadvantaged spiders and a ground-dwelling bird whereas logging benefited the spiders and ground-dwelling bird but disadvantaged the woodpecker which is dependent on old growth forest (Boyce and McNab 1994). The study concluded that a range of stand ages distributed throughout the area would result "in substantial populations of woodpeckers, spiders and turkeys as well as yielding an economic harvest of logs". The Department thus concludes that thinning of regrowth need not necessarily reduce habitat diversity and, indeed, may increase it if planned and executed with this objective in mind.

Conclusion

The distribution of types of harvesting operations in space and time will serve to mitigate impacts of logging on forest ecosystems. Integrated harvesting is endorsed as the preferred method of operation for, while some problems are acknowledged, the impact is likely to be equal to or less than that of successive operation for each type of product but with the benefit of superior resource utilisation. It is clear that no old growth forest will be harvested for woodchips or pulpwood purposes in the Kempsey and Wauchope Management Areas for the period of this approval.

There is a need for research into the long-term, cumulative impact of logging on coastal and tableland forest types.

The Department considers that the harvesting of the proposed volume of pulpwood from regrowth thinning, from head and butt salvage and from silvicultural treatment of stands will have negligible impact above and beyond that due to the production of sawlogs and that no additional controls are warranted.

Thinning operations may enhance habitat diversity if planned with this objective in view. Creation of heterogeneous forest stands should be a guiding principle in the planning of all types of harvesting operations.

3.14 Forest Resources

Forest resources are considered separately for Kempsey MA and Wauchope MA. It should be appreciated that this division is somewhat artificial for, although the two management areas are broadly centred on the Macleay and Hastings river catchments respectively, the boundary between the two management areas is primarily administrative. With the concentration of sawmilling into fewer and fewer hands, management area boundaries are becoming less important as is evidenced by the terms of the Wood Supply Agreement between State Forests of NSW and Boral Timber Division which allows the company considerable latitude in transferring Crown logs between its various processing plants throughout northern NSW. Similarly, Kempsey Timbers has a regional log allocation which authorises that company to draw supplies from Wingham, Coopernook, Kendall and Urunga MAs as well as Kempsey and Wauchope MAs. Nonetheless, as the management area remains the fundamental unit for quota control and yield regulation, assessment of each individually is the only practical approach.

3.14.1 Kempsey Management Area

The presentation of forest resource information and the discussion of sustainability in the EIS is limited, especially in the case of Kempsey MA. Although the Kempsey MA Plan 1988 (Forestry Commission 1989) contains a considerable volume of data and discussion, only some of this information is used or referred to in the EIS. Similarly EIS p.78 mentions a 1990 yield review which is neither documented nor referred to again elsewhere.

The resource situation in Kempsey is complicated by the fact that forests appear to have been overcut for quite some time (see Appendix 13a of the Management Plan for the KMA which shows an increase in hardwood sawlog cut over all but two five-year recording periods from 1935-40 to 1985-88). Several submissions alleged a history of overcutting in the Kempsey MA (e.g. 6, 19, 133, 135, 136, 139, 146, 147, 162). Some of these questioned whether sustainability could be achieved even in the second cutting cycle. In view of the apparent overcut, a program of staged quota allocation reductions was implemented in 1987 (following review of the 1978 management plan) by which a 60% reduction in the cut of quota was to be achieved by 1997 (see p.71 of the 1988 Management Plan) thus effectively matching the volume of quota logs expected to be available annually from the commencement of the second cutting cycle after 2008. However, even though these staged reductions are mentioned in the EIS, they are not clearly distinguished from further reductions that are likely to arise as a consequence of the 1990 yield review, the SEMGL and the conservation strategy. Thus there is a cumulative resource impact that is not addressed in the EIS, the overall effect of which is of great concern to local wood-using industries (50) and others (7, 97, 138, 156, 158, 159, 161).

Estimated quota sawlog availability through to the end of the first cutting cycle (EIS Table 5.12) is somewhat less (8.5%) than the estimate given in the 1988 Management Plan (p.47) even after allowing for log removals in the period 1989-1992. This is presumably as a result of the 1990 yield review although no details are provided in the EIS. Some submissions (139, 147) questioned the quota log resource estimate, claiming that a new assessment specifically for the EIS was warranted. As allegations that the estimated volume of the remaining resources are seriously in error were not substantiated, the Department can only conclude that the EIS figures are the best available (as mentioned by State Forests in its reply to submissions) and are adequate for the purpose of this assessment.

The EIS (Table 5.4) indicates that Boral's quota log allocation from Kempsey MA for the period 1993-1996 is 27,480m^3 gross with a reduction to 20,600m^3 gross scheduled for 1997. It appears that these allocations are still too large even without taking into account any other reductions due to conservation measures imposed by the Minister. Thus the moderate percentage reduction in availability of quota sawlogs shown in EIS Table 5.12 masks a greater percentage reduction in quota sawlog allocation that will need to be made during the remainder of the first cutting cycle.

Another issue raised in submissions was the concentration of ownership in the sawmilling industry to the extent that Boral Timber Division now dominates. Many expressed the view that, because Boral has a wood supply agreement, the company will receive preferential treatment to the detriment of small local sawmills when the next round of quota reductions is put into effect (10, 24, 119, 134, 138, 144, 150, 156, 162). An associated problem for these smaller businesses is that they have very little security of supply as most at best have a small quota and some have no quota at all. Kempsey Timbers, for instance, has an annual log input of about 18,000m^3 gross of which only 25% is quota logs. The EIS Table 5.12 suggests that, even after a reduction in volume of 11.5% due to extra conservation reserves and the SEMGL, 170,000m^3 gross of salvage logs and 11,500m^3 gross of small logs are available for harvest until the conclusion of the current cutting cycle. If harvested in equal amounts each year until then, the annual cut would be about 11,300m^3 gross which is about 40% less than the annual average for the decade 1978-1988. Thus there is likely to be a significant impact on salvage and small log operations even under Alternative 1 which is continuation of the current management plan.

Despite some consideration of sustained yield in the EIS (pp.76-78), no data are provided to substantiate whether logging beyond the conclusion of the first cutting cycle is sustainable. Nonetheless, having considered Appendix 16 of the 1988 Management Plan, it would appear that an annual harvest of quota sawlogs is able to be sustained from the Kempsey MA beyond the conclusion of the first cutting cycle at a rate of 20,300m^3 gross without significant impairment of the fundamental biological and physical processes of the forests. Other constraints in the second cutting cycle may result in this expected yield being reduced somewhat.

3.14.2 Wauchope Management Area

As in the case of Kempsey MA, the presentation of forest resource information and the discussion of sustainability in the EIS with respect of Wauchope MA is limited, with scant reference to forest resource information contained in the 1988 Management Area Plan (Forestry Commission 1990).

A significant difference between Kempsey and Wauchope MAs is that, while the former is not yet managed on a sustained yield basis, the latter already is (EIS p.76). Thus, the only quota reduction proposed is that arising from implementation of the SEMGL and the conservation strategy (as amended by the Minister's determination) in contrast to the program of large reductions already implemented in Kempsey MA. Overall, the Department is satisfied that the estimate of the volume of quota sawlogs to be harvested in the remainder of the first cutting cycle presented in the EIS is in general agreement with that presented in Section 1.5.2.1 and Appendices 15 and 16 of the Wauchope MA Plan 1988.

Few of the submissions received specifically addressed forest resource issues in Wauchope MA. While some were opposed to reduced resource availability in any management area (e.g. 7, 161), only 147 alleged a significant resource overestimate in Wauchope MA. On the contrary, other submissions (157, 159, 161) argued that the loss of resource due to a combination of reasons is likely to be much higher than that estimated in the EIS, perhaps even as high as 24%. Submission 144 suggested that too much of the small log resource was misdirected to Boral for the production of woodchips instead of to small sawmillers who are able to produce a higher-valued end-product from such logs. Although the Department is unable to conclude whether many logs are being directed to a low-value end use, clearly such a practice is undesirable and should be avoided.

The EIS contains no specific discussion of sustainability in the Wauchope MA. Nonetheless, from consideration of Section 1.5.3.2 of the 1988 Plan, it appears that an annual harvest of quota sawlogs is able to be sustained from the Wauchope MA beyond the conclusion of the forest cutting cycle at a rate of about 48000m^3 gross without significant impairment of the fundamental biological and physical processes of the forests. However, as in the case of Kempsey MA, this yield may need to be reduced somewhat to allow for other constraints in the second cutting cycle.

Conclusion

Although the two management areas under consideration are quite similar in size and in biological and physical attributes, the current forest resource situation in each is unique due to different histories of resource use and management. In the Kempsey MA, a program of staged quota log allocation reduction has been in place since 1987 to redress an apparent imbalance between the size of the resource and harvesting rates. The Department is unable to substantiate the estimated volume of quota sawlogs and other products presented in the EIS as the volumes are significantly different to those given in the 1988 Management Plan and details of the 1990 yield review are not provided in the EIS. Nonetheless, it seems certain that further significant reduction in quota log allocation will be necessary to allow for reduced quota sawlog availability arising from the 1990 yield review. The Department concludes that a regular flow of quota sawlogs is capable of being sustained from the Kempsey MA beyond the completion of the first cutting cycle in 2008.

The forest resource situation in Wauchope MA is relatively straightforward. The quota log resource estimates presented in the EIS are in general agreement with those given in the 1988 Management Plan. The Department concludes that a regular flow of quota sawlogs is capable of being sustained from the Wauchope MA beyond the completion of the first cutting cycle in 2020. Indeed, as the volume of quota logs available for harvest in the second cutting cycle may be 50% or more greater than that available during the remainder of the first cutting cycle, there may be opportunity for the expansion of wood-using industries after 2020.

3.15 Fire

Fire management is considered in detail in Chapter 8 of the EIS. A fire hazard ranking system developed by the Department of Planning with the assistance of the Department of Bush Fire Services (Department of Planning 1989) for use by local government councils was applied to the State forests of both MAs, the conclusion being that a *"high proportion"* of

the forest area falls within the medium or high hazard categories (p.258) although the actual proportion is not given. By interpretation of EIS Table 8.1, it may be deduced that all dry hardwood forests are in the high hazard category other than those on slopes of less than 5% (about 3^{o}). Moist hardwood forests fall within the medium hazard category if occurring on slopes less than 10% (about 6^{o}) or the high hazard category if occurring on slopes steeper than this. Rainforest falls within the low hazard category except where it occurs on slopes greater than 20% (about 11^{o}) in which case it falls within the medium hazard category. On the basis of this ranking, the study area is divided into three zones (EIS Map 8) which, despite the claim in EIS Section 8.1.5, do not seem to exactly correspond to the hazard categories. EIS Section 3.10, for instance notes that *"the fire hazard is high in coastal forest"* (Zone 1) and *"the upper catchment forests, which include a high proportion of Rainforest, Moist Hardwood and Moist Blackbutt Forest associations generally have a lower fire hazard"* (Zone 3), yet EIS Section 8.1.5 describes a significant portion of Zone 3 as having a high fire hazard. Although the relevance of the zones is thus cast into some doubt, nonetheless it seems certain from the hazard assessment and from EIS figure 3.9 that wildfire has been and continues to be a significant environmental factor in Kempsey MA. The absence of historical fire data for Wauchope MA is not explained in the EIS, but cross-checking with the 1988 Management Area Plan (Forestry Commission 1990) suggests a slightly lesser hazard than in Kempsey MA. However, as the data presented in the Plan cover only a relatively brief period (1981-1988), it would be unwise to make too much of this apparent difference. The EIS concludes that *"wildfires are the main cause of damage to forests in the Study Area and are incompatible with the objectives of forest management as they significantly reduce the quality of sawlogs, kill young regrowth, reduce water quality, destroy fauna habitats and threaten life and property"* (Section 3-10). It is upon this premise that a fuel management program is advanced as an integral part of the proposal.

State Forests formally introduced revised guidelines for fire and fuel management with the release of the new *"Fire Manual"* in 1992 (Forestry Commission n.d.) According to the manual the major components of fire management are fire suppression and fuel management planning, the former more or less corresponding to the existing District Fire Plans and the latter to be developed and progressively incorporated in Management Area Plans as these are revised. The EIS (Section 8.1.2) states that *"comprehensive fire management plans have been prepared for Kempsey and Wauchope MAs"* but it is not clear whether these are just fire suppression plans or also include fuel management plans. The Department considers that the adverse impact of planned fires on the forest environment can be effectively mitigated only where comprehensive fuel management plans have been developed and implemented.

Section 8.3.1 of the EIS states that fuel management in Flora Reserves will continue according to the fire prescriptions contained in the Reserve's Working Plan. Such action is appropriate where such plans conform to the requirements of the Fire Manual but, where they do not, revision should be undertaken promptly. Of course, new Working Plans for Flora Reserves proposed in the EIS should also conform to the requirements of the Fire Manual. The related proposal, to the effect that *"fuel reduction burning will be excluded from*

proposed Conservation Reserves unless future assessment confirms the desirability of such burning from a conservation perspective" is of some concern. Of the 20 proposed new reserves, it is intended that seven still be gazetted as Flora Reserves and so will have Working Plans prepared in due course. The Department's view is that assessment of the remaining 13 proposed reserves should be undertaken promptly and appropriate burning regimes developed for each. In developing such regimes, biological factors (such as the primary purpose for which the reserve was established) and strategic factors (such as protection of life and property) must both be considered. Of course, no fuel management may be a valid strategy in certain circumstances (see Fire Manual Section 5.38). The fuel management prescriptions so developed should be incorporated in the fuel management plan for each of the management areas.

Although the impact of regular hazard reduction burning on flora and fauna is recognised in the EIS (Section 8.2.2. and 8.2.3) and in the literature (eg. Catling 1991), it is concluded that such burning is essential *"if high intensity wildfires are to be avoided"*. The RAC Forest and Timber Inquiry (Resources Assessment Commission 1992) concluded that while the use of fuel reduction burning is controversial and the effects are not well known *"the use of fuel reduction burning... must continue in areas where reduction of hazards from wildfires is a prime management concern. Fuel reduction burning is the only tool currently available that successfully reduces the hazards due to wildfires..."*. As both the historic fire data and hazard assessment indicate that wildfires are a prime management concern in the Kempsey and Wauchope MAs, the implementation of the proposed fuel reduction program is endorsed. Nonetheless, the lack of understanding of impacts noted by the RAC and in submissions (eg. 147) is acknowledged.

The Forest and Timber Inquiry Report (Resources Assessment Commission 1992) also noted *"that fire management plans and practices must recognise landscape and ecological values and seek to implement fire regimes that maintain these where possible. Forest agencies and conservation agencies should continue to develop and implement policies and strategies for ensuring the fuel reduction burning is used on the basis of heterogeneous mosaics of areas representing different times since fire. Such heterogeneous fire mosaics may provide adequate protection from wild fire and at the same time minimise the effects of fuel reduction burning on environmental values"*. (Final Report Volume 1, p. 175). This view is recognised in the EIS which states (Section 8.3.2) that *"fuel reduction burning will be approached not just as a damage control strategy, but also as a positive environmental tool to simulate, where practicable, the original pre-European fire regime"* and that *"burning will be as flexible as possible in intensity so as to produce a mosaic of conditions of varying fire intensity and frequency within each vegetation type"*. The Department endorses this ecological approach to fuel management in the Kempsey and Wauchope MAs.

As has been established, routine hazard reduction burning has an impact on forest structure and flora composition and on fauna habitat. On the basis of information provided in the EIS, the Department considers that the impacts of planned burning on these forest attributes will be mitigated in a number of ways. Firstly, the area hazard reduced in any given year will be

small (less than 2.5% of the total State forest area according to table 8.3). Secondly, special attention to fuel reduction works in identified strategic zones will provide maximum protection for life, property and higher value forest assets while permitting less-intensive burning of non-strategic area. Thirdly, incorporation in the fuel management plans of site-specific subplans for areas of special significance should permit the particular values recognised there to be maintained in perpetuity. Such areas include Flora Reserves and Forest Preserves, reserves for the conservation of forest types, vegetative communities or individual species of flora, reserves for the conservation of wildlife habitat and special emphasis zones recognising the full range of third stage PMP categories. Lastly, impacts will be mitigated by use of burning as a *"positive environmental tool to create and sustain a heterogeneous mosaic of areas representing different times since fire"*. This should serve to enhance biodiversity over time.

Conclusion

The forests of the Kempsey and Wauchope MAs have been affected by wildfires in the past and are likely to be at risk in the future as a result of the particular combination of climatic and meteorological conditions, forest types and land use patterns within and beyond the study area. The only practical means of minimising the risk of wildfires causing significant damage is by manipulation of forest fuels.

Detailed fuel management planning is essential to hazard reduction operations if adverse impacts on forest ecosystems are to be minimised. Such planning should include specific subplans for areas with particular attributes that have been recognised as being of enduring interest.

The impacts of hazard reduction burning on forests are acknowledged but are not yet fully understood. While further research will assist resources managers in gaining a better knowledge of those impacts in the longer term, they may be mitigated in the short term by a range of strategies which should be implemented as a part of the proposal.

3.16 Traffic Impact Assessment

There are two traffic issues which require addressing as part of the assessment of the proposed activities. Firstly, there is the impact of forestry related traffic (State Forest vehicles, logging and haulage contractors) on the capacity of the local road system. Secondly, the effect of this traffic on road safety must be addressed.

The EIS provides data on existing traffic alone and truck movements, via specified routes, to mills and timber outlets. From this data it is not possible to determine if the flows being experienced, and those in the future, are beyond the capacity of the local road system. Although public submissions and Councils do not raise this as an issue.

The traffic impact assessment undertaken for the Dorrigo EIS (see Appendix K, Sinclair Knight 1992) utilised Average Annual Daily Traffic (AADT) counts and AUSTROAD Traffic Service Assessment Criteria for Rural Roads to assess the impact. Though not faultless, the methodology used in the Dorrigo EIS has been more rigorous than that used in other State Forest EISs, including the Kempsey-Wauchope EIS.

There are two perspectives to this assessment. Past forestry activities, and associated traffic, have not been the subject of environmental assessment. Therefore, the proposed activities can either be treated as an extension of past activities or as a new proposal. When evaluating the traffic impacts with regard to existing forestry activities, there will be a slight reduction in the amount of traffic generated due to a reduction in the quota sawlogs harvested. In the case of assessing the project as new, the amount of traffic generated must be compared to the traffic already existing. Data supplied in the EIS indicates that logging traffic constitutes approximately ten per cent of total traffic flow.

No data is supplied in the EIS on accidents in the area, though it states that a very low number of accidents involve logging trucks and other public road users. One submission (147a) raises the issue that the EIS does not include bridge and road maintenance costs associated with their use by logging trucks. It is considered, however, that it would be difficult and unrealistic to determine the damage caused by logging vehicles compared to that caused by milk trucks, buses and other vehicles. This issue was not raised by any Councils in the areas.

Conclusion

Based on the assessment of the information supplied in the EIS it is considered that the impact of forestry generated vehicles trips, both on the capacity of the local road system and as traffic hazards, will be minimal.

3.17 Cultural Resources

3.17.1 Aboriginal Sites

Those sections of the EIS that deal with Aboriginal cultural resources are based upon the field work and report (Packard 1992) of a specialist archaeologist. Although the report is detailed and comprehensive the summary provided in the EIS itself is somewhat limited. The Department notes that, as appropriate, the consultant archaeologist conferred with representatives of the Bunya, Birpai, Kempsey and Thungutti Local Aboriginal Councils.

The Known Resource

The specialist consultant employed a controlled, non-random site survey methodology which concentrated the effort in areas offering good survey conditions, noting that *"it is now widely accepted that the problems of accessibility and visibility are best overcome through the use of stratified or controlled non-random sampling"* (Packard 1992). None of the submissions addressed the appropriateness of this approach although one (152) did question the low sampling intensity of just 0.005%. In view of the size and nature of the study area and the constraints of time, the DOP is satisfied that the methodology employed and the sampling intensity achieved were suitable in the circumstances.

Although the EIS noted that very little archaeological work had previously been conducted in the State forests of the study area, 16 sites had already been recorded by the National Parks and Wildlife Service and a further 13 had been discovered in a recent survey of Yarrahapinni

and Way Way State Forests (Morwood and Collins 1991). It is likely that few of these recently discovered sites are relevant to the Kempsey MA as all of Yarrahapinni State Forest and most of Way Way State Forest (except for 410ha) fall within the adjacent Urunga Management Area. Nonetheless, the DOP is of the view that the exact number of identified sites on that part of Way Way State Forest within the Kempsey MA needs to be determined so that action may be taken to assess their scientific and cultural significance and classify them as necessary. Scientific and cultural assessment should be undertaken by a specialist archaeologist.

The 16 sites on the NPWS register believed to be located on State forest are listed on page 20 of the consultant's report and, while four have been accorded a Special Emphasis classification, the status of the others appears uncertain. There is even some doubt whether all are actually located on State forest. The consultant noted that the Kundabungi Range site (30-30-0105), for instance, may in fact lie within Werrikimbe National Park. The location of the 11 registered sites which do not already have a Special Emphasis classification needs to be checked and those confirmed to be on State forest should be reviewed by a specialist archaeologist in order to determine which of them warrant additional protection by the application of an appropriate PMP classification.

The field work resulted in the recording of 55 previously unknown sites, all but one of which were characterised by single or multiple flaked stone artefacts. The exception is a small rock shelter with a single artefact. Although none of the new sites was judged to be of significance to Aboriginal people, the consultant considered eight of the sites to be of sufficient scientific interest to warrant his making specific management recommendations which are repeated in the EIS (pp. 294-5), albeit with some modification. Failure to distinguish the consultant's recommendations from the action proposed in the EIS was criticised by the National Parks and Wildlife Service which argued, quite rightly in the DOP's view, that any changes to the recommendations should have been justified. Other of the consultant's recommendations are no longer relevant, having been overtaken by events. Thus, it is appropriate for the original recommendations to be reviewed by a specialist archaeologist in conjunction with local State Forests staff in order to establish which are still relevant and whether third stage PMP classification is warranted. In particular, consideration should be given to closing or relocating the track at the site known as Boonanghi 1-1 which, according to the National Parks and Wildlife Service, is not located on Boonanghi Road as claimed in the EIS.

The consultant concluded, with respect to the remaining 47 sites, that they *"have only limited scientific or Aboriginal significance. Much of what value they can impart is in their location/environmental distribution and this has already been recorded ..."* (p.82). The EIS proposes the following measures in order to mitigate the impact of forestry operations on the less significant known sites:

* conserve sites in their current condition where possible;
* confine road and track maintenance operations to the existing formation in the vicinity of sites;
* close sections of tracks on which sites have been recorded if the tracks are no longer required for forestry purposes;
* continued liaison with Local Aboriginal Land Councils about archaeological and anthropological values.

The Department endorses these measures but acknowledges the following comment from the National Parks and Wildlife Service as being particularly pertinent: *"While the EIS recognises the need to involve Aboriginal people in decisions relating to their cultural heritage, the EIS fails to understand that there should also be input on the scientific archaeological values of the sites"*. The DOP considers that the proper scientific evaluation of newly discovered sites is also of importance to the management of this resource.

During a field trip to the study area in October 1993, officers of the Department's Natural Resources Branch were shown two stone arrangement sites, one in Lower Creek SF overlooking Georges River and the other in Nulla - Five Day SF overlooking Granite Creek. As both had been discovered after publication of the EIS, no proposal for protection or future management have been made.

The location of both sites on steep rocky ridges carrying poor quality forest makes disturbance by forestry operations most unlikely. Nonetheless the Department is of the view that both are worthy of special classification as Aboriginal sites within the PMP system. As usual in such circumstances, State Forests should ensure that the exact location of these sites is not publicly disclosed in order to minimise the likelihood of disturbance or vandalism.

The Unknown Resource

A general conclusion arising from the field work was that sites seemingly occur across the full range of environmental circumstances at a mean minimum site density of 1.4 sites per square kilometre. At this density, the EIS estimates that the proposed construction of 192km of new roads during the approval period will have an impact on 326 sites (Section 7.2.7) while logging operations will have an impact on an estimated minimum 190 sites (by calculation from EIS Table 5.1) assuming recut and regrowth logging causes no additional disturbance. Following the consultant's recommendations the EIS proposes three means of mitigating the impact of forestry operations on the unknown resource:

* refinement of the predictive model by the establishment of a multi-stage archaeological project;

* survey of reserved areas such as Flora Reserves in order to obtain a picture of the *"reserved sample"* which will not be disturbed by routine forestry operations;

* survey of alignments likely to contain significant sites so that, where practicable, sites may be avoided in road construction.

The DOP endorses these measures.

Conclusion

Known sites of scientific significance should be reassessed in order to confirm that they actually do occur on State forest within the Kempsey or Wauchope Management Areas, that their significance has not been adversely affected by recent forestry operations and that they have an appropriate PMP classification or they are otherwise reserved where their significance warrants such action. Measures proposed in the EIS to protect the known resource are endorsed.

As it is likely that a very high proportion of the unknown resource consists of single or multiple flaked stone artefacts (as was the case in the 55 sites discovered in the survey) which are of limited scientific or cultural significance, the impact of forestry operations on the resource will not be great and will be mitigated by refinement of the site location model and by training of forestry staff in site identification, both of which should assist in sites being recognised, assessed and recorded and, in the case of sites judged to be scientifically or culturally significant, protected.

3.17.2 Historical Cultural Resources

Only three European cultural resources are mentioned in the EIS (see p.105): the Pipers Creek lime kilns in Maria River State Forest, the disused tin mine in the Gundle area of Kippara State Forest and the old trail which once provided access to the Carrai Plateau. Of these, the two on State forest are already classified PMP 1.1.8 (Historical Values) and, in addition, the lime kilns have been listed by the National Trust. The old Carrai Plateau trail is not the responsibility of State Forests of NSW as it does not traverse State forest. The tin mine and part of the old Oxley Highway route through Doyles River State Forest were also identified in a State Heritage Inventory Program study within Hastings Municipality but, as the old highway route falls within the adjacent Wingham Management Area, it shall not be considered further.

The extent of the survey of historical cultural resources is open to question for two reasons. Firstly, the EIS gives no indication that the services of a specialist consultant were used, nor is there a specialist report as in the case of Aboriginal sites. Secondly, it is surprising that not a single site is mentioned that was not previously known and classified within the PMP system despite a relatively long history of settlement and, especially, utilisation of forest resources within the region. Thus one might expect to see the inclusion of sites and perhaps relics associated with the harvesting and processing of forest products but none is mentioned.

The Australian National Committee of the International Council on Monuments and Sites (known as Australia ICOMOS) meeting at Burra Burra in 1979, adopted a Charter for the Conservation of Places of Cultural Significance (the *"Burra Charter"*), the aim of which is to foster the conservation of places so as to retain the cultural significance. For the purpose of the Charter, a *"place"* means *"a site, area, building or other work, group of buildings or other works together with associated contents and surrounds"* and *"cultural significance"* means *"aesthetic, historic, scientific or social value for past, present or future generations"* (Marquis-Kyle and Walker 1992). Of particular relevance to the lime kiln and tin mine sites is Article 25: *"A written statement of conservation policy must be professionally prepared setting out the cultural significance and proposed conservation procedure together with justification and supporting evidence, including photographs, drawings and all appropriate samples".*

The DOP considers that, if a site is judged to be of sufficient cultural significance to warrant Special Emphasis 1.1.8 classification, then the principles of the Burra Charter and particularly Article 25 should apply to ensure that these resources are adequately protected

and that the rationale for their recognition is clearly documented. In the case of sites on State forest, statements of conservation policy should be prepared and these, together with any site descriptions, drawings, photographs or specialist reports, should be incorporated in the relevant Management Area plan at the next revision. Any forest management prescriptions necessary to give effect to the conservation policy should also be included in the Management Plan.

Conclusion

Of four sites mentioned as being of cultural significance in the EIS, the Pipers Creek lime kilns and the Gundle tin mine are located on State forest within the study area, the old Carrai Plateau trail is located on Crown-timber lands within the study area and the old Oxley Highway route is located outside the study area.

A statement of conservation policy should be prepared for the two sites located on State forest within the study area in accordance with the principles of the Burra Charter. These statements should be included in the respective management plans at the next revision of those plans. While it is acknowledged that State Forests of NSW has no management responsibility for the old trail to the Carrai Plateau, the District Forester Kempsey should ensure that any operations licensed by him on the Crown-timber lands through which the trail passes do not prejudice the conservation of this resource.

3.18 Recreation and Tourism

The two management areas provide a valuable recreational resource and have a history of recreational use by the public. Despite the large variation in numbers from year to year, Table 3.30 (EIS p.122) indicates that, for Kempsey MA, up to 90% of annual visitor usage between 1980 and 1990 was concentrated in the rest area adjacent to the Pacific Highway within Maria River State Forest. Although comparable data are not provided for Wauchope MA, it seems likely that visitor use there may also be concentrated in forest rest areas adjacent to the Pacific Highway.

The EIS (Section 3.17.1) suggests that the study area provides a wide range of forest-based recreational opportunities. Developments provided by SFNSW either co-incidentally or specifically to facilitate the enjoyment of probably the most commonly sought opportunities are forest drives, scenic lookouts, picnic and camping areas and forest walks. Section 3.17.2 lists nine recreational activities which are specifically mentioned in the Kempsey MA plan although it is likely that the same activities also take place within the Wauchope MA. With the exception of the Maria River State Forest roadside rest area, no attempt has been made to use the Recreation Survey data (EIS Appendix G) to disaggregate annual recreational usage between the various types of recreational activities nor between the several developed sites and less developed forest areas.

Analysis of environmental impacts is addressed in Chapter 11. However, the EIS considers only the impacts of tourism and recreation on the State forests of the study area and not the impacts of harvesting and associated forestry operations on recreation. It concludes that the impact of forest recreation is generally insignificant due to relatively low rates of usage per

unit area while potential problems at sites where usage is concentrated may be overcome by careful initial selection and timely maintenance. The Department concurs that, in this regard, impacts are negligible.

The preferred means of assessing the likely impact of forestry operations on recreation is by the application of a methodology capable of yielding semi-quantitative results. One such methodology developed for and used by the United States Forest Service is the Recreation Opportunity Spectrum (Clark and Stankey 1979). The Department's assessment of the EIS suggests that opportunities to partake in recreational activities requiring semi-primitive motorised or roaded natural settings (to adopt the ROS terminology) will be enhanced by the proposed forestry operations whereas opportunities to partake in recreational activities requiring primitive or semi-primitive non-motorised settings will be reduced. Although the extent of the shift in balance is not known in this instance, the ROS methodology does provide a means of quantifying such changes if thoroughly applied as described in the User's Guide (USDA n.d.).

Only one submission (5) directly addressed forest recreation and this supported a continuation of current recreation policies. Several submissions (133, 138, 144) claimed that the EIS was deficient because of an alleged failure to address tourism (and specifically eco-tourism) as distinct from recreation while another (147) claimed that tourism potential had been *"unfairly and ridiculously dismissed"*. Eco-tourism has been defined as tourism which is (a) based upon relatively undisturbed natural areas, (b) non-damaging and non-degrading, (c) a direct contributor to the continued protection and management of the protected areas used and (d) subject to an adequate and appropriate management regime (Valentine 1991). It is the Department's view that these claims have merit as the EIS does not address current use and tourism potential other than to mention that *"operators located in Port Macquarie and other coastal towns conduct tours of State Forest areas and make a significant contribution to the local economy and employment in the area"* (p. 299). No information is given about the number or specific location of operators, areas of State forest used, the number of visitor-days each year, contribution to Forestry District revenue and to the local economy and trends in usage of such services despite the claim in Section 11.3 of the EIS that *"tour operators will continue to be managed through a permit system which will allow the Commission to monitor the level of usage by these operators"* (p. 300). Thus, it is difficult to reach a firm conclusion about the tourism potential of the Kempsey and Wauchope Management Areas although at this stage the Department is inclined to agree that no significant tourism opportunities exist in State forests of the Kempsey MA in the short term because *"more spectacular and more accessible tourism resources are available elsewhere"* (submission 150). Presumably these are centred on the beaches and other coastal features which make the north coast of NSW such a popular holiday destination. The same is probably true of the Wauchope MA also.

The Recreation Survey report (EIS Appendix G) indicated that some survey respondents were critical of the questionnaire. The Department shares this concern as the survey seems to have been poorly focussed with very few of the questions eliciting useful information about recreation or tourism. This concern is perhaps borne out by the fact that, while the Recreation Survey is reported in Chapter 3 of the EIS, the results are not given and no analysis is attempted.

Conclusion

The Kempsey and Wauchope Management Areas provide a range of recreational opportunities, however, data regarding location, volume and types of historic and current usage are limited.

While the impact of recreational activities on the environment has been considered, there has been no corresponding consideration of the impact of forestry activities on current or potential recreational activities or tourism. Nonetheless, the Department considers that impacts are unlikely to be significant because of the uneven distribution of recreational usage. High usage areas, on the one hand, are generally shielded from logging impacts by visual resource protection corridors or special management prescriptions or both while, in all other areas, the unit rate of usage per hectare per annum is likely to be so low that the impact of logging on dispersed recreational activities is negligible.

Although several eco-tourism operators are already established within the study area, the lack of information about the services they offer and the current and expected demand for those services makes it very difficult to estimate the potential use of State forest areas for such purposes. This warrants further investigation. However, the Department concludes that the relatively easy accessibility of competing destinations will result in very little increased use of State forests for eco-tourism during the approval period.

3.18 Scenic Resources

The description of scenic resources in the EIS (Section 3.13) is brief. The landscape is divided into three broad units (coastal plain, major river valleys and dissected upper slopes) and visually prominent landforms are identified on an accompanying map (Map 9) in satisfaction of Director's requirement 1(d). The impact of harvesting and other forest operations on scenic resources is considered in Section 5.2.13 where it is concluded that, despite the strong visual impact of recent logging, a combination of factors effectively mitigates the impact on scenic resources. Those factors are the relatively rapid recovery of logged areas as regeneration develops, the significant number of trees retained in each logged compartment and the preference of tourists and other casual forest visitors to travel on established forest drives or other major forest road enclosed by visual resource protection corridors (PMP 1.1.6). The Department concurs with this view.

Only one submission (147) commented on scenic resource issues, alleging a failure of the EIS to identify areas of particular aesthetic value. While it may be argued that the visually prominent landforms identified on Map 9 are of particular aesthetic value, it seems likely that the comment in the submission is aimed more at the Old Growth Forest Assessment (Appendix F, Volume 2) which records only basic quantitative information such as location, soil types, area, forest types and disturbance history. No assessment of aesthetic value was attempted. Thus, while the Department acknowledges that this criticism has some merit, it should be pointed out that assessment of qualitative attributes such as aesthetic value is fraught with difficulty and that no widely accepted methodology exists for the evaluation of such attributes (Dyne 1992).

Conclusion

Proposed forestry operations will have a negligible impact on scenic resources provided areas classified PMP 1.1.6 in current management plans are maintained. Although old growth forest areas have not been included in the consideration of scenic resources, it is the Department's view that their omission does not compromise the above conclusion.

3.20 Grazing

According to the EIS (Table 3.38), the area of State forest grazed is 28,265 ha which is only 13.6% of the total State forest area. Clearly grazing is not as important a use of the forest estate as it is in some other forest management areas. Of the total grazed area, 72% is authorised by permits and leases issued by State Forests and thus over which State Forests may exercise management control while the balance is Crown Lands Act tenures over which State Forests has little or no management control.

The Fauna Survey report (p.129) quoting the literature, lists three ways in which the grazing of domestic stock may adversely affect native fauna, viz. loss of shelter, competition for food resources and changes in soil properties caused by hard hooves. In addition, it is claimed that prolonged grazing by domestic stock alters the composition and structure of forest vegetation and hence fauna habitat. Indeed, Austeco Pty Ltd (1992), in the Fauna Impact Statement for the Glen Innes Management Area, went so far as to claim that *"grazing and associated burning is responsible for the greatest loss of fauna biodiversity and habitat simplification of any land use practiced within the Management Area"*. Specifically with regard to the Kempsey and Wauchope Management Areas, the Fauna Survey report (p.130) concluded that *"it was not possible to assess whether the distribution of native mammals is affected by the extent of grazing ... However, such an assessment would be possible using existing information by GIS analysis"*.

The EIS itself (p.245) proposes that grazing within State forests continue at existing levels with the proviso that domestic stock be excluded from Flora Reserves and other reserved areas. Such a proposal gains some support from those lodging submissions (e.g. 156), others argued that a continuation of grazing cannot be justified as the EIS failed to properly assess the effects in either the short or long term (147). The National Parks and Wildlife Service (152) argues for the exclusion of grazing from areas of critical habitat for critical weight range mammals as well as from Carrai and Cochrane State Forests in order that Hastings River Mouse habitat may be protected.

There is a pressing need for the impact of grazing by domestic stock and associated burning on native forests to be quantified. Realising that information is unlikely to be forthcoming in the short term, it is appropriate that there be no increase in the area of State forest leased for grazing except where lands with existing grazing rights granted under the Crown Lands Act are dedicated as State forest during the approval period. Indeed, the exclusion of grazing from some areas now used for this purpose may well be warranted in the interests of fauna conservation as argued by the National Parks and Wildlife Service (152). Even a large reduction in the area grazed would have negligible impact on District revenue as the EIS reported income from grazing to be much less than 1% of total income for both Kempsey and

Wauchope MAs (Table 3.38 and Table 5.5) although the impact of such a reduction on the pastoral operations of individual graziers may well be significant. The benefits of such a course of action for fauna are more difficult to quantify but may be expected to include the maintenance of habitat crucial to the survival of Schedule 12 ground-dwelling mammals such as the Hastings River Mouse.

Conclusion

Grazing of domestic stock is an historic forest use with minimal financial returns to State Forests but, it may be assumed, greater returns to the graziers who occupy State forests for this purpose. Although grazing undoubtedly has an impact on native forests, the nature and extent of that impact on the forests and, particularly, the native animals that live there is not known. Accordingly, it is concluded that grazing should be permitted to continue at present levels as proposed but that there should be no expansion of grazing activity during the approval period pending results of studies established to investigate the impacts of grazing and burning on native flora and fauna. Habitat crucial to the survival of Schedule 12 ground-dwelling mammals shall be preserved by the application of prescriptions specific to the known requirements of those species.

3.21 Beekeeping

Table 3.39 within the EIS shows that there are 145 Occupation Permits for Beekeeping in the study area, the majority of which are in Kempsey MA (71%). Although no figure is given in the EIS, a comparison of Map 14 (Grazing and Beekeeping) and Map 17 (Conservation Strategy) suggests that perhaps four existing bee sites will be affected by proposed additional Flora Reserves and conservation reserves (all on Maria River SF in Kempsey MA).

Within the study area, dry hardwood forest types are generally best suited to beekeeping (EIS p.160). These types occupy about 43% of the total area of State Forest and 76% of other Crown-timber lands (Table 3.4), predominantly in the east of the study area. Availability, however, is limited to some extent by difficulty of access while few of the sites that are accessible are suitable for use throughout the year (submission 148).

The Fauna Survey report notes that *"there is considerable information about the impacts from the introduced Honey Bee upon native Flora and Fauna"* (p.130) and quotes at length from a report prepared for the Australian National Parks and Wildlife Service (Mount King Ecological Surveys 1992). These impacts are of two broad types : competition with native fauna for resources and alteration of floral composition. The Fauna Survey report concludes that, while there is probably insufficient evidence to justify the exclusion of beekeeping from the Kempsey and Wauchope MAs, there should be no further expansion of the industry and that feral bee hives should be destroyed. However, as is pointed out in one of the submissions (148), many of the examples of adverse impacts of honey bees on native flora and fauna are of questionable relevance to the study area. For instance, the report suggests that loss of nectar to honeybees may reduce the attractiveness of native species to native bees with a consequent decline in pollination. One of the species mentioned as being in danger is *Grevillea barklyana*, but this occurs only on the south coast and southern tablelands of NSW. Similarly, it is suggested that regular vehicle

movements associated with beekeeping may assist in the spread of dieback disease in Western Australia, but it seems that there is no greater risk of spreading dieback with beekeeping vehicles than with any other vehicles. Clearly, such examples serve to highlight the lack of knowledge of impacts specific to the forests of the study area, a shortcoming emphasised in several submissions (e.g. 147, 152).

As it is usual practice for SFNSW not to grant Occupation Permits for Beekeeping over Flora Reserves and other reserved areas, implementation of the proposed conservation strategy would result in the loss of about four existing bee sites on Maria River SF and, while this is less than 3% of the total number of sites currently under Occupation Permit, these particular sites are of special value to the local industry as they are among a limited number that are useful for over-wintering and spring breeding (148).

Despite concern expressed in the literature about competition with native insects and vertebrates for resources, effects on the pollination of some native plant species and the additional (and unquantified) impact of feral populations of honeybees (e.g. Pyke 1990, Paton 1990), there seems to be as yet insufficient evidence to justify the removal of all domestic bees from State forests within the Management Areas at this stage. Rather, a continuation of the existing practice whereby domestic bees are excluded from Flora Reserves and other reserved areas is preferred.

In view of the particular value to apiarists of the four or so sites within the proposed Boogoolum Flora Reserve, consideration may be given to mitigating the impact on the local apiary industry by the substitution of other sites that are readily accessible and that carry similar forest types. Alternatively, sites on private land may be utilised. The availability of suitable substitutes would facilitate the cancellation of existing permits before or at the time of gazettal of the new Flora Reserve. If, however, no substitute sites are available, the only other options are cancellation (resulting in a reduction in the number of occupied sites) or suspension of the current practice in this instance to permit bee sites in the new Flora Reserve indefinitely or for a specified period. On balance, the Department prefers that the practice of excluding domestic bee hives from Flora Reserves be maintained despite the likely impact on the local apiary industry. This adverse impact may be mitigated to some extent by allowing the phasing out of sites during the first five years of the approval period.

Conclusion

Current knowledge of the impact of honey bees on native flora and fauna is judged to be insufficient to warrant the exclusion of the apiary industry from State forests. However, the existing practice of not issuing Occupation Permits for Beekeeping over Flora Reserves and other reserved areas should be maintained.

Substitute sites should be found if possible to replace the small number of existing sites affected by the proposed Boogoolum Flora Reserve. If equivalent sites cannot be located elsewhere, site permittees should be allowed to retain the sites for a period of up to five years from the date of the determination in order to mitigate the impact of the creation of the new Flora Reserve on their operations.

3.22 Other Crown Timber Lands

The EIS identifies the proposal as being the continued management in the K/WMA of State Forests and the utilisation of timber resources on other Crown timber lands within the study area. The proposal includes some 207 887 ha of State Forests and 93 732 ha of vacant Crown lands, leasehold lands and timber reserves.

The stratification of surveys for flora and fauna covered both Crown timber lands and State forests equally. Unless areas are specifically referred to in this report, the Department is satisfied with this survey effort. The assessment of Crown timber lands for archaeological value and soil typing is recognised and the inclusion of harvesting proposals and yield estimates for these lands is acknowledged.

Since the Crown timber lands outside of the State forests have been assessed in this EIS, it is considered that the determination of the proposal by the Minister for Planning should include all the Crown timber lands of the K/WMA that are the subject of the SFNSW proposal.

Conclusion

The Department considers the coverage of other Crown timber lands in the K\WMA EIS to be sufficient to allow the Minister's determination to apply to these lands as well as State forests.

3.23 Air Quality and Noise Pollution

Noise

The EIS details a number of potential sources of noise impact as a result of continued forest management. These sources of impact include; operation of machinery in the forest and trucks used to haul logs.

The statutory controls relating to noise control for all of the above-mentioned operations, including both Local Government and Environmental Protection Agency regulations are detailed in the EIS. Given that the existing statutory controls will serve to reduce impacts to acceptable levels and the operation of machinery in forests will be generally isolated from nearby residents, it is considered that the noise impacts of the proposal will not be significant. Furthermore , in comparison to the existing situation the proposal will result in reduced impact due to sawlog quota reduction.

Neither affected local councils or the EPA raised concerns, in their submissions, with respect to their relevant jurisdictions under the Noise Control Act.

Air Quality

The impact of localised air pollution from vehicle emissions was not addressed in the EIS. However it is evident that the level of vehicle emission will be reduced from current levels since the proposed activity will result in a lower number of vehicle movements than at present, due to sawlog quota reductions.

The EPA having statutory responsibility for the issuing of pollution licences under the provisions of the Pollution Control Act did not raise any concerns in its submission, with respect to air pollution.

The undertaking of fuel reduction burning by State Forests can have a significant impact on air quality resulting from high smoke levels. It is considered by the Department, however, that fuel reduction burning is essential to ensure public safety and decrease the risk of wildfire.

The air quality impacts of this burning are reduced due to the isolated locality and the lack of alternative sources of air pollution in the vicinity of the proposed operations. The restriction of this activity to a 2 - 3 month period on an annual basis also reduces the impact of this activity on air quality since impacts are short term. The Department agrees with the statement in the EIS that if fuel reduction burning is not carried out the frequency and intensity of wildfires is greatly increased. Such wildfires generate much larger volumes of smoke that is dispersed over vast areas and remains in the atmosphere for much longer periods than smoke from fuel reduction burning.

Conclusion

It is acknowledged that the undertaking of the proposal will result in some air quality and noise pollution impacts, however these are not considered to be significant. Furthermore they will be controlled through various statutory regulations. Impacts will also be less than those currently occuring due to sawlog quota reductions decreasing the level of activity of forestry operations.

3.24 Enhanced Greenhouse Effect

The RAC Inquiry (RAC 1992) concluded that the issue of the impact of forestry operations on the enhanced greenhouse effect was not clearly resolved. This remains the case and, given the global and complex nature of this issue, it is beyond the scope of a single EIS to resolved.

It is possible, however, to consider the merits of converting old growth forest to regrowth forest. The EIS states that it is reasonable to conclude that the proposed harvesting of old growth forests will in time reduce the quantity of carbon dioxide in the atmosphere at least marginally.

Though some minor benefit has been identified for increasing the area of regrowth forests, under certain conditions (see p.233 of the EIS), the RAC Inquiry (1992a) did not support the case for converting old growth forests into regrowth forests in order to create a positive carbon balance. This decision reflects the situation where even large scale plantations and afforestation projects would only result in a minor contribution to mitigating enhanced greenhouse effects. In addition, the harvesting of a forest will increase, in the short term, greenhouse gases through:

- immediate losses of carbon from the soil;
- creation of waste material and use of fossil fuels in timber harvesting and production.

The issue of the part that the general forestry industry plays in mitigating enhanced greenhouse effects, needs to be addressed at a broader scale, such as through the National Greenhouse Response Strategy.

Conclusion

Based on the assessment of the subject area and proposed activities, it is expected that the impact, positive or negative, on enhanced greenhouse effects will be negligible.

3.25 Energy

The harvesting and processing of timber from State Forests in the Study area will involve the direct consumption of energy through the burning of fossil fuel and wood waste. It is stated in the EIS, however, that the preparation of an accurate energy budget is extremely difficult, since the amount of energy consumed is dependant on a number of variable factors and is therefore constantly changing. Details are provided on the energy requirements for processing of different wood based products.

The reduction in quota sawlog production associated with the proposed activity will result in a slight reduction in local energy consumption. This will probably be offset, however, by the trend towards increasing the proportion of timber which is processed by kiln drying and dressing. This decrease will be further offset if the reduced hardwood timber supply is substituted by other materials, such as steel or concrete, which consume considerably more energy in their production. The Department agrees with the conclusion that the energy consumed in the production of timber building materials is relatively low compared with other building materials. Therefore, since the proposal contributes to the continued availability of wood-fibre products in the market, the Department concludes that the proposal promotes lower energy consumption.

Conclusion

The harvesting and processing of timber from State Forests will result in the direct consumption of energy. The Department concludes, however, that the continued availability of wood-based products will result in lower energy consumption than the use of substitutes which use considerably more energy in their production.

3.26 Cumulative Effects

Cumulative environmental effects can be defined as the interaction, combination and compounding of effects associated with one or more activities. These cumulative effects occur over time and space, gradually altering the structure and functioning of biophysical systems. They may subsequently affect the socio-economic well-being of people and their community. Under the TI(IP) Act 1992, 15 areas are identified for which EIS's are required to be prepared. State Forests have prepared five to date and are in the process of preparing the remaining ten. As such it is clear that the decision of the Minister for Planning, in determining these EIS's will impact many regions in Northern NSW and may have cumulative impacts.

The cumulative economic impacts of the SFNSW proposals (as amended by the Minster for Planning) relate to reduction in quota as a result of reductions in yield from various Management Areas on the North Coast. The consequences of this can be far reaching, particularly given the linkages in the Timber Industry and the complex flows of timber. The economic consequences are superimposed on the structural change occurring in the hardwood forest industry and private commercial decisions made by individual companies. It is therefore difficult to discern the true cumulative consequence of the Minister's decisions beyond recognising that all other things being equal, increasing conservation areas and imposing habitat prescriptions will result in quota reductions and feed into the structural changes that are currently happening in the industry.

From a social perspective the Department of Plannings findings in the areas that it has examined to date indicate that the main impact of quota reduction is on individuals and their families rather than the prosperity of town or community facilities and services. Furthermore while there are linkages between the forest industry and different communities, the majority of direct social impacts resulting from decisions occurring in say the Kempsey/Wauchope Management Area occur in the Hastings Municipality and Kemspey Shire. Thus the main social impacts from different SFNSW proposals and determinations by the Minster for Planning tend to be geographically separate thus minimising cumulative impacts in specific towns.

This is not to dismiss the fact that in certain instances mills receive resource from many management areas, e.g. Kempsey Timbers, and therefore such a mill and the town it is located in may be cumulatively affected by decisions made with respect to forestry operations. Although it needs to be recognised that the commercial decision of companies such as Boral who own a number of mills on the North Coast and transfer wood from mill to mill could also have socio-economic consequences.

Cumulative ecological effects relate primarily to the potential biophysical impacts of logging operations on the various management areas affected by SFNSW EIS's on the North Coast. The EIS proposal for the Kempsey/Wauchope Management Area will result in a lower level of impact than the current plans of management for Kempsey and Wauchope Management Areas. This decrease in impact is due to a reduction in the volume of quota sawlogs, resulting from the proposed conservation reserve strategy and the implementation of the SEMGL. Furthermore, the limitation of the approval to 10 years will allow for a revisiting of impacts and appropriate reassessment in terms of changing economic circumstances and community perspectives on conservation after the expiry of this approval period. This will reduce the likelihood of long term cumulative impact. Thus, the cumulative ecological impacts of this proposal will be minimised by the inclusion of ameliorative measures such as those listed above and the subsequent conditional determination by the Minister for Planning.

It must be acknowledged that the Kempsey/Wauchope Management Area proposal will, however, result in logging operations occurring in areas that have not been previously logged. These operations will result in some cumulative impacts. The implementation of recommendations relating to the order of working for old-growth areas, flora conservation, expanded fauna prescriptions and adherence to the SEMGL will substantially reduce these impacts.

Conclusion

Some cumulative impacts will occur as a result of the implementation of this proposal and similar TI(IP) Act EIS's in NSW.

Nevertheless, social impacts tend to be geographically separate and thus can be considered in individual EISs. Furthermore, it is envisaged that economic impacts will feed into and reflect current structural changes occurring in the timber industry on the North Coast. The cumulative ecological impacts will be reduced to acceptable levels through the decrease in forestry activity resulting from sawlog quota reductions, the limitation of the approval to 10 years and the implementation of flora reservations, fauna prescriptions and the SEMGL.

3.27 Monitoring

The monitoring of enrivonmental impacts has long been considered to be one of the most important issues in the EIS process and one which has been generally carried out the least satisfactorily (Martyn et al, 1990). Monitoring, properly carried out, can provide valuable information for future decision-making and can alert administrators to unforeseen impacts, allowing projects to be altered accordingly. In forestry this would allow amendments to existing prescriptions and redevelopment of additional management prescriptions to be put in place to prevent impacts detected by monitoring.

Unfortunately, monitoring is also an extremely expensive process. The K/WMA is a very large, complex area and the large range of possible impacts of logging operations reflects this. To monitor all of these impacts within the K/WMA would place an unnecessary burden on the finances of the Central Region of the SFNSW, which administers the MAs. This is because many of the possible impacts will not be unique to the MAs., but may occur in all management areas. It is therefore scientifically acceptable for the monitoring programs described in this report to be integrated with the State Forests' monitoring and research program that will run throughout the north-east forests or the State. This is also more acceptable from an economic viewpoint as there is no need to repeat monitoring programs in every management area.

However, State Forests is yet to notify the Department that a regional monitoring program has been developed and, as such, the Department is unable to assess whether this program is suitable to monitoring the impacts of forestry activities in the K/WMA. Thus all monitoring prescriptions recommended by this report must be implemented in the study area. This position can be reconsidered when a regional monitoring strategy has been developed to the satisfaction of the Minister for Planning.

The Department of Planning does not have the information necessary to determine which monitoring should be carried out at which sites in order to achieve the objectives of such a program and this decision must be left to the SFNSW to determine. The SFNSW should, of course, be mindful of ecological variation when making decisions as to whether monitoring results from a particular situation will be transferable to the K/WMA or other management areas. The reporting of monitoring programs is also a matter which has great support (e.g. Martyn et al, 1992) and it is considered that the results of monitoring programs should be published triennially by the SFNSW.

3.28 Transitional Arrangements

Conditions attaching to the Minister's determination of the EIS become binding on all logging operations within State Forest or Crown-timber lands for the duration of the approval. Nonetheless, the Department is mindful of the fact that the forests of both the Kempsey and Wauchope Management Areas have yielded supplies of logs for local industries over a long period of time and that continuation of logging operations without interruption is vital to such industries. The Department further acknowledges that the Timber Industry (Interim Protection) Act aims to "provide interim protection for the employment of workers engaged in the logging of certain forests (s.3a) while also providing for "a full and proper environmental assessment to be made of logging operations..."(s.3b). As application of the conditions across-the-board at the date of determination would result in the severe disruption of logging operations, the Department considers that a staged implementation would best achieve the objects of protecting jobs and mitigating environmental impact of logging.

Several compartments in both the Kempsey and Wauchope Management Areas have approved harvesting plans and s.120 licences issued by the Director of the National Parks and Wildlife Service while others have approved harvesting plans only although s.120 licences have been sought. The Department considers that logging should be permitted in these compartments under the existing harvesting plans (provided s.120 licences are forthcoming for those compartments which do not already have them) for up to three months from the date of the Minister's determination to allow State Forests sufficient time to amend the harvesting plans in conformity with the conditions of the determination. It is noted that none of the compartments to which the concession shall apply are listed in Schedule 1 of the Timber Industry (Interim Protection) Act. Also, the Department acknowledges that State Forests has already implemented the more stringent Standard Erosion Mitigation Guidelines for Logging in both Kempsey and Wauchope Management Areas.

Conclusion

It is unreasonable to expect approved harvesting plans to be amended immediately the Minister's determination of the EIS is made. Thus, in order to ensure that log supplies to industry are not interrupted, logging in compartments with approved harvesting plans for for which s .120 licences have been obtained or sought at the date of the determination shall be permitted under the existing harvesting plan, for up to three months from the date of the Minister's determination, provided such compartments are not included in Schedule 1 of the Timber Industry (Interim Protection) Act.

4.0 RECOMMENDATIONS

The following recommendations flow from the consideration and conclusions in Chapter 3 and will form the basis for the conditions attached to the Minister's determination. It should be noted that the EIS and supporting documentation contain extensive information on procedures and conditions that will be implemented to ameliorate the impact of the forestry proposal. These have not all been duplicated in this chapter. The following recommendations should be implemented in addition to those proposed in the EIS and should prevail in the event of any inconsistency.

Definitions

a) For the purpose of these recommendations "old growth" shall be taken to mean "unharvested".

b) For the purpose of these recommendations "Rainforest" shall be as defined in Forestry Commission of NSW Research Note 17 - "Forest Types of NSW".

Determination

1) It is recommended that the Minister for Planning approve the forestry operations as proposed in the EIS and as amended by conditions based on the following recommendations.

Length of Approval

2) This approval shall be limited to a maximum of 10 years.

Land to Which the Approval Applies

3) Approval shall be granted with respect to State forests and other Crown-timber lands in the K/WMA except where logging is otherwise prohibited by these recommendations.

Consistency with Other Plans and of licenses etc

4) Management Plans and all Operational Plans, including Harvesting Plans, shall be consistent with these recommendations.

5) All licenses, permits or other authorisations issued by State Forests of NSW for logging operations shall be consistent with these recommendations and the procedures and conditions described in the K/WMA EIS and supporting Reports.

Order of Working

6) Logging of unlogged forest within Wauchope Management Area shall occur in the order shown in the following table.

Table 1 - Recommended order of working for Wauchope Management Area

Group	Block	State Forest	Compartments
A	5	Mount Boss	133, 134
	32	Bellangry	52
	35	Doyles River	162
	6a	Mount Boss	141,142,143,145,178,179,180
	34a	Doyles River	245
B	6b	Mount Boss	148, 196
	8	Mount Boss	189-191, 203, 204
	9	Mount Boss	123-132, 336, 337
	27	Doyles River	217,218,220,222,238,241,242
C	14	Kippara	15, 17
	15	Kippara	4
	17	Ballengara	39, 40, 43, 44, 45, 47-49
	18	Ballengara	46, 50-53
	22	Doyles River	247, 248, 250
D	20	Doyles River	257-260, 264
	23	Doyles River	203, 204, 209-213, 216
E	10	Mount Boss	264-272, 302, 304, 305
	11	Mount Boss	299,315,318-322,325,326,335
	12	Yessabah	309, 311, 312, 327-334
F	2	Mount Boss	94-97, 117
	3	Mount Boss	153, 155
	24	Doyles River	175,176,181-195,200-202,205-208
	29	Doyles River	147-159
	30	Doyles River	165-174

7) Logging of unlogged forest within Kempsey Management Area shall occur in the order shown in the following table.

Table 2 - Recommended order of working for Kempsey Management Area

Group	Block	State Forest	Compartments
A	2	Nulla-Five Day/Pee Dee	88-94
B	1	Nulla-Five Day	101,102,123,124,139,144,145
C	6	Lower Creek	1, 6, 7, 11, 27, 30
	10	Nulla-Five Day	106
	11	Nulla-Five Day	21, 22, 104, 105, 147-150
	X	Willi Willi VCL	Flat Top Mountain
D	5	Styx River	14, 15
	7	Styx River	16, 17
	9	Nulla-Five Day	108, 109, 111
	12	Styx River	19, 20, 23
	13	Styx River	24, 25, 26, 31
E	8	Nulla-Five Day	110, 113-116
F	3	Nulla-Five Day	119, 121
	4	Lower Creek/Styx River	12, 18, 29*

* Compartments 29 and 12 (in that order) may be logged out of order with the order of working if no other supplies are available from the Kempsey MA due to wet weather.

Fauna

Multiple Use Habitat Features

8) Unless otherwise specified by these recommendations, any habitat feature retained for the purpose of one recommendation may also be counted as retained for the purposes of any other recommendation provided that it meets the requirements of that recommendation.

Habitat tree retention

9) a) In Moist, New England and high quality Dry Hardwood forest an average of six habitat trees per hectare shall be retained where this density exists. These must be well spaced throughout the area being harvested.

b) In low quality Dry Hardwood forest an average of four habitat trees per hectare shall be retained where this density exists. These must be well spaced throughout the area being harvested.

c) Sufficient recruitment habitat trees must be retained in order to maintain the prescribed density of habitat trees in perpetuity.

d) For the purposes of this recommendation:

(i) low quality Dry Hardwood forest is defined as having a site height of 30m or less;

ii) Habitat trees are defined as live, hollow-bearing trees being of a condition enabling them to survive until such time as recruitment habitat trees have developed hollows; and,

iii) Recruitment habitat trees are defined as those trees of an age and condition such that they are likely to survive and develop hollows before nearby habitat trees die.

g) Where the prescribed density of habitat trees or recruitment habitat trees is not available, all such trees which are available must be retained, except where removal is necessary for log dumps or roads.

10) Pre-logging inspections shall identify and mark habitat and recruitment habitat tees to ensure their retention. The person(s) performing this operation must have been trained in the identification of trees suitable for these purposes.

11) Clusters of vegetation shall be retained about habitat trees and must include understorey layers and ground logs (where present before operations commenced). Trees may be felled within these clusters but ground disturbance machinery shall be excluded.

12) Logging debris shall be removed from around habitat trees if top-disposal burning is proposed and damage to such trees is likely.

Yellow-bellied Glider

13) When a Yellow-bellied Glider sap feed tree is located (identified by feeding scars):

a) Within a 100m radius:

i) all trees with feed scars must be retained;

ii) an additional 30 trees (>10cm dbh) of sap feed tree species (e.g. *Eucalyptus propinqua, E. punctata* and *E. tereticornis*) must be retained; and,

iii) a minimum of 15 mature bark shedding trees must be retained, unless the scarred sap feed tree is already located within a 100m radius that has been retained in accordance with this recommendation.

b) Within an area of 50ha located about a sap feed tree prescribed by recommendation 13a or about a record of a Yellow-bellied Glider where no sap feed trees can be located:

i) an average of 10 trees (>10cm dbh) per hectare of sap feed tree species (e.g. *E. propinqua, E. punctata, E. tereticornis*) must be retained;

ii) an average of 5 mature bark shedding trees per hectare must be retained; and

iii) trees in unlogged remnants (e.g. filter strips, steep slopes) may count toward trees retained for the purpose of this recommendation, unless the sap feed tree is already located within a 50m area that has been retained in accordance with this recommendation.

The 50ha area prescribed by this recommendation need not necessarily be centred on the sap feed tree prescribed in recommendation 13a, but may be placed over all sap feed trees located in the logging area and subject to recommendation 13a.

14) a) Trees retained by recommendation 13a may count toward trees retained for recommendation 13b.

b) Sap feed trees may not count as mature bark shedding trees.

c) Where the minimum numbers of retained trees prescribed by recommendation 13a or 13b do not exist, all trees which satisfy these recommendations shall be retained.

Koala

15) Trees with evidence of regular use by koalas (scratch marks on trunk, faecal pellets on the ground) shall be retained.

16) a) State Forests of NSW shall develop an appropriate prescription for the amelioration of the impacts of logging operations on koalas suitable for use in the Kempsey and Wauchope Management Areas.

b) This prescription shall be developed within two years of the date of the determination of the Kempsey-Wauchope Management Areas EIS by the Minister for Planning.

c) The further approval of the Minister for Planning is required before the prescription described in recommendation 16a is implemented in preference to that described in recommendation 15.

Hastings River Mouse

17) a) The area shown on Map 4 shall not be disturbed until such time as both its significance to the population of the Hastings River Mouse in the vicinity, and the significance of that population to the survival of the species has been further assessed.

b) The further approval of the Minister for Planning must be sought before disturbance occurs in any part of the area indicated on Map 4.

c) The proposed Bungawarrah Flora Reserve shall be extended to the boundary of Carrai State Forest as shown on Map 4.

18) a) The prescription in respect of the Hastings River Mouse proposed in the FIS shall be implemented.

b) Additionally, a 20m retention strip shall be placed along all gullies upstream from the potential habitat of the Hastings River Mouse to the ridge tops within the compartment in which the habitat is found.

Terrestrial Mammals

19) Unused roads shall be allowed to revegetate except where they are necessary for fire control.

20) 1080 baiting shall not be carried out by the State Forests of NSW in the following areas, excepting crown leasehold tenure lands, until such time as its impacts on Critical Weight Range species has been fully assessed:

Mount Boss State Forest;
Doyles River State Forest;
The Carrai Plateau;
The Petroi Plateau;
Nulla-Five Day State Forest
Pee Dee State Forest;
Cairncross State Forest;
Bulga State Forest;
Boonanghi State Forest;
Yessabah State Forest;
Collombatti State Forest;
Ingalba State Forest;
Tamban State Forest;
Broken Bago State Forest;
Cowarra State Forest; and,
Queens Lake State Forest.

21) Serious consideration should be given to the impacts of unauthorised burning when re-issuing occupational grazing licences.

22) Dead stags shall not be felled unless retaining them would create a hazard.

Rufous Scrub Bird

23) a) Areas within compartments 12 and 18 of Styx River State Forest and 119-121 of Nulla-Five Day State Forest which exhibit the habitat requirements of the Rufous Scrub Bird shall not be burnt deliberately or logged until further assessment of the significance of the area to the Rufous Scrub Bird has occurred.

b) The further approval of the Minister for Planning must be sought before operations begin in the areas described in recommendation 23a.

c) For the purposes of this recommendation, the habitat requirements of the Rufous Scrub Bird shall be defined as extremely dense cover 2-50cm above ground, moderate cover 50-100cm above ground, a moist microclimate at ground level and abundant leaf litter.

24) Prelogging surveys shall be conducted between August and October of the preceding year before any logging in the predicted range of the Rufous Scrub Bird may occur in order to detect, map and protect any existing territories.

25) a) Known Rufous Scrub Bird territories shall be protected by a disturbance free zone of 250m radius about the centre of the territory.

b) Post harvest burning shall be carried out so that it does not enter this zone.

Large Owls

26) Prelogging surveys for Powerful and Sooty Owls at an intensity of one sampling site per 1000 ha shall be conducted in the following blocks of unlogged forest:

Kempsey M.A.	Branch Creek area of Nulla-Five Day SF
	Pee Dee SF and adjacent Nulla-Five Day SF
	Styx River SF adjacent to Flying Fox Mountain
Wauchope M.A.	Yessabah SF
	Kindee section of Mount Boss SF
	Apple Tree Mountain section of Bellangry SF
	Kennedy's Mountain sections of Mount Boss SF
	Northern end of Abbotsmith Ridge section of Mount Boss SF
	Mount Alabaster - Sawyers Creek section of Mount Boss SF
	Ballengarra SF south of Stockyard Creek
	Red Hill section of Doyles River SF
	Ralfes Peak section of Doyles River SF
	Doyles River SF south of Tobins River and west of Stockyard Creek
	Doyles River SF adjacent to Mount Seaview Nature Reserve

Doyles River SF south of Fenwick's Road and adjacent to Fenwick's Scrub

27) Where there are known records of Sooty or Powerful Owl nests a disturbance free zone of 200m radius shall be retained; in the case of roost sites this disturbance free zone shall be 100m radius.

Bats

28) Permanent water bodies greater than 10m in length shall be surrounded by unlogged zones of 100m radius where no filter strip protection already exists.

Reptiles

29) Thirty three percent of logging sub-compartments (being those areas serviced by a single log dump) shall have no post-harvest burns carried out.

Glossy Black Cockatoo

30) a) When selecting the 33% of sub-compartments from which post-harvest burning is to be excluded (Recommendation 29), the selection process will follow the order of precedence below:

i) first, those sub-compartments where it considers that burning would cause excessive damage; and

ii) second, those sub-compartments with mature *Casuarinaceae* stands.

b) Damage to mature *Casuarinaceae* stands is to be avoided by all reasonable means.

Amphibians

31) Pre-logging surveys for the following amphibians shall be carried out in likely habitat that is not protected by the implementation of any other prescriptions recommended by this report or by prescriptions incorporated into the Harvesting Plan by State Forests of NSW:

Sphagnum Frog
Barred Frog
Giant Barred Frog
Green and Golden Bell Frog
Green-thighed Frog
Glandular Frog
Peppered Frog

Rare, Poorly Known and Sensitive Species

32) a) The following species shall have the indicated disturbance free zones reserved. These reserves shall be centred on known occurrences.

Species	Radius of Disturbance Free Zone (m)
Square-tailed Kite	200[a]
Powerful Owl	200[a]/100[b]
Masked Owl	200[a]/100[b]
Sooty Owl	200[a]/100[b]
Pacific Baza	100[a]
Large Footed Mouse-eared Bat	100[c]
Beccari's Mastif Bat	100[c]
Yellow-bellied Sheath-tailed Bat	100[c]
Greater Broad-nosed Bat	100[c]
Troughton's Eptesicus	100[c]
Great Pipistrelle	100[c]
Little Bent-wing Bat	100[c]
Common Bent-wing Bat	100[c]
Brush Tailed Phascogale	200
Squirrel Glider	200
Eastern Pigmy Possum	100
Long Nosed Potoroo	200
Sphagnum Frog	50
Barred Frog	200[d]
Giant Barred Frog	200[d]
Green and Golden Bell Frog	200[d]
Green-thighed Frog	200[d]
Glandular Frog	200[d]
Peppered Frog	200[d]

a - About known nest sites only
b - About known roost sites only
c - About known roost sites with more than 20 individuals only
d - Only applies to riparian habitat within this radius

b) When ten such records are obtained for any of these species, the status of the species shall be reassessed and the condition may be reviewed. The further approval of the Minister for Planning will be required before the condition can be revoked or altered.

Refugia

33) a) In old growth forest, refugia shall be retained where pre-logging inspections identify habitat areas of significance to the species listed on Schedule 12 of the

National Parks and Wildlife Act 1974. The approximate size of these refugia shall be 100m by 300m and these refugia shall not be logged.

b) Areas reserved due to the prescriptions contained elsewhere in these conditions may serve as refugia if they constitute habitat areas of significance for species listed in Schedule 12.

Pre-logging Inspections

34) a) Pre-logging inspections shall be undertaken in order to identify all habitat features which are the subject of prescriptions, contained in these recommendations, for the amelioration of the impact of logging operations on fauna.

b) State Forests of NSW shall approve a person who is suitably trained in the identification of such habitat features to carry out such inspection. The inspection shall be carried out with regard to the discussion of pre-logging inspections in this report.

c) The results of these pre-logging inspections and the prescriptions which are implemented as a result of such pre-logging inspections, shall be recorded in Harvesting Plans.

Monitoring

35) The impacts of logging, burning and grazing on native fauna shall be monitored.

36) The impacts of feral animals on native fauna shall be monitored.

Salvage Logging after Wildfire

37) After wildfire, unlogged forest may be logged in an order different to that given in recommendations 6 and 7 only if there has been a substantial diminution of old growth values of the unlogged forest as a result of the wildfire.

38) After wildfire regrowth or recut forest may be salvage logged in an order different to that proposed in the EIS should significant damage by wildfire have occurred.

39) The environmental constraints on general harvesting contained in these recommendations must be followed in salvage logging after wildfire with the following exceptions:

a) dead hollow-bearing trees will be retained to make up the prescribed number of habitat trees;

b) recommendation 15 will not apply;

c) recommendations 13 and 14 will only apply to post-fire feeding scars;

d) where the habitat feature(s) that other fauna recommendation(s) apply to are no longer present or are reduced in extent, as evidenced by pre-logging inspections,

then the recommendation(s) will no longer apply or will only apply to the extent that those feature(s) remain.

Flora

Rare Species

40) a) State Forests of NSW shall conduct pre-logging surveys to identify unknown, rare, vulnerable and endangered plant species (Briggs and Leigh 1988) in:

(i) Forest Types: 32, 39, 45, 48, 49, 64, 70, 73, 74 (including 62/74), 85, 87, 92, 97, 101, 117, 122, 126 and 168.

(ii) Dyke, Cowarra, Mount Skillion, Old Station, Skillion Flat, Mount Seaview and Pee Dee State Forests.

b) For all pre-logging surveys for unknown, rare, vulnerable or endangered plant species, the following shall apply:

(i) if a rare or unknown (Briggs and Leigh 1988) plant species is found and this species is not represented in an area protected from logging by the EIS, as modified by these recommendations, then the location of this species shall be protected from disturbance.

Once a rare or unknown species is afforded protection from disturbance, should this species later be found to occur elsewhere in the K/WMA, subsequent protection is not required;

Prelogging surveys are not required for rare or unknown species which have already been afforded protection from logging within the K/WMA by the EIS as amended by these recommendations.

(ii) if a vulnerable or endangered (Briggs and Leigh 1988) species is found, then it shall be protected from disturbance.

41) No logging or new roading shall be conducted:

a) in Compartments 264-272, 304 of Mount Boss State Forest;

b) in areas mapped by State Environmental Planning Policy (SEPP) No.14.

42) Areas identified as conservation areas on Map 17 of the EIS shall not be logged or have new roads pass through them, except for that allowed by recommendation 77.

43) a) State Forests of NSW shall not conduct logging and new roading operations in:

(i) areas where *Amorphospermum whitei* is known to occur within Nulla-Five Day State Forest;

(ii) areas where *Boehmeria platyphylla* var. *austroqueenslandica* is known to occur within Birdwood PMP 1.1.7 area;

(iii) areas where *Dodonaea serratifolia* is known to occur;

(iv) areas where *Melaleuca groveana* is known to occur;

(v) areas where *Sarcochilus hartmannii* is known to occur;

(vi) areas where *Callistemon* sp.aff. *linearifolius, Pseudanthus pimeleoides, Pultenaea petiolaris* and *Boronia chartacea* occur within the Bril Bril Creek PMP 1.1.7 area.

b) State Forests of NSW shall investigate the occurrence of *Goodenia fordiana* in Broken Bago State Forest and, in consultation with the Department of Planning, protect the least disturbed population of this species from logging and new roading.

44) State Forests of NSW shall, in consultation with the Department of Planning, create a conservation area in either Ingalba or Tamban State Forests to protect an area containing both *Eucalyptus ancophila* and *Eucalyptus fusiformis*, giving preference to the least disturbed area containing these species. If these species do not occur together, then State Forests of NSW shall, in consultation with the Department of Planning, reserve the least disturbed population of *Eucalyptus fusiformis*. (In this situation *E. ancophila* will be protected by the provision of Recommendation 59). Neither logging nor new roading may occur in the conservation area established in accordance with this recommendation.

45) State Forests of NSW shall conduct surveys for:

a) *Marsdenia liisae* in Banda Banda Flora Reserve to confirm its occurrence. If it is not found in Banda Banda Flora Reserve, State Forests of NSW shall conduct pre-logging and pre-roading surveys for this species in Mount Boss State Forest. These surveys shall be limited to the extent necessary to find and protect a viable population of this species from logging and new roading;

b) *Callistemon accuminatus* in Broken Bago State Forest. These surveys shall be limited to the extent necessary to find and protect a viable population of this species from logging and new roading.

46) Prior to any logging or new roading occurring in Old Station, Mount Skillion and Skillion Flat State Forests, State Forests of NSW shall conduct spring surveys to identify whether the endangered species *Diuris disposita* occurs in these forests. Any populations found shall be protected from logging and new roading.

47) State Forests of NSW shall conduct pre-logging and pre-roading surveys for:

a) *Asperula asthenes* and *Diuris pallens (Diuris pedunculata)* in Mount Boss State Forest, particularly in the vicinity of Mount Boss Trigonometrical Station.

Any areas containing populations of these species shall be reserved from logging and new roading.

48) No logging or new roading shall occur within 20m of the locations of rare, unknown, vulnerable, endangered (Briggs and Leigh 1988) or significant (Binns and Chapman 1993, p.28-31) species afforded protection by the EIS as amended by these recommendations.

Forest Types

49) Any State forest or other Crown-timber lands that is not currently afforded a Forest Type map, shall not be logged or roaded unless that area is typed to Research Note 17 (1989) standards, examined for critical Forest Types and flora communities (identified in Recommendations 51, 52, 56, 59, 62 below) and the appropriate percentage or areas identified in these recommendations reserved.

50) a) Ballengarra State Forest shall be retyped to at least identify the extent of Forest Types 62, 62/74, 73 and 74.

b) Doyles River State Forest shall be retyped to at least identify the extent of Forest Types 111, 167 and 168.

c) Tamban, Ingalba and Collombatti State Forests shall be retyped to at least identify the extent of Forest Type 62 and 74.

51) a) State Forests of NSW shall reserve all of Forest Type 41 from logging.

b) State Forests of NSW must reserve a minimum 10% of the areal extent of Forest Type 101, 8ha of which must be located in Carrai State Forest. State Forests of NSW must give preference to old growth when selecting areas for reservation;

c) State Forests of NSW must reserve 10% of the areal extent of Forest Type 45, 3ha of which must be located in Styx River State Forest. State Forests of NSW must give preference to old growth when selecting areas for reservation;

d) State Forests of NSW must reserve 10% of the areal extent of Forest Type 87, 1 ha of which must be located in the Yessabah Flora Reserve. State Forests of NSW must give preference to old growth when selecting areas for reservation.

52) a) State Forests of NSW shall reserve a minimum of 10% of the areal extent of the following Forest Types giving preference to old growth: 39, 48, 49, 70, 73, 74, 62/74, 85, 92, 111 and 117;

b) State Forests of NSW shall reserve a minimum of 10% of the areal extent following Forest Types giving first preference to old growth areas on basalt geology, second preference to old growth, and third preference to regrowth/recut areas on basalt geology: 167 and 168;

c) State Forests of NSW shall reserve a minimum of 10% of the areal extent of the following Forest Types giving preference to old growth: 46, 54, 60, 62, 119, 152, 159 and 164;

d) State Forests of NSW shall reserve a minimum 5% of the areal extent of Forest Type 37 giving preference to old growth;

53) a) In calculating the appropriate percentage of reservation listed above (Recommendations 51(b), (c), (d) and 52, consideration shall be given to all typed State forest and other Crown-timber lands;

b) This recommendation will operate so that at any given time the amount of reserved Forest Type will equal the percentage appropriate to that Type having regard to the then typed State forest and other Crown-timber land;

54) a) Initially, the appropriate reservation for Types 62, 62/74, 73, 74, 111, 167 and 168 shall be determined on the basis of their known extent as at the date of the Minister's approval;

b) However, as State Forests and other Crown-timber lands are typed in accordance with Recommendation 50, the appropriate percentage of these Types will be reserved;

c) After State Forests of NSW has complied with Recommendation 50, State Forests of NSW shall review the reserved areas of these Types and may revise the boundaries of the reservations. However, when revising these boundaries, State Forests of NSW must comply with Recommendations 52 and 53.

55) When reserving Forest Types in accordance with Recommendations 51 and 52, State Forests of NSW must have regard to and take into consideration the areal extent of the Forest Types to be protected and the contiguity of the protected Types.

56) Any Forest Type listed between Forest Types 30 and 215 of Research Note 17 (Forestry Commission of NSW 1989), which is encountered in future Forest Typing (Recommendation 49) or retyping (Recommendation 50) and which is not considered in Recommendations 51 or 52 above or listed in Table 9.1 of the EIS, shall be protected from logging and new roading.

57) Areas of Forest Types reserved in accordance with these recommendations will be located in Crown-timber land other than land affected by a profit a prendré in favour of the Crown and land held under a lease from the Crown.

Significant Plant Communities

58) Prior to any logging or new roading occurring in Skillion Flat, Mount Skillion and Old Station State Forests, State Forests of NSW shall conduct surveys to establish the presence or absence of the following communities: *Eucalyptus amplifolia ssp. amplifolia-E. tereticornis-Angophora subvelutina, E. maculata-E. moluccana*, and *E. moluccana-E. siderophloia-E. propinqua*. State Forests of

NSW shall protect 10% of each of these communities from logging, if present, giving preference to old growth.

59) All areas of the community *E. grandis-E. ancophila* shall be protected from logging.

60) State Forests of NSW, in consultation with the Department of Planning, shall create a conservation area (prohibiting logging) in Broken Bago State Forest to reserve the least disturbed population of *Eucalyptus pyrocarpa-E. agglomerata*. No logging shall occur in this conservation area.

61) Pre-logging surveys shall be conducted in Cowarra State Forest to identify *E. bancroftii and E. bancroftii-E. seanna* communities. All such communities shall be protected from logging.

62) State Forests of NSW shall protect a minimum of 10% of the *E. nobilis* community giving preference to old growth.

Rainforest

63) Trees shall not be felled into or within rainforests other than to the minimum extent necessary for roading operations through rainforest approved by the Minister's approval;

64) All unlogged warm temperate and cool temperate rainforest shall be protected by a buffer strip of 20m width. Trees shall not be felled within this buffer strip other than to the minimum necessary extent required for roading operations through rainforest approved by the Minister's approval;

65) No snig track shall enter or cross rainforest or rainforest buffer strips.

66) New roads shall avoid rainforest wherever possible. Where there is no feasible topographic alternative, roads may be constructed through rainforest. Such roads shall conform with the following:

a) New roading shall aim to cross rainforest at its narrowest point.

b) Pre-roading inspections shall be consistent with Recommendations 76 and 78.

c) Rainforest canopy shall be disturbed as little as possible in road construction.

d) Road clearing must be restricted to the absolute minimum for safe vehicle passage. In flat sections road clearing width shall be restricted to 6m. In steeper areas the clearing width may increase but shall be limited to 18m.

e) Large trees (80cm dbhob or greater) are to be avoided wherever possible.

f) Any trees necessarily felled for road construction shall be pushed out along the roadline to minimise disturbance of vegetation on either side of the road.

g) Upon the completion of use:

(i) each rainforest crossing point shall have earthworks or formations drained so as not to hold water and to facilitate vegetation establishment;

(ii) each rainforest crossing point shall be planted with shade tolerant rainforest shrub and tree species to a density which reflects that of the surrounding rainforest area.

67) When carrying out prescribed burning (fuel reduction or post-harvest), State Forests of NSW shall avoid burning in rainforests.

Weeds

68) State Forests of NSW shall liaise with NSW Agriculture to develop a weed control plan for *Lantana camara* giving consideration to mechanical, chemical and land management means of control. Such a weed control plan shall be completed and a copy forwarded to the DOP within 2 years of the date of the Minister's determination of the K/WMA EIS. It shall then be incorporated in the Kempsey and Wauchope Management Plans at the next revision.

Conservation Strategy

69) State Forests of New South Wales shall amend the Conservation Strategy identified in the Kempsey/Wauchope Management Areas EIS in accordance with these recommendations.

70) When amending the Conservation Strategy, State Forests of NSW shall have regard to and take into consideration the areal extent of reserves and the contiguity of the reserve system so that the Conservation Strategy will minimise edge to area ratios and, as far as possible, ensure a contiguous reserve system.

Soils and Hydrology

71) Logging operations in any compartment shall not be carried out unless a Harvesting Plan has been prepared by State Forests of NSW which takes into account the site specific characteristics of that compartment and conforms with any erosion hazard and sediment control strategy relevant to that compartment. Logging shall be carried out in conformity with that Harvesting Plan.

72) An erosion hazard and sediment control strategy shall:

a) be prepared after consultation with CaLM and consideration of its advice;

b) determine where erosion hazards are located and their range;

c) make provision for:

(i) road location, design, construction, drainage and erosion control measures;

(ii) snig track and log dump location, drainage and erosion control measures;

(iii) upper slope limits for harvesting, snig tracks and roads;

(iv) ground cover management techniques;

(v) criteria to determine whether or not to rip temporary log dumps;

d) conform with the SEMGL;

e) be consistent with the terms and conditions of this approval.

73) Persons with soil conservation training appointed by the SFNSW shall determine erosion hazard and supervise the implementation of any erosion hazard and sediment control strategy.

Monitoring

74) State Forests of NSW shall monitor:

a) the implementation and compliance with the erosion hazard and sediment control strategy;

b) the effectiveness of that strategy to control erosion;

c) the impacts of logging operations on turbidity, water chemistry, water yield and key aquatic species. Such monitoring shall include the effect of storms on these factors.

75) State Forests of NSW shall consult with and take into consideration the advice of:

a) CaLM with respect to the nature and scope of any monitoring program required under Conditions 74(a) and (b); and

b) CaLM and the EPA with respect to Condition 74(c).

New Roads

76) Pre-roading surveys shall be conducted to identify Aboriginal sites. New roads shall be located so as to avoid identified Aboriginal sites unless topographic constraints make alternative routes impractical and the Director-General of the National Parks and Wildlife Service has granted Consent to Destroy.

77) No new roads shall be constructed in conservation areas or flora reserves (as shown on Map 17 of the EIS) except through the eastern section of Banda Banda Flora Reserve as shown on Map R4 of Appendix C of the EIS.

78) New roads shall avoid damaging or destroying unprotected areas of unknown, rare, (Briggs and Leigh 1988) or significant (Binns and Chapman 1993, p.28-31) plant species unless there is no other topographic alternative on which to locate the road.

Gravel Pits

79) In the selection of new sites to be used for gravel extraction, State Forests of NSW shall avoid areas:

a) which contain habitat (hollow-bearing) trees;

b) which contain Schedule 12 fauna;

c) which contain unknown, rare, vulnerable, endangered (Briggs and Leigh 1988) or significant (Binns and Chapman 1993 p.28-31) plant species.

80) Pre-construction surveys shall be conducted to identify Aboriginal sites. New gravel extraction pits shall be located so as to avoid Aboriginal sites unless no alternatives are available and the Director-General of the National Parks and Wildlife Service has granted Consent to Destroy.

Fire

81) If not already in place, Fuel Management plans shall be developed and implemented in Kempsey Management Area and Wauchope Management Area in accordance with the directions given in Section 4 of State Forests of NSW "Fire Manual". Such plans shall be in place within 12 months of the date of the Minister's determination.

82) Fuel management prescriptions in Working Plans for existing Flora Reserves shall be reviewed within 12 months of the date of the Minister's determination. Those that do not conform to the fuel management guidelines of the Fire Manual shall be amended to so conform.

83) Fuel management prescriptions developed for new Flora Reserves proposed in the EIS shall conform to the fuel management guidelines of the Fire Manual.

84) Fuel management prescriptions shall be developed for each of the 13 conservation reserves not proposed for gazettal as Flora Reserves within 12 months of the date of the Minister's determination. In developing such prescriptions, biological and strategic factors must both be considered.

85) a) State Forests of NSW shall develop burning prescriptions to favour the germination and propagation of unknown, rare, vulnerable, endangered (Briggs & Leigh 1988) or significant species (Flora Survey Report p.28-31) that are protected from logging by the EIS, as modified by these recommendations.

b) In developing these burning prescriptions, State Forests of NSW shall consult with the CSIRO Division of Plant Industry, particularly in regard to the information contained in the *"National Register for the Fire Response of Plant Species"*, and take into consideration the information contained in this Register and advice provided by the CSIRO.

c) Where there is no available information on the appropriate fire interval to facilitate the germination and propagation of a particular rare, unknown, vulnerable, endangered or significant plant species located in the reserved areas referred to above, then such species shall be afforded a minimum fire-free interval of 10 years. State Forests of NSW shall develop a burning prescription which affords such species a minimum fire-free interval of 10 years.

d) All information obtained by this recommendation shall be documented and recorded in the Fuel Management Plans developed for the Kempsey and Wauchope Management Areas.

Note: this recommendation is not meant to apply to all areas where rare, unknown, vulnerable or endangered species occur, but only apply to those areas that have been protected from logging by the EIS as modified by these recommendations.

86) a) SFNSW shall apply burning prescriptions developed under recommendation 85 to any land protected from logging by the K/WMA EIS (as modified by these recommendations) where unknown, rare, vulnerable, endangered or significant plant species occur. These burning prescriptions shall extend a minimum of 20 metres in any direction, from where such plant species occur.

b) Recommendation 86(a) does not apply if the location of a particular species is such that the absence of hazard reduction burning is reasonably considered by the SFNSW to pose a threat to human life and property. In such cases, SFNSW may conduct hazard reduction burning but only to the extent necessary to minimise the threat. All such instances shall be documented prior to conducting any burning and recorded in the Fuel Management Plans developed for the Kempsey and Wauchope Management Areas.

87) Where it is necessary to suppress uncontrolled fires, SFNSW need not comply with recommendation 86(a) but must record the event in its Fire Records as soon as reasonably possible after the fire is suppressed.

Implementation of Quota Reductions

88) Any quota reductions which result from:

a) the implementation of the conservation strategy, as amended by the recommendations in this report;

b) logging in conformity with the SEMGLs,

shall be implemented in approximately even steps over the first 5 years of the approval.

Beekeeping

89) Beekeeping shall not be permitted within Flora Reserves. Nonetheless, if alternative bee sites cannot be found to accommodate apiarists affected by the gazettal of the proposed Boogoolum Flora Reserve, they shall be allowed to retain the sites they

currently occupy for a period of up to five years from the date of the Minister's determination in order to allow them sufficient time to restructure their operations.

Cultural Resources

90) Aboriginal sites discovered in the course of logging operations shall undergo preliminary evaluation by forestry staff who have appropriate skills for such work. Unusual or potentially significant sites should be referred to a specialist archaeologist for more detailed investigation and formulation of a recommendation regarding third stage PMP classification or other appropriate action.

91) Aboriginal stone arrangement sites in Lower Creek and Nulla-Five Day State Forests of NSW shall be classified PMP Special Emphasis Aboriginal sites.

92) Statements of conservation policy shall be prepared for the Pipers Creek lime kilns and the Gundle tin mine in accordance with the provisions of the Burra Charter.

93) These statements of conservation policy shall be incorporated in the appropriate Management Area plan at the next revision, together with any forest management prescriptions necessary to give them effect.

94) a) Of the 13 Aboriginal sites identified in the survey of Yarrahapinni and Way Way State Forests (Marwood and Collins 1991), the number located with the Kempsey MA shall be determined.

b) A specialist archaeologist shall review the identified sites on Way Way State Forest as well as the 11 sites elsewhere within the Kempsey and Wauchope Management Areas included on the National Parks and Wildlife Service register of Aboriginal sites which do not already have an appropriate third stage Preferred Management Priority classification. Those sites judged to be of significant scientific or cultural interest shall be recognised by means of a suitable Preferred Management Priority classification.

95) The consultant's recommendations regarding the eight scientifically significant sites (of the 55 sites discovered during the archaeological survey) shall be reviewed by a specialist archaeologist in order to establish which are still relevant and whether third stage Preferred Management Priority classification is warranted.

Grazing

96) There shall be no expansion in the area of State forest grazed by domestic stock during the approval period except where Crown-timber lands with pre-existing grazing leases granted under the Crown Lands Act are dedicated as State forest.

Harvesting

97) If not already established, a project to investigate the long-term, cumulative impacts of forestry operations on the major forest types common to the Kempsey and Wauchope Management Areas shall be initiated.

98) Thinning of regrowth forests shall be planned and executed so as to create heterogeneous stands with a diverse range of habitats, consistent with good silvicultural practice.

Monitoring-General

99) All monitoring prescriptions contained in these recommendations shall be implemented within the Kempsey and Wauchope Management Areas.

100) The design and implementation of monitoring programs shall have regard to the discussion of monitoring in this report.

101) The results of the monitoring program proposed in the EIS and those from the monitoring programs required under these recommendations shall be incorporated into a report which shall be prepared at least every three years from the date of this approval and shall be made available to the public.

Transitional Arrangements

102) Logging in compartments with approved harvesting plans and for which s.120 licences have been obtained or sought, at the date of the determination, shall be permitted under the existing harvesting plan, for up to three months from the date of the Minister's determination, provided such compartments are not included in Schedule 1 of the Timber Industry (Interim Protection) Act 1992.

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APPENDIX 1

Dr H Drielsma
Commissioner
Forestry Commission of NSW
Building 2
423 Pennant Hills Road
PENNANT HILLS 2120

-2 APR 1992

Attention: Mr Peter Smith, Manager,
Environmental Assessments Branch.

Dear Dr Drielsma,

FORESTRY OPERATIONS IN THE KEMPSEY/WAUCHOPE MANAGEMENT AREAS
ENVIRONMENTAL IMPACT STATEMENT

Thank you for your letter of 10 February 1992 indicating that you are consulting with regard to the preparation of an environmental impact statement (EIS) for the above operations.

For those parts of the Kempsey/Wauchope Management Areas listed in Schedule 1 of the Timber Industry (Interim Protection) Act, 1992, an EIS is required to be prepared where the proposal is an activity, referred to in the Environmental Planning and Assessment (EPA) Act, 1979, which is likely to significantly affect the environment. For those parts of the Kempsey/Wauchope Management Areas listed in Schedule 4 of the Timber Industry (Interim Protection) Act (which excludes those parts listed in Schedule 1 of the Act) Section 8(2) of the Act requires an EIS to be prepared as if Part 5 of the EPA Act had not been suspended (in so far as that Part would have required an EIS). Therefore, in this letter, requirements for an EIS for the above operations are provided as if Part 5 of the EPA Act had not been suspended.

It is recognised that the EIS will cover all operations in the Kempsey/Wauchope Management Areas and will consider the broad scope of operations well into the future. It is expected that detailed assessments of the environmental impact of specific activities will be undertaken at the appropriate time and using the overall context of the present Kempsey/Wauchope Management Areas EIS.

It is noted that the Commission intends to publicly advertise its intention to prepare an EIS for the Kempsey/Wauchope Management Areas. It is recommended that local issues identified in any submissions to this advertisement, be considered in the preparation of the EIS. It would also be appreciated if copies of any submissions received at this stage in the EIS process are forwarded to the Department.

The contents of the EIS shall include matters listed in Clause 57 of the regulation. Particular note should be taken of paragraph (e1) at Clause 56, which deals with the impacts on the habitats of endangered fauna.

It is recommended that consideration be given to issues raised in any submission that may be received from the National Parks and Wildlife Service regarding the preparation of the EIS, as well as the provisions of the Endangered Fauna (Interim Protection) Act 1991.

In addition, pursuant to Clause 58 of the regulation, the following matters shall be specifically addressed in the EIS:

1. **Description of the Kempsey/Wauchope Management Areas**

a) a survey of the fauna, including a description of the distribution and relative abundance of animal populations and in particular indicating the presence of any rare and endangered species and their habitats.

b) a survey of the flora, in particular identifying the location of any rare and endangered species and identifying old growth forest and rainforest areas.

c) an assessment of the water quality and hydrological regime in the catchments within the Kempsey/Wauchope Management Areas, and a description of the nature and characteristics of soils in the study area.

d) identification of visually prominent sites at local and regional levels, a survey of cultural and historical sites and a description of the tourism, recreational and educational values of the area.

e) a description of the relationship of the area to adjoining and nearby National Parks.

f) an assessment of the social and economic significance of the timber industry to the Kempsey/Wauchope Management Areas.

g) an assessment of the sustainability of the proposal.

2. **Consideration of the Likely environmental Impact**

a) the effect of the proposal on the flora and fauna of the study area and their habitats, in particular describing potential impacts on rare and endangered species, and any proposed mitigation measures.

b) the impact of proposals for fire management, potential bushfire hazard and measures to mitigate against this hazard.

c) the impact on water quality, water supply and the hydrological regime of the affected catchments, and the affect on soils and soil physical properties, potential for erosion (particularly in areas where the slope exceeds 25^{o}) and sedimentation and any measures proposed to mitigate against these impacts.

d) the impact of the proposal on scenic, visual and educational values and the impacts on/of tourism and recreation in the area.

e) the effect of any proposed forest roads on the study area in terms of soil erosion, infestation by noxious weeds and introduction of feral animals.

f) the impact of the industry on the local road network.

g) the impact on the flora and fauna of adjoining and nearby National Parks and any proposed mitigation measures.

3. Consideration of Alternative Timber Sources

4. Provisions for Monitoring the Implementation of Mitigation Measures Outlined in the EIS

Your attention is directed to the Manual for Environmental Impact Assessment previously circulated by the Department (especially chapters 5 and 6) for information appropriate for consideration in the preparation of an EIS.

When an adequate EIS has been obtained for the subject proposal, the Commission should then proceed with the matter in accordance with Section 112 and 113 of the EPA Act, and place the document on public exhibition as required by Section 9(3) of the Timber Industry (Interim Protection) Act. The procedures for public display that are to be followed by the Commission are as in clauses 60 to 64 of the Environmental Planning Assessment Regulation, 1980.

The Commission should also note that the EIS should be made available for inspection at the same time in the offices of the Commission and the Department as well as any other agencies nominated by them, as required by the Timber Industry (Interim Protection) Act and the EPA Act as appropriate. To ensure that simultaneous exhibition occurs, the Forestry Commission should forward the necessary documents to the Department prior to the commencement of the public display period. This will enable concurrent exhibition in the Department's head office and the relevant regional office where appropriate.

If the Commission intends to present the EIS to the National Parks and Wildlife Service to be exhibited in fulfilment of the requirements of the licensing provisions for endangered fauna of the National Parks and Wildlife Act, the Commission may wish to consider simultaneous exhibition.

Should any submissions be made during the period of public exhibition, such submissions, including any submission prepared by the Commission, should be forwarded to the Secretary in accordance with Section 9(3) of the Timber Industry (Interim Protection) Act and the EPA Act as appropriate.

It is requested that any submissions be forwarded to the Department within seven days of the close of the period of public exhibition to enable examination of those submissions.

Can you please advise the Department whether the Kempsey/Wauchope Management Area EIS is intended to be completed by 31 May 1993, as stated in Schedule 4 of the Timber Industry (Interim Protection) Act, and please notify the Department if there is likely to be any significant variation of this.

Should you require any further information regarding this matter, please do not hesitate to contact us again.

Yours sincerely,

S. O'Toole
Acting Director

APPENDIX 2

SUBMISSIONS TO THE EIS PUBLIC EXHIBITION

Sub. No.	Name
1	Department of Mineral Resources
2	Chamber Mines, Metals and Extractive Industries
3	Christine Purvis
4	Public Works Department
5	Recreational Four Wheel Drive Club Association
6	National Parks Association, Armidale Branch
7	A.G. McNeil
8	Sarah Lindsay
9	Hastings Municipal Council
10	Aitken & Rumbel Timbers
11	Wendy Brown
12	Marvin & McNamara P/L
13	Bruce Jeffrey MP, Member for Oxley
14	Vera Matsinos
15	CRA Exploration P/L
16	Department of Bush Fire Services
17	Department of Water Resources
18	Wauchope Chamber of Commerce
19	Macleay Valley Afforestation Association
20	Koala Preservation Society
21	Jennifer Short
22	Dorothy Oakley
23	W H Boyd
24	Ken Miller
25	Denis Barry
26	G R Barry
27	K R Johanson
28	Frederick Chauncy
29	J B Quargormain
30	Ross Grey
31	G Spence
32	A Grey
33	I Snowden
34	P Webster
35	J W McInerny
36	M McInerny
37	W S Turner
38	Paul O Cline
39	W J Line
40	G N Tisdell
41	C W Temple
42	R J Temple
43	Darren Turner
44	C Possington
45	R Mackay
46	D Woods
47	N Kell
48	C Berdwen
49	D C Brown
50	B Murray
51	Bill Styls
52	S Inns
53	K Brown
54	L Woodlands
55	Daryl Coombs
56	B Fletcher
57	D Cooper
58	S Higgins
59	Glen A Brown
60	Jim Chapman
61	R Pead
62	A Faichney
63	R J Squire
64	Ben Buttsworth
65	D J Clenton
66	J M Barnes
67	N W Bud
68	B Strison
69	George McForm
70	N McLintock
71	A J Mills
72	A J Kenney
73	N K Coleman
74	R J Clente
75	W A Cross
76	L A King
77	P J Pale
78	Ricky J Barnett
79	G Crane

80 James Wilson
81 C Steinmetz
82 K K Smith
83 D Smith
84 Victor Ilias
85 M J Green
86 R Wallins
87 Neil Urquhart
88 R Darcy
89 N Scott
90 Glen N Coombe
91 T Tisdell
92 M Smith
93 G Renwitt
94 ?
95 Australian Museum
96 Dianne Nolan
97 Kempsey Council
98 Mrs J L Clifton
99 Tony and Fay Bischoff
100 Wayne Kelly
101 Kevin Heydon
102 Boyed E Hennessey
103 Tony Zaccazan
104 Graham Delforce
105 Peter Stace
106 Robert Edwards
107 Dong Jaenke
108 Robbie Carroll
109 Scott Hayward
110 Bob Hardy
111 Hilton Soares
112 C Bennett
113 Douglas Head
114 P White
115 John Pigott
116 Paul Carroll
117 Ted Baker
118 Petition signed by 12
119 Bartlett Haulage Co P/L
120 W S Paluch, Manager, Mid-North Coast Apiaries
121 Kylie Rabbitt
122 Michael Keegan
123 Kevin Brown
124 Michael Pigott
125 Clive Walmsley
126 Colin Settle
127 Leo McGuiness
128 Terry Hollis
129 Michael Kirwan
130 Brian Robbitt
131 G Forrest
132 Ashley Wilmott
133 James Tedder, North Coast Environment Council Inc
134 Beechwood Timbers Pty Ltd
135 James Ainsworth
136 Lisa Intemann
137 Brian England, Manager, Macleay Industry Development Office
138 R Calvert
139 Lyn Orreq, Vice President Nambucca Valley Conserv. Assn
140 Alexander Gilmore
141 Environment Protection Authority
142 Lisa Intemann, Co-ordinator, The Info Shop.
143 Patrick McEntee,
144 Patrick McEntee, Port Macquarie Conservation Soc.
145 Susan Russell and Gregory Hore, Wingham Forest Action
146 TWF Parkhouse, President, National Parks Association
147a Megan Edwards, Western Region Co-ordinator, North East Forest Alliance
147b Dailan Pugh, Far North East Region Co-ordinator, North East Forest Alliance
147c Barrie Griffiths
148 Apiarists Association Mid North Coast Branch
149 Rhett M Priestley
150 Kempsey Timbers P/L
151 Greg Viney
152 National Parks and Wildlife Service
153 Institute of Foresters of Australia
154 N & C Irvine
155 L Mounser
156 Wauchope Chamber of Commerce
157 Ian Conley
158 Forest Protection Society Mid North Coast Branch
159 Forest Protection Society
160 The Wilderness Society
161 Forest Products Association
162 Green Alliance
163 Boral Timber Division

164 State Development
165 Cyprus, Gold Aus Corp
166 CaLM